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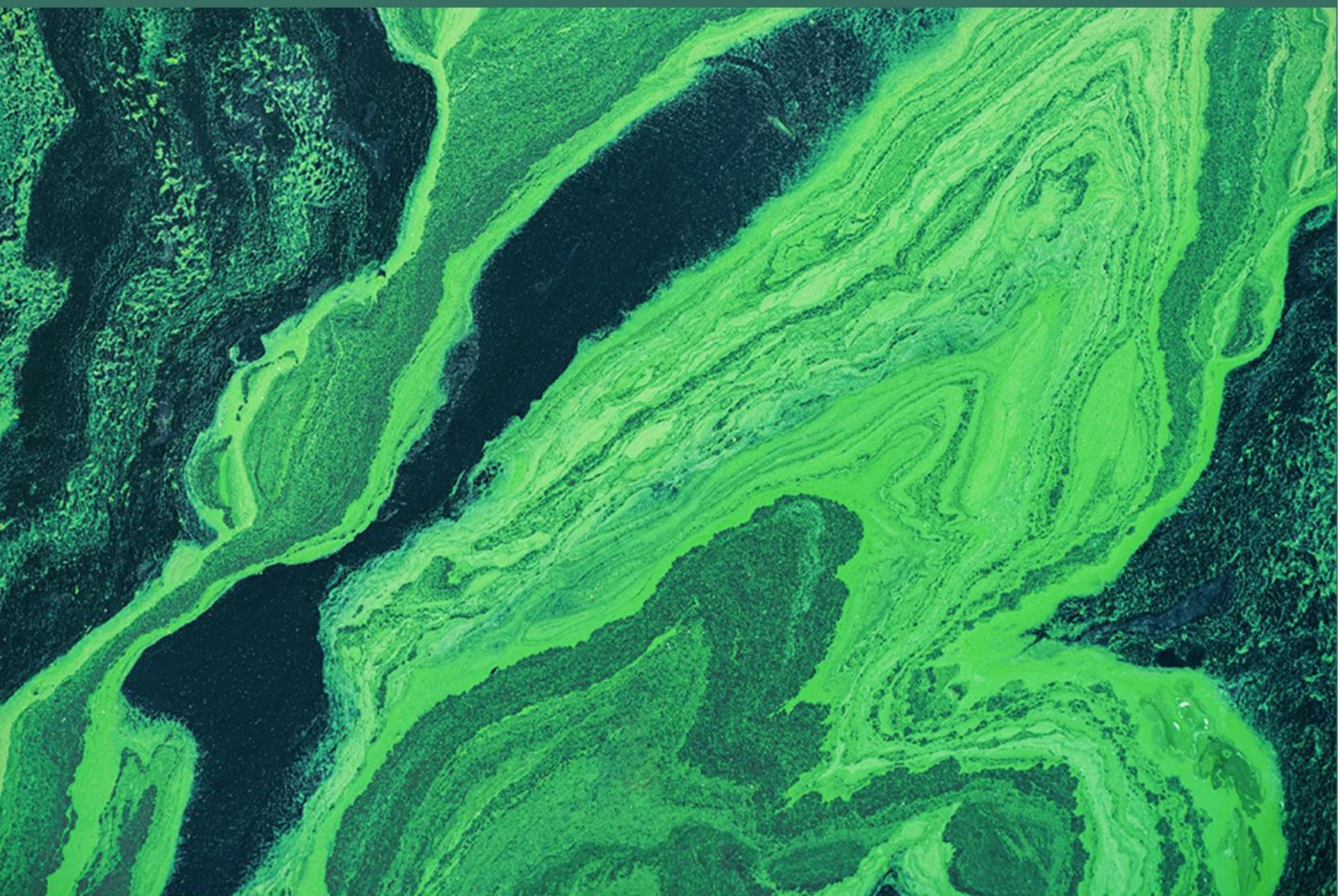

Through science we can

Contents

Agricultural Science and Policy

The effect of agri-environment schemes on biodiversity in the UK and EU

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Abstract

Biodiversity is declining globally, within Europe almost one in five of species are threatened with extinction. Human modification of the environment, such as for agriculture, is a key driver of these losses. However, biodiversity supports a wide range of ecosystem services important for agriculture, such as pollination, pest control and nutrient cycling. A mechanism to support biodiversity and ecosystem services in agricultural landscapes is the implementation of agri-environment schemes (AES). Numerous studies have investigated the response of biodiversity to AES, reporting largely positive responses, but making generalised conclusions on the optimum locations, conditions and methodology for the implementation of different AES remains difficult. Here, we provide an updated meta-analysis which explores the influence of a suite of AES implementations across the UK and EU, as well as providing an understanding of the context dependencies in these relationships.

DivMoST - Monitoring meadow orchards: Methods for automated localization and biodiversity evaluation of indicator organisms.

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Abstract

Species-rich habitats such as meadow orchards have declined for the last decades. These extensively managed grasslands with high-stem fruit trees of different species and ages provide important habitats for many animal species. To monitor their decline, a comprehensive dataset on their spatial distribution is needed.

The project DivMoSt aims to develop a method for automated identification of orchards in Austria. The extraction of the monitoring objects is based on field assessments of 46 meadow orchards, spatial explicit expert knowledge of fruit growing, and geospatial data analysis.

Further, we aim to fill biodiversity monitoring gaps in meadow orchards by surveying indicator animal groups. We survey wild bees and butterflies along standardized transects, record bats using automated ultrasonic recorders and mist nets, and monitor birds through audio recordings and observations.

Our findings will contribute to the Austrian biodiversity report, enabling conservationists to detect potential threats sooner and implement targeted protective measures accordingly.

Evaluating the impact of Premier Tech's 'Acrotelm-Harvesting Method' on *Sphagnum* regrowth potential in Canadian peatlands

PhD candidate Éléonor Bergeron-de Pani[1,2], PhD Mélina Guêné-Nanchen[1], Professor Line Rochefort[1]

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Abstract

Aligned with its commitment to improving peatland management, Premier Tech is developing the 'Acrotelm-Harvesting Method' (ACM), which aim to harvest the less decomposed acrotelm layer to potentially preserve peatland's hydrological conditions, surface vegetation, and carbon stocks. This study evaluates the ACM's impact on the *Sphagnum* regrowth potential across three dominant plant communities: hummock, lawn, and hollow, in a Canadian peatland by assessing *Sphagnum* productivity and decomposition using brush wires and decomposition bags.

Decomposition rates were similar between ACM-harvested sites and the natural peatland across all plant communities. ACM positively impacted *Sphagnum* productivity in hummock and lawn communities, in contrast to the natural area. While *Sphagnum* productivity was initially null in the hollow community of ACM-harvested sites, it recovered two years post-harvest, but not to a similar level as the natural hollows. Further monitoring over the next two years will assess the long-term effects and sustainability of this innovative harvesting method.

Agricultural soil as a carbon sink: can we really measure it?

Dr Peter E Levy

UK Centre for Ecology and Hydrology

Abstract

Sequestering carbon in agricultural soils has been proposed as a means of offsetting greenhouse gas emissions and thereby mitigating climate change. Schemes have been developed to monetise this as tradeable carbon credits. However, these schemes need to be transparent and verifiable to avoid "green-washing"; to be able to value soil carbon sequestration, we need to be able to measure it.

Here, we consider the factors involved in measuring changes in soil carbon in such schemes: field sampling design, lab protocols and their biases, and geostatistical extrapolation of samples to whole-field or farm scale. Changes caused by external factors (climate changes, CO_2 etc) have to be estimated via modelling and discounted to ensure "additionality". We also consider how the uncertainty affects the economic value of potential soil carbon credits. We describe a software tool to capture the scientific community's expertise, for use by land managers and potential providers of carbon credits.

Unseen allies: could 'bee hotels' support insect pest control and pollination?

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Abstract

'Bee hotels' are commonly deployed to provide nesting sites for solitary bees and have been extensively studied in Europe and North America. Artificial nesting substrates are thought to support native solitary bee populations and are thus important for both bee conservation, and potential pollination services in highly altered landscapes. We conducted two experiments to test if artificial nesting structures support bees. First, we placed hardwood timber trap nests in 14 urban food gardens in Sydney. Second, we deployed three different types of nesting substrates at 16 berry orchards in Coffs Harbour within different landscape contexts. The hardwood trap nests ('bee hotels') primarily attracted ants, spiders and wasps. Preliminary results indicate that particular nesting substrates will target particular bee species that provide pollination services to crops. Our research emphasises the importance for the need to adapt artificial nesting structures to match local bee and insect species as well as environmental conditions.

Towards predicting the impact of novel landclasses on biodiversity: a case study on incorporating silvoarable agroforestry into a process-based pollinator model

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Abstract

Contemporary, regenerative land cover classes such as silvoarable agroforestry have received increasing policy and public interest in recent years following calls for 'ecological intensification'. Early empirical studies suggest temperate silvoarable systems support pollinator communities, potentially benefitting ecosystems and human economies. However, it is unknown what effect they'll have if widely adopted. Modelling approaches could help to predict this, but statistical models struggle to predict forwards for novel landclasses. Instead, process-based models could be used, if the new landclass can be parameterised. They are also well-equipped to account for the spatial and temporal heterogeneity of silvoarable systems, and how these interact with the movement ranges and active periods of pollinators. We investigate the best technique for integrating these systems into the well-established, process-based pollinator model Poll4pop, using our own field data. We use our findings to make recommendations for similar parameterisation exercises, to help predict future biodiversity consequences of novel landclasses.

National hedgerow condition mapping using structural remote sensing data.

Dr David J Luscombe, Dr Naomi Gatis, Prof. Karen Anderson, Prof. Richard E Brazier

University of Exeter

Abstract

Hedgerow in the UK provide diverse, liner woody habitats with unique ecological connectivity and valuable carbon storage and sequestration. The ecological condition of these landscape components is relatively poorly understood, given the spatial variation in their management, extent, structural diversity and species composition.

We present a method to map and classify the management condition of UK hedgerows across national extents using publicly available laser altimetry data and the segmentation of object geometries.

These data demonstrate that hedgerow management class can be estimated using indices of structure height, width and liner fragmentation. Output classes are aligned to existing management classes (PTES.org), highlighting the optimum management strategies for specific areas.

These data can describe vectors of change in agriculturally managed hedgerow systems, provide estimates of above ground carbon and biodiversity and be used to extrapolate the impact of changing management strategies across the UK.

"Impact of Climate Variability on Livelihoods Dependent on Agriculture: A Comprehensive Review for Madhya Pradesh-India"

Ms Simran Yadav, Dr Anup Prakash Upadhyay

Indian Institute of Forest Management

Abstract

Madhya Pradesh, a key agricultural state in India, faces substantial challenges due to climate variability, which impacts the livelihoods of its rural population reliant on agriculture. This paper presents a comprehensive review of how climate variability—characterized by shifts in temperature, precipitation patterns, and the frequency of extreme weather events—affects agricultural productivity and rural livelihoods in Madhya Pradesh. Through an analysis of existing literature and data, we evaluate the effects of these climatic changes on crop yields, income stability, and food security. The review identifies regional variations in vulnerability across the state's diverse agro-climatic zones and examines how different areas are uniquely impacted. Additionally, we discuss the effectiveness of current adaptation strategies and policy measures aimed at mitigating these impacts. The findings highlight the urgent need for region-specific interventions to enhance resilience and ensure the sustainability of agricultural systems and rural economies in the face of increasing climate uncertainties.

Soil organic carbon and yield temporal stability under no till and organic farming

Author Ana Campos Cáliz[1,2], Co-author Sthephen A. Wood[3], Co-author Mark A. Bradford[4], Co-author Emily Oldfield[5], Co-author Enrique Valencia[6], Co-author César Plaza[1], Co-author Pablo García-Palacios[1]

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Abstract

Crop production increases with high levels of soil organic carbon (SOC). However, the benefits of SOC on the temporal stability of crop yield remains unclear, hindering the potential of soil health to harness crop production under climate change. In this study, we conducted two global meta-analyses to evaluate whether organic farming and no-till strengthen the relationship between SOC and yield temporal stability. Additionally, we explored the role of soil properties, climate, experimental design and farming practices as drivers of the SOC-yield stability relationship under organic farming and no-till. Our results can help to elucidate whether carbon farming strategies can also help to stabilize crop yield under a changing climate.

testing the effectiveness of field margins in preventing spray drift from reaching non-target lepidopteran larvae.

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Abstract

Field margins are vital components of agricultural landscapes, offering habitats that support biodiversity, and buffering agrochemical displacement into the larger environment. This study examined how variation in plant cover and height across different field margin types: (managed grass margins, unmanaged grass margins, pollen and nectar margins) affects abundance and diversity of Lepidopteran larvae and influences their likelihood of exposure to pesticide spray drift. Lepidoptera in the managed grass margin were predicted to have the highest likelihood of pesticide spray drift exposure, and the unmanaged grass margin the lowest. An almost unique assemblage of Lepidoptera was found in each margin type; the pollen and nectar margin supported the highest abundance of Lepidopteran larvae, while the managed grass margin, had the highest species richness and diversity. These findings underscore the importance of maintaining a variety of field margin types within agricultural landscapes to enhance biodiversity and protect vulnerable species from agricultural practices.

Assessing sustainability of an English Farmer Cluster and creating a simplified sustainability assessment tool for use across European Farmer Clusters

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[1]Game and Wildlife Conservation Trust. [2]James Hutton Institute. [3]Luxembourg Institute of Science and Technology

Abstract

The EU's Farm to Fork Strategy, aimed at transitioning European farming to a more sustainable food system, creates the need to easily assess farm sustainability and provide farmers with a tool to identify potential management changes. As part of FRAMEwork, a pan-European project, ecologists worked collaboratively with farmers in Farmer Clusters (FCs). We sought to identify if the sustainability of the FCs had changed over the course of the project. Initial assessments have focused on the arable and mixed English FC, with farm management information being collected through a detailed questionnaire. We determined which sustainability indicators (e.g. biodiversity) were significant when compared against control values. Further data inspection allowed us to identify which elements of the management were driving the significant results. These could then be used to create a simplified questionnaire and sustainability assessment tool to be used on all the arable and mixed FRAMEwork FCs.

Modelling relationships between crop yield and landscape scale pollination services

Emmeline R Smith

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Abstract

Pollinators are critical for food security with an estimated 75% of global crops dependant on pollination, contributing $235-577 billion to the global economy. However, pollination services are not evenly distributed across landscapes and determining where resources should be invested to support pollinator populations is vital. Sophisticated models exist for predicting pollinator activity but determining the relationship between predicted visitation and realised yield is more difficult. We combined yield data from over 5000 sites with a state-of-the-art process-based model that simulates bee foraging and population dynamics. This enabled us to determine the statistical relationship between predicted wild bee visitation and measured yield of oilseed rape, the most widespread pollinator-dependent crop in Europe. We show how this can be used to identify areas expected to receive below-average pollination service and crop yield, which can then be targeted with agri-environment interventions to support bee populations and crop production.

Identification of Farmland Bird Indicator Species for Practitioner Monitoring in the United Kingdom

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[1]Game and Wildlife Conservation Trust. [2]James Hutton Institute

Abstract

There has been a growing appreciation of the role of indicator species in monitoring and assessing farmland ecosystem health. Indicator species are often more easily recognised by novice surveyors and using a narrower range of species in monitoring programs reduces expert surveyor costs and allows communication to focus on specific 'flagship' species whose conservation provides wider benefits to ecosystem health. Indicator species are, however, often selected without clear scientific justification or without clearly demonstrating their appropriateness as indicators of the taxa they are acting as a surrogate for (e.g. biodiversity). Drawing on field data collected through the FRAMEwork project, a multi-institute, pan-European project, possible farmland bird indicator species for lowland mixed farmland are identified. Their suitability as indicator species is assessed by evaluating relationships between these species and measures of specialist bird abundance and richness, as well as their relationships with wider bird abundance and richness.

The factors affecting pollinator abundance and diversity in urban agriculture.

Ms Emily K Millerchip[1], Mr Adrian Kaluka[1], Ms Lizzy Rainey[2], Dr Maria Clara Castellanos[1], Dr Beth Nicholls[1]

[1]University of Sussex. [2]Brunel University London

Abstract

Urban food growing has significant potential for providing nutritious food to urban populations. However, plant-pollinator interactions in urban food-growing environments remain understudied. Many urban crops benefit from insect pollination, yet little is known about how local and landscape-level factors influence the provision of pollination services. This study examines the frequency and diversity of insect visits across multiple crop species in urban allotments in Brighton & Hove, UK. Timed flower-insect counts were conducted twice per month during the growing season across seven sites. We analysed the impact of factors such as growing space size, ornamental flower cover, tree cover, and proximity to natural forest on flower visitation rates and pollinator species richness. Preliminary results indicate that visitation rates significantly increase with allotment size, and pollinator species richness is greater with higher plot-level tree cover. This study underscores the importance of understanding urban growing at site and landscape levels, to optimise crop-pollinator interactions.

Evaluation of an open-source nutrient delivery ratio model for estimating pesticide loads in river catchments

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Abstract

Diffuse source pesticide pollution is problematic for soils, wildlife, water quality, and human health. Quantifying runoff risk is important for predicting these impacts and targeting mitigation. However, collecting long-term large-scale data is time- and resource-intensive. Introducing modelling could more efficiently estimate pesticide loads. However, many existing models are too complex or not spatially explicit.

We combined the InVEST Nutrient Delivery Ratio model with national pesticide maps to model pesticide loads across southern Great Britain for two pesticides. We compared this with a measurement-based approach, using pesticide concentration data from the Environment Agency and generated influenced river flow data.

We found significant positive relationships between measured and modelled pesticide loads, explaining up to 90% of regression variation when accounting for the proportionate area of arable land cover in catchments. Our flexible modelled approach can map the relative risk of pesticide runoff over large spatial extents, including for catchments with limited monitoring.

Modelling land-use and biodiversity impacts of UK dietary guidelines

Ms Niamh M Kelly[1,2], Dr Rebecca Wells[2], Dr Christian Reynolds[2], Prof Richard Pearson[1]

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Abstract

Compared to national dietary guidelines, the UK food supply has an excess of sugar, dairy, red meat and oils, and an undersupply of fruit and vegetables. A land use scenario was developed to better align the two, as part of an interdisciplinary project integrating, healthy diets, agricultural policy and biodiversity modelling.

The land use change will be allocated with GIS using a 2x2km dataset of UK land cover. Species distribution modelling will then be used, with an ensemble model including bioclimate, generalized linear and random forest models to estimate the potential impacts on pollinators in the UK. This will be based on occurrence records of 515 pollinators, which form part of DEFRA's species of interest.

The results of this project will help to highlight the links and potential co-benefits of aligning agriculture and land use with healthy diets, along with indicating practical agriculture policy implications for encouraging these changes.

Hoverfly use for the pollination of commercial soft fruits

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Abstract

The global decline in wild pollinators causes significant losses to soft fruit growers through malformed fruits and increased reliance on commercial pollination. Mitigating this requires improved ecosystem services from existing wild pollinators, such as hoverflies, which also have the additional benefit of providing biological control. This greater efficacy of pollination can be achieved through greater odour attraction within crops using semiochemical lures. However, most hoverfly attraction research focuses on ovipositional behaviour for biocontrol.

Therefore, we are identifying attractive semiochemicals using gas chromatography and mass spectrometry to create an attractive odour blend focused on improving pollination efficacy by both wild and reared hoverflies. Odour blends are being trialled for efficacy via Y-tube bioassays. This will further be confirmed with electroantennography, wind tunnel behavioural assays, and field trials on commercial crops. Eventually, we aim to produce a semiochemical lure deployable in crops to improve pollination services and yield in commercial soft fruits.

National horizon-scanning for future crops under a changing climate

John W Redhead[1], Matt Brown[1], Jeff Price[2], Emma Robinson[1], Robert J Nicholls[2], Rachel Warren[2], Richard F Pywell[1]

[1]UKCEH. [2]UEA

Abstract

Agricultural crops, and our management of them, affect our impacts on the natural environment. As the climate changes, some current crops may become less suitable, whilst others may offer opportunities to adapt agricultural systems by adopting crops that better suit shifting local climates. Mapped projections of relative climatic suitability across a wide range of crops can help identify these potential changes. Parametrising process-based models for multiple crops is complex, so there is value in using simpler approaches as a 'horizon-scan' to target further research. We present a horizon-scan based on EcoCrop data, mapping changes in suitability under +2°C and +4°C warming scenarios, for over 160 crops across the UK.

Climate change is likely to bring opportunities to diversify UK cropping systems, as many potential new crops show widespread increases in suitability. However, realising these opportunities is likely to require substantial changes to current farming systems and supply chains.

Bees and multiple stressors: the effects of an insecticide and nutritional stress on the Red Mason Bee (*Osmia bicornis*).

Megan Reilly[1], Dr Alison O'Reilly[2], Dr Dara Stanley[1]

[1]University College Dublin. [2]Lund university

Abstract

Bees exist in complex environments where they encounter multiple stressors regularly. Previous research investigating the effects of these stressors have mostly focused on social species and single stressors (e.g. neonicotinoid insecticides). Most bee species are solitary with drastically different life histories to social species, which may affect their sensitivity to pesticides and other stressors. Pyrethroid insecticides are commonly used in Ireland and have different modes of action to neonicotinoids, and may differ in their effects on bees. This project will investigate the effects of nutritional stress and a pyrethroid insecticide on sublethal characteristics of *Osmia bicornis*. Using semi-field and lab techniques, bees will be exposed to pesticides and flowers of differing nutritional value, and foraging behaviour, navigation and reproductive output measured. This research will address knowledge gaps around the effects of multiple stressors on solitary bees, and how nutrition may impact and potentially mitigate the effects of insecticides.

Using citizen science to study wheat-mycorrhizal interactions at a national scale

Dr Tom Thirkell

Crop Science Centre, University of Cambridge

Abstract

We were interested in wheat-mycorrhizal interactions in response to contrasting land management strategies in UK agriculture. Sample collection was required across >500km within 2 weeks – an unfeasible task for a single sampling team. A ‘citizen science’ approach was therefore used. Each participant was sent an identically prepared sampling pack and protocol for sample collection and handling, and samples were returned to the laboratory by postal service.

We found considerable variation in mycorrhizal colonisation, with a strong trend for reduced mycorrhizal abundance in agricultural sites of higher disturbance.

The ‘citizen science’ model proved ideal to address our research questions. Not only could we generate data of publishable quality, but the network also continues to facilitate dialogue between farmers, plant breeders and academics, with an aim to expand the experimental work in a more targeted manner. Our main conclusion is that farmer networks offer enormous potential for research studies in plant-soil science.

Plant and aphid variation in response to microbial inoculation with cascading impacts on parasitoid wasps

Megan Parker, Dr Sharon E Zytynska

University of Liverpool

Abstract

Aphids reduce agricultural yield and quality by extracting plant nutrients and vectoring diseases. Pesticides, although effective, can damage ecosystems and pest populations are evolving resistance. There is increasing evidence for using soil microbiome manipulation to enhance plant resistance to insects as a pest control strategy. We consistently observe aphid suppression by specific soil microbes, but also observed earlier arrival of parasitoid wasps and higher rates of parasitism of aphids on rhizobacteria-inoculated plants in the field. We examined this indirect effect of plant-microbial inoculation on aphids using a combination of plant biochemistry analyses, aphid gene expression (RTqPCR), and aphid-parasitoid assays. We present data demonstrating the impact of microbial inoculation on the plant metabolome and aphid gene expression that could lead to reduced aphid fitness and increased parasitism rates. Overall, we aim to provide practical solutions for agriculture and food security.

Spatial Prioritisation: An approach for identifying more impactful actions on land

Rory Barber, Julia Daly, Azra Gordy, Landry Green, Jo Hawker, Gwawr Jones, Hannah McGrath, Enya O'Reilly, Betty Roberts, Emma Wright

Joint Nature Conservation Committee

Abstract

Intensive agricultural management has had a significant impact on nature in the UK. Farming directly affects biodiversity declines through habitat loss and fragmentation, and indirectly contributes to pressures on soil health, pollinators, air and water quality. Ambitious policy targets e.g., 30x30, Net Zero, Plan for Water are aimed at tackling these many pressures, but with competing demands on land, how do you decide what action to take where to maximise benefits across multiple policy targets?

Our approach considers numerous evidence sources to build a system that identifies and ranks land management actions in a location based on their suitability and potential impact on delivery of multiple ecosystem services. The approach also highlights trade-offs and opportunities where many benefits can be realised.

This can enable decision makers and land managers to consider actions that have greater environmental benefits and therefore offer better value for money.

Mimicking wild megaherbivore behaviour: does regenerative grazing benefit moths?

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Abstract

Grazing megaherbivores can benefit biodiversity in pastures. However, in the UK, high stocking density can lead to overgrazed vegetation, with detrimental effects on moths. Regenerative grazing (RG) aims to mimic wild megaherbivore grazing behaviour by increasing herd numbers whilst moving cattle to fresh pasture daily. This study investigates whether RG is beneficial for moths in comparison to 'set-stocked' grazing. Thirteen pairs of regeneratively-grazed and set-stocked fields across Scotland were surveyed for caterpillars using sweep netting and for adult moths using light trapping. Moths responded negatively to increasing grazing intensity (number of cattle Ha^{-1} yr^{-1}), which tended to be higher in set-stocked fields due to a higher number of grazing days. However, both sheep presence and the percentage cover of ryegrass also had a negative effect on moths. This highlights that RG could benefit moths if grazing intensity is reduced, but pasture composition and grazing of sheep must be considered.

Do agri-environment schemes benefit Lepidoptera by providing nectar resources, potential larval host plants, or both?

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Abstract

Much research into the effectiveness of agri-environment schemes (AES) have focused on which management options can deliver for biodiversity. However, most studies do not demonstrate whether the benefits of AES on pollinators are due to the provision of suitable breeding habitat or by merely acting as nectar-rich 'honeypots' attracting adults from the wider landscape. Using data from a four-year biodiversity survey (LandSpAES project) we tested whether AES deliver benefits for Lepidoptera and disentangled the relative impact of floral resources and richness of the whole plant community using structural equation modelling. We found that the benefits of AES on Lepidoptera abundance, richness and diversity were positively mediated by both floral resources and botanical richness but that the relative impact of botanical richness was greater. This provides valuable evidence of the effectiveness of AES for Lepidoptera and highlights the importance of AES options that increase richness of potential host plants.

Does land use change ensure human development in Brazil? Evidence from agricultural cultures, 2007-2016

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[1]School of Public Health, University of São Paulo, Brazil. [2]Institute for Energy and Environment, University of São Paulo, Brazil

Abstract

Assuming that land use improvements enhance jobs and infrastructure, we investigated human development and changes in the amount of hectares dedicated to agriculture in Brazilian municipalities from 2007 to 2016. The data on land use and development were obtained from MapBiomas and the Firjan System, respectively. In Brazil, the area allocated to oil palm grew by 175.3%, with sugarcane, coffee, and soybeans following at increases of 74.6%, 43.3%, and 40.8%. Cotton and pasture areas decreased by 40.7% and 0.3%, while aquaculture, rice, and citrus saw modests increases of 12.6%, 30.2%, and 35.1%. Surprisingly, no oil palm-producing municipality had high development in either year, but the number of municipalities with high development and dedicated to aquaculture, rice, and citrus increased significantly. Since development may not depend only on expanding cultivated areas, we recommend further studies to explore inequalities on Brazilian agrifood systems.

Intensification traps in agricultural landscapes as roadblocks for transformative change

Dr Alfred Burian[1], Dr Claire Kremen[2], Dr Navin Ramankutty[2], Dr Zia Mehrabi[3], Dr Ralf Seppelt[1]

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Abstract

Intensive agriculture fueld by external inputs constitutes a major strategy for 'feeding the world'. However, such conventional intensification is linked to diminishing returns and can result at high levels into 'intensification traps' - production declines triggered by negative biodiversity feedback effects on yields. Here, we use a dynamic landscape model to evaluate the mechanisms driving intensification traps and assess financial costs that prevent farmers to exit them. Key in our analyses are temporal dynamics and delayed responses of biodiversity to reduced management intensities. We show that long biodiversity recovery times can result in substantial financial hurdles for transformative change in agricultural landscapes. These hurdles can trigger trap-situations, even if reductions of management intensity would result in higher farm revenues under equilibrium conditions. Hence, a better understanding of the agro-economic consequences of biodiversity recovery times is essential to avoid intensification traps and associated double losses of biodiversity and food security.

Riparian Ecosystem restoration in Tropical Agriculture: 5 years of data from the RERTA project, in Indonesian Oil Palm plantations.

Dr Becky E Heath[1,2], Prof Edgar C Turner[1], pk Agung Aryawan[3], Prof. Damayanti Buchori[4], Dr Purnama Hidayat[4], Dr. Sarah Luke[5]

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Abstract

Growing over 20-30 years an oil palm plantation can support a high degree of biodiversity and carbon sequestration, whilst producing up to 7x more oil per m^2 than the next most productive vegetable oil. For these reasons, oil palm is a vital crop whilst being well poised for sustainability, however, its expansion often competes directly with the extent of tropical rainforests. Owing largely to market pressures, increasing numbers of plantation owners have opted for more sustainable practice, to join "sustainable oil palm" accreditation schemes. In this talk, I'll explain 5 years of results from a large-scale, international, and largely interdisciplinary project designed to inform guidelines like these: RERTA (Riparian Ecosystem Restoration in Tropical Agriculture). Specifically, I'll explain how alternate riparian reserve restoration strategies affect: biodiversity, ecosystem function, soil, waterway health and importantly yield. These results provide essential data to inform sustainability guidelines and enhance the effectiveness of accreditation schemes.

Urban agriculture ecology: green roof crop growth is comparable to conventional agriculture

Adriano N Roberto, J. Scott MacIvor, Marney E Isaac

University of Toronto

Abstract

Understanding ecological dynamics of green infrastructure can enhance multiple ecosystem services, including urban agriculture. Many urban areas already produce crops within city limits, however growing space is the most restraining factor to urban crop production. Green roof agriculture increases growing areas, though these environments are stressful to plants. Using 20 species from 4 crop types - leafy, legumes, fruiting, and herbs - we determined changes in yield of crops planted in two types of green roofs (intensive and extensive) with variable soil depths and compared to yields in conventional on-ground garden beds. All crops produced greater edible yield in intensive beds compared to the extensive, most of which also produced higher edible yield in garden beds. This suggests that an increase to green roof substrate depth supports crop growth as well as differential ecological stressors, including pests and disease, on plant health for productive agricultural spaces in cities.

The effects of riparian habitat restoration on frogs within oil palm plantations in Sumatra, Indonesia.

Mr. Jamal Kabir[1], Mr Agung Aryawan[2], Dr. Sarah Luke[1], Dr. Helen West[1], Prof. Edgar Turner[3]

[1]University of Nottingham. [2]Sinar Mas Agro Resources and Technology. [3]University of Cambridge

Abstract

Oil palm (*Elaeis guineensis*) expansion across Southeast Asia has led to deforestation and reductions in biodiversity. Preserving riparian buffers along waterways is a potential strategy for boosting biodiversity within established plantations, yet management and restoration guidelines remain limited.

Our work on the Riparian Ecosystem Restoration in Tropical Agriculture (RERTA) Project in Sumatra, Indonesia, examines how different active and passive restoration strategies, including tree planting, affect biodiversity and ecosystem functions. We focussed on frogs, a taxon dependent on terrestrial and freshwater habitats, and sensitive to changes in management. We conducted repeat frog surveys in restoration treatments and surrounding oil palm over five years. We found frog abundance increased and community composition changed over time relative to surrounding plantations, indicating that riparian restoration areas may provide valuable resources for biodiversity within the landscape. We hope results from this project contribute to oil palm management guidelines, including those advocated by sustainability certification schemes.

Effects of farm management practices and landscape composition on invertebrate biodiversity in the Free State Province, South Africa

Dr Hemant Tripathi[1], Dr Steven Sait[1], Lisemelo Motholo[2], Teboho Mofokeng[2], Astrid Jankielsohn[2], Dr William Kunin[1]

[1]Faculty of Biological Sciences, University of Leeds, LS2 9JT, UK. [2]Small Grain Institute, Agriculture Research Council, Bethlehem 9702, South Africa

Abstract

Agricultural transformations and climate adaptation strategies impact farm management, with implications for biodiversity and ecosystem services. We compared the impact of traditional (TA) and conservation agricultural (CA) practices and landscape composition on invertebrate biodiversity within commercial and subsistence farms in the Free State Province, South Africa, facing climate risks and land use pressures.

Commercial CA farms practising cover cropping and livestock integration generally showed lower biodiversity, although ground-dwelling taxa abundance increased mainly due to increased homogenisation compared to commercial TA farms. In contrast, subsistence CA farms with manure, zero-till and intercropping indicated greater invertebrate biodiversity and biocontrol potential than subsistence TA farms, primarily due to increased heterogeneity. Landscape composition played a key role in both management types: farms with more non-crop habitats showed higher biodiversity and carbon sequestration.

Our research highlights the complex trade-offs between agriculture and biodiversity under climate and land use adaptation with important policy implications.

Spatial management can improve pollinator diversity within large-scale Citrus crops

Dr. Natacha P. Chacoff[1,2], Dr. Carolina Monmany Garzia[1], Dr. Andrés F. Ramirez-Mejía[3,1], Dr. Roxana Aragón[1,2]

[1]Instituto de Ecología Regional (CONICET-UNT), Tucumán, Argentina. [2]Fac. de Cs. Naturales e IML (UNT), Tucumán, Argentina. [3]Department of Ecology, Zoology and Genetics. Institute of Biology Universidad Federal de Pelotas. Brazil

Abstract

Pollinators are vital for plant reproduction, crucial for ecosystem health and crop production. In agricultural landscapes, pollinator conservation involves diversifying crops, sustaining natural habitats, and maintaining flowered non-crop areas. We evaluated how non-crop areas in large-scale Citrus plantations can promote pollinators by studying four lemon farms in NW Argentina. We selected 16 plots, eight at edges between natural forest and citrus and eight in open areas near citrus plants, using 12 pan traps per plot during the flowering season. We recorded 1316 Anthophila specimens from 5 families and 62 species. Open areas showed higher bee abundance ($\beta=3.59$, $p=0.03$) and richness ($\beta=2.39$, $p=0.001$) than edge areas, though species composition remained consistent across habitats. However, it varied throughout the flowering season. These findings suggest that managing non-crop areas effectively can enhance pollinator conservation in citrus plantations.

Developing a Soil Spectral Library for England: A Tool for Rapid In-Field Carbon Analysis in Agriculture

Ms Jessica C J Underwood[1], Dr Aidan Keith[2], Mr Alister Leggatt[3], Professor Chris Collins[1]

[1]University of Reading. [2]UK Centre for Ecology and Hydrology. [3]Affinity Water

Abstract

This study focuses on developing a soil spectral library and prediction model for soil properties e.g. carbon content, for England using soil samples from the Countryside Survey and a near infrared spectroscopy scanner. The Neospectra scanner is a simple, field deployable, handheld device which with associated models can predict soil carbon content in situ, offering an accessible tool for rapid soil analysis. These devices have the potential to monitor soil carbon under changing land management and offer farmers and researchers a rapid assessment tool to monitor soil health. This dynamic approach has multiple benefits over current lab-based methods, as it is rapid, requires little preparation and provides near instant results enabling subsequent action to be undertaken quickly and enhancing user engagement.

The mutual benefit between ecosystem health and donkey welfare; exploring grassland heterogeneity and donkey behaviour for landscape management

Miss Jessie Fitts[1], Dr. Paul Lintott[1], Dr. Mark Steer[1], Dr. Laura Kubasiewicz[2]

[1]UWE Bristol. [2]The Donkey Sanctuary

Abstract

Despite originating from semi-arid environments, over 20,000 donkeys (*Equus asinus*) are kept as companion animals in the UK. Grazing primarily in fields and pastures, existing management practices may lack species rich environments to provide donkeys with sufficient graze and browse opportunities. Additionally, a lack of appropriate management can result in lasting negative impacts on the environment including a reduction in biodiversity and reduced soil organic carbon from overgrazing. In this poster we will outline our research investigating the impact of habitat heterogeneity and botanical diversity on donkey welfare. We highlight the drivers that influence donkey behaviour and outline the ecological management techniques required to support both welfare and biodiversity. We will also share the findings from our dietary preference experiment to understand how native hedgerow and trees can be used to increase biodiversity in agricultural settings alongside improving donkey health and welfare.

Rapid Metabolomic Fingerprinting for Forest Risk Commodity Traceability

Mr Henry Jennings[1], Dr Caspar Chater[1,2], Dr Cady Lancaster[1], Dr Victor Deklerck[3,1,4]

[1]Royal Botanic Gardens, Kew. [2]University of Sheffield. [3]World Forest ID, Washington DC, USA. [4]Meise Botanic Garden, Meise, Belgium

Abstract

Demand for commodities such as soy and cacao are driving biodiversity loss. To reduce the impact of agricultural expansion on deforestation, the UK and EU deforestation regulations aim to improve soy and cocoa supply chain transparency and traceability. One obligation of these regulations is to provide evidence of point of harvest, for which traders and regulators will need science-based traceability tools to comply. Metabolic fingerprinting, using Direct Analysis in Real Time Time Of Flight-Mass Spectrometry (DART TOF-MS), is a rapid and inexpensive technique previously used in timber identification. Here, using our World Forest ID geo-referenced South American soybean reference collection, and cacao collection from Africa and Ecuador, we demonstrate an effective DART-TOF-MS analysis pipeline using RandomForest classification models and the synthetic minority over-sampling technique (SMOTE) to support harvest origin verification for these commodities.

Peatland restoration can provide a climate benefit on all time scales: a case study with The Wildlife Trusts

Miss Xiao Zhang, Dr John Lynch

University of Oxford

Abstract

Peatlands provide one of the largest terrestrial carbon stocks in the UK. However, a large proportion of peatland is degraded, becoming a major source of carbon emissions. Ecological restoration can reduce carbon dioxide (CO_2) emissions and ultimately return peatlands to carbon sinks, but can also increase methane emissions. Increasing methane, as a short-lived but strong greenhouse gas, may cause increased warming for several years after peatland restoration. To investigate this, we evaluated emissions and resultant climate impacts of peatland habitats before and after restoration by The Wildlife Trusts using several alternative 'CO_2-equivalence' conversion metrics and a simple approach modelling warming over time. We found that restoration has likely already provided large emission reductions. Though some restoration transitions do increase methane emission, there is still a net climate benefit even in the short term; and the restored sites can provide long-term ongoing cooling. Therefore, peatland restoration should continue to be encouraged.

Hyperspectral reflectance bioindicators reveal pollination status in *Brassica napus* flowers

Ms Catherine Parry, Dr Richard J Gill

Imperial College London

Abstract

Pollination underlies plant yield, health, and reproductive success in agricultural and natural systems worldwide. It is therefore concerning that declining animal pollinator populations compounded by growing demands for food are leading to rising pollination deficits, with globally significant economic and environmental implications.

Despite this urgent issue, accurate and scalable tools to quantify and track pollination across useful spatiotemporal scales are lacking. Using machine learning we have identified novel candidate hyperspectral reflectance bioindicators which can be applied to accurately predict pollination and senescence in Oilseed rape flowers. Using our in-situ hyperspectral imaging system to generate time-series floral reflectance profiles, I demonstrate the utility of hyperspectral reflectance for revealing floral ultrastructural and metabolomic changes that are invisible to the naked eye. These findings have the potential to quantify previously unidentifiable pollination deficits in real-time at the landscape scale, with broad applications across crop and non-crop species to inform targeted pollinator conservation.

Behavioural Ecology

Effects of Artificial light at night and predator cues on freshwater Gammarids.

Mr Wrya Agha Hassan

Nicolaus Copernicus University in Torun. Pirmam Technical and Vocational Institute

Abstract

Artificial light at night (ALAN) from urban sources, such as streetlights, disrupts natural day-night patterns and impacts animal behavior and predator-prey dynamics. I studied the effect of different nocturnal light spectra on predator effectiveness, using the freshwater amphipod Gammarus jazdzewskii as the predator and chironomid larvae as prey. Our results showed higher prey consumption in darkness, with no significant difference between cool white LEDs and high-pressure sodium lamps (HPS). Both ALAN and predator cues reduced the time G. jazdzewskii spent in refuge, while light type influenced movement duration. This indicates that G. jazdzewskii perceives nighttime illumination as a threat, suggesting ALAN could alter its survival in the wild by diminishing food consumption and affecting behavior. These findings highlight the ecological impact of artificial lighting on nocturnal species.

Environmental trigger factors and behaviour patterns in European hedgehogs (*Erinaceus europaeus*) over the hibernation period.

Miss Jess Connors[1,2], Professor Jane Hurst[1], Miss Amanda Davidson[1], Dr Julia Nowack[3], Professor David Bardell[2]

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Abstract

UK hedgehog numbers have declined dramatically. Anthropogenic changes in global and local environmental conditions and altered hedgehog distribution towards more urban areas may negatively impact on hibernation, affecting survival. Movement and behaviour of four hedgehogs housed overwinter in an extensive, semi-naturalistic enclosure with *ad libitum* food availability were monitored using radiofrequency tracking and motion-sensitive cameras. Light intensity and duration, temperature, humidity and dew point were continuously monitored and recorded. Despite exposure to identical environmental conditions, there was variation in whether hibernation occurred or not, time of onset and emergence from hibernation and number and timing of arousals. Nest sharing was frequently observed. Weight loss over hibernation was less than previously reported. Food was consumed during arousals, with individual food preferences demonstrated. Rapid weight gain followed emergence. Sex and daylight duration <9hrs may influence hibernation. A greater understanding of hibernation drivers can help inform conservation measures in this vulnerable species.

Quantifying diet and anthropogenic foraging in large gulls using diet metabarcoding

Dr Alice Risely[1], Dr Bart Donato[2], Dr Tim Frayling[2], Dr Naiara Guimaraes Sales[1]

[1]University of Salford. [2]Natural England

Abstract

Land-use change is causing widespread shifts in biodiversity richness and composition. Whilst many species are restricted to undisturbed habitats, some generalists have adapted to land-use change by exploiting human resources. To understand the consequences of urban adaptation for individuals and populations, it is useful to be able to identify diet composition and anthropogenic food items across individuals, which is often challenging for highly generalist species. Diet metabarcoding can provide high-resolution diet data yet can have its challenges, including the amplification of host DNA, sensitivity of sample type, and a large array of potential target primers. This study tests various sampling and primer methods to compare diet data using uber-generalist Herring (*Larus argentatus*) and Lesser-black backed (*L. fuscus*) gulls as a model system, and presents the results of this study so far. This work will be useful for researchers studying the diet and foraging ecology of generalist species more broadly.

Warning coloration fails to prevent predation in aquatic caterpillar: species from the Brazilian savanna after fire

M.Sc Iasmim Pereira de Freitas[1], Prof Vanessa Stefani[2], Dr Drielly Queiroga[3], Prof Lucélia Nobre Carvalho[4], Prof Juliana Gonzaga Oliveira[2], Prof Helena Maura Torezan-Silingardi[2], Prof Kleber Del Claro[2]

[1]Universidade de São Paulo. [2]Universidade Federal de Uberlândia. [3]University of Cincinnati. [4]Universidade Federal de Mato Grosso

Abstract

Many animals use conspicuous colours to warn predators and avoid predation. Terrestrial caterpillars often employ this strategy, but it is understudied in semi-aquatic species. This study examines whether the orange-black colouration of the semi-aquatic caterpillar *Paracles klagesi* (Erebidae) serves as a warning display. We tested if: 1) fish predators have an innate aversion to orange coloration, 2) caterpillars are unpleasant, and 3) predators learn to avoid orange caterpillars faster. Results showed fish do not innately avoid orange-black but learn to avoid all caterpillars after an initial encounter, regardless of colour. Also, fish displayed aversive behaviors after attacking, indicating caterpillars are unpleasant. We conclude that orange-black coloration does not impact learning avoidance, suggesting that fish might use other cues, such as shape, texture, and chemical signals, to recognize and avoid *P. klagesi* caterpillars. This study highlights how complex warning colour signals are in predator-prey dynamics in freshwater habitats. Funding: CAPES-001; CNPq-403647/2021-5.

Assessing the impacts of coral restoration on butterflyfish behaviour

Ms Sera Maserati[1], Mr. Timothy A.C. Lamont[2], Ms Tries B. Razak[3]

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Abstract

Widespread degradation of coral reefs has major implications for reef-associated organisms. In particular, reef fish rely on coral reefs for habitat and food. Reducing coral coverage alters reef fish behaviour, often increasing aggression and reducing population sizes.

In many areas around the world, coral restoration efforts aim to restore reef ecosystem functioning - but little is known about restoration effects on non-coral species.

This study quantifies the behaviour of butterflyfish - an important coral reef fish family - in both natural and restored coral reef areas. We measure the levels of of aggression and territorial defence exhibited by thee fish in natural and restored contexts, testing the hypothesis that altered coral composition in restored areas will lead to altered territorial dynamics. By understanding the behavioural patterns of coral-obligate fish, we can better assess the wider ecosystem impacts of coral restoration efforts, delivering a more holistic evaluation of their success.

Ants in the Hot Seat: Investigating Thermal Biology at a Macroecological Scale

Miss Sophie L Mallett[1], Dr Tom R Bishop[1], Dr Ian Vaughan[1], Dr Lily Leahy[2], Dr Xim Cerdá[3], Mr Tristan Klaftenberger[4], Miss Lucy Wheatley[1], Mr Shane King[1], Mr Kester Leyshon[1], Mr Icaro Wilker[5]

[1]Cardiff University. [2]La Trobe University. [3]Estación Biológica de Doñana. [4]University of Lausanne. [5]Universidade Federal de Lavras

Abstract

Understanding species' thermal responses is vital for predicting climate change impacts on ecosystems. Traditional dry bath methods for studying thermal biology are labor-intensive, focusing mainly on critical temperatures like CTmax and CTmin, where organisms lose their righting reflex. These methods often miss more complex thermal responses affecting foraging and running speed. Automated Locomotor Activity Monitors (LAM) housed in a programmable incubator can generate continuous data to create thermal performance curves (TPCs). These curves reveal inter- and intra-species differences in thermal tolerance. In a study of thirteen ant species, we compared consistency and reliability for predicting thermal limits between the two methods: the LAM and dry bath. While LAM proved reliable for upper thermal limits, it was less effective at detecting lower limits. Despite this, LAMs offers significant advantages over dry baths, including higher-throughput, continuous and objective data at lower labor costs, making it a valuable tool for thermal biology research.

Predators and Pollutants: Investigating the Behavioral Responses of *Asellus aquaticus* to Multiple Stressors

Mr. Akshay Mohan[1], Dr. Blake Matthews[2], Dr. Katja Räsänen[1]

[1]University of Jyväskylä. [2]Eawag - Swiss Federal Institute of Aquatic Science and Technology

Abstract

Species inhabiting freshwater ecosystems face multiple stressors, with chemical pollutants and predation significantly influencing their behavior and survival. This study investigates the combined effects of Tebuconazole, a common agricultural fungicide, and predator cues from dragonfly larvae on the behavior and survival of *Asellus aquaticus*, a keystone detritivore. We employed a 2x2 factorial experimental design to systematically explore these interactions under controlled conditions. *A. aquaticus* were exposed to environmentally relevant concentrations of the fungicide and predator presence, with their behavior tracked using advanced video analysis techniques. Preliminary results reveal significant behavioral changes, including altered feeding patterns and exploratory behavior, suggesting complex effects on keystone species and ecosystem functionality. These findings underscore the importance of integrated approaches to managing multiple environmental stressors, providing deeper insights into their collective impact on biodiversity and ecosystem health.

The effect of anthropogenic noise on red squirrel and pine marten behaviour

Ms Emily Legge[1], Dr Hansjoerg Kunc[1], Professor Xavier Lambin[2]

[1]Queen's University Belfast. [2]University of Aberdeen

Abstract

Anthropogenic noise can alter an animal's perception of its environment, potentially affecting risk assessment and leading to behavioural modifications. These changes, such as reduced foraging and increased vigilance, may cascade through trophic levels and impact ecosystem dynamics. Thus, increasing noise levels are particularly concerning for red squirrels (*Sciurus vulgaris*) and pine martens (*Martes martes*), which are species of conservation concern in the UK, recovering from near eradication. Effective management of these species requires an understanding of their responses to environmental stressors, such as anthropogenic noise. This study is the first to experimentally quantify the effects of anthropogenic noise on in-situ red squirrel and pine marten behaviour. Our evidence shows that both species double their alert time when exposed to anthropogenic noise, but that response timings vary. Our findings increase understanding of the behavioural flexibility of recovering predator and prey species in a landscape with changing sounds.

Tracking and Probabilistic Modelling of Bombus Terrestris Flight Paths across Cluttered Landscapes

Mr Christopher J Noroozi, Dr Michael T Smith

University of Sheffield

Abstract

Critical to conservation is understanding how animals use landscapes. Current landscape-scale flying insect tracking methods are either too expensive, too heavy and/or struggle to operate in cluttered environments - meaning the effects of landscape differences on behaviour are difficult to observe. Being able to monitor the activity of flying insects across different landscapes could provide insights into how to better manage land, and understand their decision making processes.

We are developing a novel method for landscape-scale insect tracking using rotating Bluetooth transmitters with ~250m range placed across a landscape and <40mg tags attached to foraging bees. The archival tag infrequently receives noisy & uncertain data due to power constraints, so a Gaussian Process is used to model the individual's flight path, using variational inference for 'probabilistic triangulation'. Field trials have shown that tagged bees are able to fly and forage. We found a reconstruction accuracy of within +/-5°.

Can we help caribou win the race against HIREC: how behavioural ecology can benefit the conservation of an endangered species

Prof. Martin-Hugues St-Laurent

Université du Québec à Rimouski / Centre for Forest Research

Abstract

Boreal caribou, a threatened species in Canada, has been declining rapidly for decades due to predation pressure exacerbated by resource extraction activities. But can caribou adapt to human-induced rapid environmental changes (HIREC)? Using telemetry data collected on hundreds of caribou and predators during the last 20 years in the eastern Canadian boreal forest, we have shown that females are forced to make behavioural compromises that have fitness consequences. Notably, (1) females that use food-rich, recently logged areas are more likely to be killed by a wolf or to lose their calf to a bear; (2) female responses to clearcuts are shaped by the evolutionary exposure of their ancestors to wildfires; and more interestingly, (3) females can "learn" to cope with the risk associated with cutblocks throughout their lives. Fortunately, several pieces of evidence suggest that caribou can adapt to HIREC. The pressing question is whether they can adapt quickly enough.

Behavioural heterogeneity across killer whale social units in their response to feeding opportunities from fisheries

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Abstract

Intra-population heterogeneity in the behavioural response of predators to changes in prey availability caused by human activities can have major evolutionary implications. However, heterogeneity in the extent to which individuals in marine top-predator populations have responded to new feeding opportunities from fisheries is poorly understood. Using 18 years of photo-identification data paired with statistical models, we show that killer whale social units within a subantarctic population (Crozet Islands) interact with fisheries to feed on fish caught on fishing gear (i.e., depredation behaviour) at varying spatial and temporal extents. This variation is partly explained by social units having acquired the depredation behaviour through either social transmission or independent learning. These findings highlight the role of social dynamics in shaping species' response to human-induced changes, leading to intra-population behavioural heterogeneity that can have major implications for the long-term conservation of top marine predator populations.

Do rising temperatures influence pollen provisioning in the solitary bee *Osmia bicornis*?

Dr. Elisa Gomes[1], Ms Eliza Miller[1], Mr Jamie Smith[1], Dr Jamie Dodd[1], Dr Elizabeth Nicholls[2], Prof. Jeremy E. Niven[2], Dr. James D. J. Gilbert[1]

[1]University of Hull. [2]University of Sussex

Abstract

Wild bees provide the ecologically and economically crucial ecosystem service of pollination - but are impacted by human-induced environmental changes such as rising temperatures. Temperature affects insect behaviour and physiology, but the interplay between temperature and nutrition has rarely been studied. Solitary mason bee larvae (*Osmia bicornis*) develop on pollen provisions collected by adults. Larval nutritional requirements change with temperature, but whether adults adjust their foraging rules to meet these requirements is unknown. We therefore investigated the impact of temperature on parental pollen provisioning in *O. bicornis* in field conditions. We analysed the plant species and nutritional composition of provisions gathered by females provisioning nest boxes heated to three temperatures. Initial findings suggest that females preferred nesting at higher temperatures, although this resulted in higher larval mortality. This study will shed light on how climate heating may change foraging behaviour of solitary bees, and therefore the pollination services they provide.

Scavenger Diversity at Hunter-Derived Offal Piles in the Midwestern United States

Mr. Christopher J. Huff, Dr. Peter R. Minchin, Dr. Richard L. Essner

Southern Illinois University Edwardsville

Abstract

Each fall hunters in the United States harvest millions of White-tailed Deer (*Odocoileus virginianus*). Field dressing of deer provides a large influx of nutrient-rich offal into the ecosystem over a short period. We used trail cameras placed over offal piles to examine scavenger diversity among three habitat types: agricultural field, forest edge, and forest interior (17 sites, >4000 images). We documented ten scavenger species across sites. We found no significant difference in Shannon diversity (p = 0.085), species richness (p = 0.14), habitat preference (p = 0.61), or community structure (p = 0.64) among habitat types. There was a significant difference in preferred mean feeding times of avian vs. mammalian scavengers (p < 0.00001). The similarity of the scavenger guild across habitat types may be attributable to the highly fragmented landscape of the Midwestern U.S. as well as the generalized behaviour of the scavengers.

How do social relationships and spatial proximity affect behavioural synchrony in feral cattle?

George M. W. Hodgson[1], Kate J. Flay[2], Tania A. Perroux[2], Alan G. McElligott[1]

[1]Department of Infectious Diseases and Public Health, City University of Hong Kong.
[2]Department of Veterinary Clinical Sciences, City University of Hong Kong

Abstract

Synchronisation is an important allelomimetic behaviour, indicating social cohesion in group-living species and affecting the survival and fitness of individuals through foraging and anti-predator strategies. The association between social relationships, spatial proximity, and synchronisation is largely unexplored in free-ranging ungulates, as individual sociodemographic factors (e.g., dominance or affiliation) are often unknown, and group level synchronisation data unavailable. Using scan sampling with all individuals in a group of feral cattle (*Bos taurus*), we investigate whether behavioural synchrony is associated with proximity and differences in social relationship. We find that focal animals are more synchronised with closest neighbours than with randomly selected individuals in the group. We aim to analyse these data on a dyadic level, investigating whether differences in sex, dominance or sociality are associated with likelihood of synchrony. Thus, we will test whether dyadic relationships can explain variation in synchrony beyond the effect of proximity.

Tri-trophic interactions affect local and landscape prey diversity in vole-seed systems

Molly Gilmour, Filippa Erixon, Prof Jana Eccard

University of Potsdam

Abstract

Greater diversity of resource species increases ecosystem stability. Although this pattern is recognised in ecology, it is important to further our understanding of the processes that maintain resource diversity. In this study we investigated how tri-trophic interactions affect local and regional diversity of a resource over time, using a tri-trophic predator - rodent (consumer) – seed (resources/prey) system. Using an experimental semi-wild system, we assessed how consumer density and behaviour influenced resource diversity after foraging (DivGUD approach (Eccard et al. 2022)). Resource diversity was affected by an indirect tri-trophic effect of predation on consumer behaviour. Resource communities in risky foraging microhabitats had higher local (alpha) diversity compared to those in safe foraging microhabitats. Regional diversity (gamma) remained independent of consumer density. Our results show that consumer decisions, that are affected by predation risk and/or consumer competition, can act as a mechanism determining species diversity on the resource level.

The timid invasion: Why are native wood mice in Ireland displaced by invasive but shy bank voles?

Prof. Dr. Jana Eccard[1], Bernd Boßlet[1], Prof. Dr. Ian Montgomery[2], Dr. Peter Stuart[3]

[1]Animal Ecology, Potsdam University Germany. [2]Emeritus, Queens University Belfast. [3]Institute of Technology, Tralee

Abstract

There is only one native species of forest rodent in Ireland, the wood mouse (*Apodemus sylvaticus*). Continental bank voles (*Myodes glareolus*) have been invading Irish hedges, woods and plantations since the 1920s. The invasion shows spatial sorting, with bank voles being shyer at the invasion edge than in established ranges (Eccard et al. 2022). We investigated behavioural differences between the two species, comparing 6 invasion and pre-invasion sites using camera traps with a shortened focal length (360 trap nights). Bank voles fed more efficiently than wood mice; wood mice did not prolong their activity pattern in response to the increased resoucre pressure from the bank voles. However, bank voles did not displace wood mice from good feeding sites by aggression. Our results indicate that wood mice have not evolved a flexible response to resource competition by bank voles contributing to their decline in areas of Ireland invaded by bank voles.

My research project was eaten! Unveiling predator-prey dynamics of bluefin tuna and orcas using high-resolution biologging

Jessica Rudd[1], Ghalia Abel[1], Francisco Baringo[2], Samantha Birch[3], Barbara Block[4], Martin Collins[5], Renaud de Stephanis[2], Owen Exeter[1], Francesco Garzon[1], Christophe Guinet[6], Thomas Horton[1], David Righton[3,7], Jeroen Van Der Kooij[3], Matthew Witt[1], Serena Wright[3], Lucy Hawkes[1]

[1]University of Exeter. [2]Conservation, Information and Research on Cetaceans (CIRCE). [3]Centre for Environment, Fisheries and Aquaculture Science. [4]Stanford University. [5]British Antarctic Survey. [6]Centre d'Etudes Biologiques de Chizé. [7]University of East Anglia

Abstract

Biologging has been used on a range of wild animals to document spectacular feats of migration and behaviour. We describe the pursuit, capture, and ingestion of an adult Atlantic bluefin tuna (*Thunnus thynnus*) (175 cm, estimated weight: 81 kg), which was instrumented with a biologging tag, by a predator, most likely an orca (*Orcinus orca*). The predation event lasted over 19 minutes, with the tuna exhibiting elevated activity (max acceleration 3.12 g), several near escapes, and a rapid ascent from 126 m at 3.6 $m.s^{-1}$ followed by death and handling at the surface. Orca were separately recorded using video tags, capturing and handling tuna cooperatively in a manner consistent with the tuna data. We then present 11 days of orca accelerometry, with diel patterns of activity and 77 feeding events from internal temperature data. These unique datasets provide insight into the energetic dynamics of two of the ocean's fastest predators.

Animal Perspectives in Ecology: methods for integrating welfare into ecology

Dr Vittoria Elliott[1,2], Dr. Janire Castellano-Bueno[1,3]

[1]Wild Animal Initiative. [2]National Museum of Natural History, Smithsonian Institution. [3]Newcastle University

Abstract

This talk will introduce and highlight the benefits of using wild animal welfare science research methods for understanding the ecology of wildlife. First, we frame the welfare of wild animals as a function of their affective experiences, and describe how this understanding can help ecologists better interpret their observations. Next, we describe the utility of behavioural and ecophysiological indicators of welfare for ecological studies. Finally, through a series of case studies we will present results showing how measuring welfare both enhances rigor and repeatability, as well as how integrating wild animal welfare into the study of behavioural ecology, population dynamics, food web ecology, and ecosystem processes can help us disentangle the complex connections among diverse ecological systems. Through this talk we hope to inspire researchers to embrace the use of novel wild animal welfare science methods to enhance ecological studies across a wide range of study systems.

Does long-tailed tit preen oil contain a signature of kinship?

Joey Baxter, Professor Ben J Hatchwell

University of Sheffield

Abstract

The ability to discriminate between kin and non-kin is advantageous, both to avoid inbreeding and to enhance indirect fitness by cooperating with relatives. The redirected system of helping in cooperatively breeding long-tailed tits (*Aegithalos caudatus*) means that, prior to helping, individuals interact with both close relatives and unrelated conspecifics. Therefore, accurate kin recognition mechanisms are likely required when making helping decisions. While the role of olfaction in kin recognition is well-documented in many taxa, it has only recently gained attention in birds. Olfactory kin recognition has now been evidenced in several avian species, but not yet in any cooperative breeder, despite the kin-selected fitness benefits available in these social systems. We compare the composition of preen oil, the primary source of a bird's odour, among individual long-tailed tits. Specifically, we investigate whether preen oil composition is consistent within individuals over time, and whether relatives have more similar preen oil.

The behavioural responses of bumblebees to simulated rain

Laura A Reeves[1,2], Ellie M Jarvis[1,3], David A Lawson[1], Sean A Rands[1]

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Abstract

Bumblebee activity typically decreases during rainfall, putting them under the threat of the increased frequency of precipitation due to climate change. We observed the behavioural responses of bumblebees (*Bombus terrestris*) to simulated rain. During rainfall, a greater proportion of workers left the arena than entered, the opposite of which was seen during dry periods, implying that they compensate for their lack of activity when conditions improve. The proportion of workers flying and foraging decreased while resting increased in rain. This pattern reversed during dry periods, providing further evidence for compensatory activity. The increase in resting behaviour during rain is thought to evade the high energetic costs of flying while wet without unnecessarily returning to the nest. This effect was not repeated in individual time budgets, measured with lone workers, suggesting that the presence of conspecifics accelerates the decision of their behavioural response, perhaps via local enhancement.

Adding LiDAR data to ecoforest maps in habitat selection studies uncovers behavioural choices of large mammals in Quebec.

Mr. Brendan Blanchard, Prof. Robert Schneider, Dr. Frédéric Lesmerises, Prof. Martin-Hugues St-Laurent

Université du Québec à Rimouski

Abstract

Habitat selection in large mammals typically relies on forest maps to link the locations of individuals to environmental data. Forest maps in Quebec, Canada, yield information on forest composition, whereas LiDAR can provide metrics of 3D vegetation structure and is not fully leveraged in wildlife research. We aim to determine if combining these products improves habitat selection predictions for large mammals in boreal forests. We used mixed logistic regressions to characterize habitat selection, and cross-validation to assess model performance. Results demonstrate that integrating LiDAR data with forest maps significantly enhances prediction accuracy across species, though benefits vary with seasons and study areas. Vegetation structure is the main determinant for caribou in both summer and winter seasons, whereas forest composition is most important for moose in winter. These differences can be partly attributed to contrasting compositions between northern and southern forests, and the timing of LiDAR data acquisition in summer.

Factors Affecting Flight Decisions and Turbine Avoidance in Soaring Raptors (Red Kite and Common Buzzard) at wind farms: A Vantage Point Study in Northern Scotland

Miss Anna G Costley-Wood[1], Professor Kirsty Park[1], Dr Brad Duthie[1], Professor Colin Galbraith[2], Dr Ian Hulbert[3]

[1]University of Stirling. [2]NatureScot. [3]Skorpa

Abstract

With the global transition to decarbonised energy, the UK is seeing a rapid increase in onshore wind farms, particularly in ecologically sensitive upland areas like Northern Scotland. This expansion presents challenges for species such as the Red Kite, a large raptor reintroduced in recent decades after near-extinction. This study focuses on a 20-turbine wind farm in Moy, South Inverness, analysing 7 years of flight data to understand how Red Kites interact with wind farms. The research addresses three key questions: (1) Which environmental variables influence flight paths within the wind farm? (2) How do temporal factors affect proximity to turbines? (3) How do these interactions differ from those of the Common Buzzard? Using vantage point flights, correlated random walk analysis, and structural equation modelling, the findings aim to inform conservation strategies that minimize collision risk and support the Red Kite's continued recovery in the UK.

Sexual segregation in a large mammal: influence of early-life individual behavioural strategies and impact on life-history traits

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Abstract

Sexual segregation is common in mammals, but little is known about the detailed process (i.e. timing and consequences) by which young males leave their natal groups to join adult male groups. We investigated how neonatal traits and early-life states affect this process in fallow deer (*Dama dama*). We defined two key behaviours: (i)when and why males leave their mother group and (ii)whether and why they revisit natal areas before completing segregation. Path analysis revealed that fawns with higher birth weights grew larger antlers, left earlier, and returned less often to natal groups. Bold fawns, measured by heart rate during handling, were more likely to form same-sex groups and revisit natal areas. Early leavers showed higher survival rates before adulthood but did not have better body conditions than late leavers. This study provides the first evidence linking early-life behavioral individuality to sexual segregation and its impact on life-history traits.

Post-Nesting movements of seabirds in the Lakshadweep Islands: A Pioneering Satellite Tracking Study from the Indian region

Mr. Rajdeep Mitra

Wildlife Institute of India

Abstract

A study was conducted in the Lakshadweep Archipelago in the Arabian Sea from February to April 2024 to assess the nesting seabird populations and understand their fine-scale movements. At Pitti Island, only Sooty Tern and Brown Noddy were found actively nesting. On 8 May 2024, one individual of each species was captured and subsequently satellite-tagged. The Sooty Tern's tag stopped transmitting after five days, during which it frequently travelled far distances likely to bring food for the fledgling. In contrast, the Brown Noddy remained around Pitti for three months, frequently making trips only to the nearby waters. After 106 days, it started migrating northward, covering over 1,500 km to coastal and inland regions of western India, before its tag stopped responding on August 29. This pioneering study highlights for the first time post-nesting movements of a seabird from the Indian waters, forming a baseline for future research in this region.

Thermal niche tracking through phenological shifts

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Abstract

Identifying how and why species vary in their ability to adjust to rapidly changing climates is a key challenge in ecology. While phenological shifts in birds have been studied in the context of resource availability, little is known about whether such shifts allow populations to maintain a consistent thermal niche. We will examine the degree to which 21 temperate bird species track thermal niches across spatial (latitude) and temporal (yearly) scales. Using data from the British Trust for Ornithology Nest Record Scheme, we will quantify the relationship between incubation temperatures and nesting success and assess how shifts in laying dates maintain optimal thermal conditions. This research will explore differences in thermal niche tracking between migratory and resident species, enhancing our understanding of avian adaptation strategies in response to climate change.

Beyond the Surface: Nesting Depth and Climate Resilience in Desert Chameleons

Liran Sagi, Prof. Amos Bouskila

Ben-Gurion University of the Negev

Abstract

Reproductive success in reptiles is intricately linked to environmental conditions, making nest site selection by the females a critical adaptive behaviour. While laboratory studies often focus on controlled incubation conditions, natural nesting strategies and conditions remain underexplored. The desert chameleon (*Chamaeleo chamaeleon musae*) serves as a case study for understanding how species adapt to extreme environments. Females dig extensive burrows, reaching depths of 1m, to create optimal conditions for their eggs, which require an 11-month incubation period. These chameleons use thermal cues to decide whether to abandon a nesting attempt and hydric cues to assess when they have reached the ideal depth, ensuring the survival of their offspring. These deep nests help buffer against extreme temperatures and moisture loss, potentially offering protection against the effects of climate change. Examining these behaviours, provides insight into the significance of natural nesting strategies in mitigating environmental challenges, highlighting their importance in species resilience.

Investigating the effect of body size and reward volume on the foraging ecology of bumblebees *(Bombus terrestris audax)*.

Mr Joseph L Gillson, Dr Jonathan G Pattrick, Prof. Geraldine Wright

Department of Biology, University of Oxford

Abstract

Bumblebee workers show considerable within-colony size variation. Generally, larger bumblebees forage outside, whilst smaller bumblebees undertake within-nest tasks. This alloethism has typically been explained by larger bumblebees being able to fly farther and carry more forage; however, there may also be a cognitive component. Disentangling cognitive versus morphological causes of alloethism is tricky: given that larger bumblebees can carry more, during each foraging trip they might interact with more flowers, therefore having more learning experiences. Utilising foraging assays involving bumblebees of different sizes, and by varying nectar volumes, we sought to resolve the relationship between bee size, number of floral choices, and learning performance. We found that the number of floral interactions per foraging trip varied with both bee size and nectar volume, influencing learning performance. These factors also affected foraging energetics and we discuss our results within the context of the pollination ecology of small and large bees.

Wind speed and direction determine large herbivores movements in African savanna systems

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Abstract

Although rarely studied, variation in wind conditions can impact animal perception of the environment, and ultimately affect foraging efficiency and predation risk. This study aims to investigate to what extent both wind speed and direction matters for large-scale herbivore movements. We used GPS data recorded in multiple protected areas, on four species of large African herbivores experiencing contrasted predation risks, providing a comprehensive understanding of the impact of wind on movements. We found that species with high predation risk increasingly avoids moving far away as wind speed increases. Also, animals making long displacements, moved significantly more frequently upwind rather than cross-/backwind. Although we observed significant variability between individuals and sites, it is clear that wind matters for herbivore movements and this study therefore supports the need to delve deeper into the biological mechanisms underpinning the patterns we observed.

Environmental drivers of natal dispersal in a facultative cooperative breeder

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Abstract

Most studies investigating environmental factors affecting natal dispersal focused either on the departure or the arrival phase, or accounted for only few environmental variables. We used 27 years of data from a long-tailed tit population and a thorough vegetation census (9 metrics, 233 sampling points) to study the habitat features affecting natal dispersal. Tree density, the presence of hedgerows and a dense understorey habitat positively correlated with nest density, i.e. habitat attractiveness. Yet, nest density did not predict breeding success, presumably because of the high predation pressure across the whole study area, irrespective of habitat type. Finally, our integrated step selection analysis showed that recruits dispersed to habitats with higher tree density and diversity and more understorey vegetation than their natal site, thus favouring a combination of foraging- and nesting-related cues. They also dispersed to more densely populated areas, suggesting a role of conspecific attraction in this facultative cooperative breeder.

Monkey hear, monkey do…what? Testing Automated Behavioural Response systems as a methodology to investigate behavioural hypotheses using pygmy marmosets as a model system

Dr Larissa Barker, Dr Sarah Papworth

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Abstract

Multiple hypotheses have been used to describe how humans impact animal behaviour, but there are numerous challenges to field-testing these hypotheses, including observer effects and sufficient sample sizes. To overcome this, we deployed Automated Behavioural Response systems (ABRs) to conduct playback experiments testing the risk-disturbance hypothesis and distracted prey hypothesis in eastern pygmy marmosets (*Cebuella niveiventris*). This generated 1,268 videos and 128 successful trials in 5-weeks. We found behavioural differences across playback conditions for predator vocalisations and anthropogenic noise across both experiments, confirming that ABRs could revolutionise field hypothesis testing. This was the first application of an ABRs to an arboreal species and the smallest (~110g) targeted animal it has been successfully applied to. The high data volume produced creates a challenge as manual processing is time-consuming. We are in the initial stages of overcoming this by using machine learning to code the behaviour of the marmosets in the videos.

The potential for non-invasive surveying of terrestrial small mammals using camera trapping and acoustic monitoring

Miss Lili M Stiff

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Abstract

As the need for conservation programs and species monitoring increases with climate and ecosystem changes, the development of effective non-invasive monitoring methods is becoming more important. Terrestrial small mammals provide important ecosystem services and are traditionally monitored using live trapping, which comes with several biases and ethical concerns. Camera trapping, and perhaps acoustic monitoring, may allow small mammals to be surveyed non-invasively while collecting species presence and behavioural data. This study compares camera trapping with acoustic monitoring using AudioMoths in order to assess the viability of acoustic monitoring as a long-term and large-scale monitoring method for small mammals. Three designs of tunnel, including the Mostela, are compared in terms of small mammal preferences and general performance. Vocalisations are matched to behaviours seen on video in order to develop our understanding of call functions.

Changes in niche partitioning due to ongoing drought: A behavioural comparison of sympatric Alouatta pigra and Ateles geoffroyi in the Calakmul Biosphere Reserve.

Mr Joshua L Sains

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Abstract

As climate change impacts intensify, understanding niche partitioning in sympatric primates is crucial for conservation. In the Calakmul Biosphere Reserve (CBR), two primate species—the Mexican spider monkey (Ateles geoffroyi) and the Yucatan black howler monkey (Alouatta pigra)—once occupied different dietary niches within overlapping home ranges. However, changes in precipitation and prolonged droughts are reducing fruit availability. Over six weeks of observation, we found that A. geoffroyi has shifted from frugivory to folivory, potentially bringing it into direct competition with A. pigra, whose diet remains unchanged. Kernel density estimates reveal overlapping home and core ranges, with both species relying on high-quality forest areas. The scarcity of water may be limiting A. geoffroyi's range, affecting their group dynamics and increasing competition with A. pigra, potentially threatening the future conservation of both species in the CBR.

Navigating complex landscapes: a holistic framework for animal movement decisions

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Abstract

Movement is influenced by processes operating across multiple spatial and temporal scales and constitutes a significant portion of the energy budget of vertebrates, underpinning critical behaviours such as foraging. The costs of movement are determined by the characteristics of the landscape an animal traverses, also known as the energy landscape, while energetic gains are dictated by the resource landscape. However, a range of other environmental, ecological and anthropogenic landscapes have been highlighted as major drivers of movement and space use in mobile animals such as the landscape of fear, social sampling and the human impact landscapes. Nevertheless, a holistic framework unifying this wealth of landscapes remains lacking. We propose the 'optimal movement framework' which seeks to provide a more comprehensive understanding of animal movement decisions. We highlight the ecological and conservation application of this approach and provide novel examples of marine top predators in dynamic wind- and seascapes.

High variability in vital rates with positive autocorrelation negatively affects humans' capacity to buffer against the variable inflation environment

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Abstract

Decades of ecological research improved our understanding of how natural populations respond to environmental stochasticity. However, seldom have these hypotheses, applied to non-human species, been extended to humans. Here, we cross that bridge by examining how variability in inflation shapes long-term growth rates of humans. Following the demographic buffering hypothesis, we test whether increasing positively autocorrelated variance in inflation environments negatively affects humans' buffering capacity. Using high-resolution economic and demographic data from 76 countries over 1971-2021, we measured the structured demographic buffering as the sum of stochastic elasticities of growth rate to vital rates. To capture the effect of autocorrelated variability in vital rates on demographic buffering, we approximated the growth rate using stochastic sensitivities and elasticities. We find that increasing vital rates variance with positive autocorrelation in the inflation environment affects humans' buffering capacity negatively. Our approach explains the structured demographic buffering mechanism against environmental drivers, such as inflation.

Eastern chimpanzees (Pan troglodytes schweinfurthii) concentrate their space use around water sources during periods of low water availability

Hella Péter[1], Walter J Akankwasa[2], David Eryenyu[3,2], Dr Catherine Hobaiter[4,2], Vincent Kizza[2], Dr Sarah Johns[1], Dr Nicholas Newton-Fisher[1]

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Abstract

The ecological role of free water in African rainforests is largely unexplored. However, climate change is predicted to increase seasonal variation in temperature and precipitation in the region, leading to less reliable water availability. For effective predictions of population dynamics and conservation, more knowledge on how animals in the region rely on water is needed. Here, we explore changes in the space use of a wild community of eastern chimpanzees, a flagship species, corresponding to seasonal water shortages. We describe seasonal fluctuations in individual ranging and the within-season usage patterns of a fallback water source. Ranging centred on the fallback water source during water shortages, the use of which intensified as the shortages progressed. We demonstrate that water and its availability can be a major shaper of behaviour even in mesic environments, and discuss implications for conservation & human-wildlife coexistence.

Do bank voles adjust their energy expenditure during rest to their perceived predation risk?

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Abstract

Balancing the need for food with the risk of predation during foraging is one of the main challenges animals have to face on a daily basis. We aimed to investigate whether bank voles, *Myodes glareolus,* adjust to high perceived predation risk by lowering their energy expenditure during rest and whether any energetic flexibility would be correlated to consistent differences in behaviour. We exposed individuals to two contrasting predation risk scenarios by altering the illumination of their enclosure. We found that bank voles adjusted food intake and energy expenditure depending on perceived predation risk, with significantly higher energy intake during the dark phases. While energy expenditure was lower during the light phases during the first two days, this difference was no longer observed during the third day. Surprisingly, neither energy intake, nor giving up density or energy expenditure were correlated to consistent differences in risk-taking behaviour of individuals.

Quantifying the rewidling: comparative movement analysis of wild and translocated predators

Mohammad S. Farhadinia[1,2], Luciano Atzeni[2], Viatcheslav V. Rozhnov[3], Jose A. Hernandez-Blanco[3], Anna A. Yachmennikova[3], Maria D. Chistopolova[3], Alexander N. Minaev[3], Natalia A. Dronova[3], Alim B. Pkhitikov[4], Sergey A. Trepet[5], Paul J. Johnson[2], David W. Macdonald[2]

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Abstract

Understanding the behavioural characteristics and movement patterns of re-wilded animals is paramount, particularly in assessing the success of re-wilding initiatives. This study focused on comparing the behaviour of re-wilded Persian Leopards in Russia to their wild counterparts in Iran. We employed Behavioural Change Point Analysis (BCPA) and fitted linear and non-linear equations to the Net Squared Displacement (NSD) patterns in each break. We calculated attributes for each breaks related to movement characteristics or spatio-temporal correlates. Russians leopards were consistently slower than Iranian animals, especially when encamped. They spent more time ranging and travelled more distance during ranging and excursion trips. Russian animals travelled less in each state compared to Iranian leopards. Linear Discriminant Analyses significantly separated the two countries, suggesting different behavioural patterns. These results highlight the intricacies of movement ecology and emphasize the need for targeted conservation strategies that consider the behavioural ecology of re-wilded animals in new habitats.

Insect responses to restored riparian buffer strips in oil palm plantations in Indonesia

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[1]University of Cambridge. [2]University of Reading. [3]University of Nottingham

Abstract

The Riparian Ecosystem Restoration in Tropical Agriculture Project, a long-term Before-After Control-Impact experiment, was established to trial alternative restoration strategies along riparian margins, including passive and active restoration (enrichment planting with six native tree species), within established oil palm plantations in Riau, Indonesia. This study assessed butterfly and assassin bug abundance, species richness and composition across the treatments, five years after the experiment was established. We also assessed changes in butterfly activity, habitat choice and behaviour. Despite clear differences in habitat structure between treatments, we found little impact of alternative treatments on butterfly or assassin bug abundance and species richness, or aspects of butterfly behaviour. Our results indicate that restoration of riparian margins may take longer to have an effect on butterflies and assassin bugs, highlighting the importance of long-term monitoring.

Rewilding carnivores: A comparative study of predation patterns of Persian leopards.

Emily S Hammond[1], Viatcheslav V Rozhnov[2], Jose A Hernandez-Blanco[2], Anna A Yachmennikova[2], Luciano Atzeni[3], Maria D Chistopolova[2], Alexander N Minaev[2], Natalia A Dronova[2], Alim B Pkhitikov[4], Pavel I Weinberg[5], Zaur V Dzutsev[5], Sergey S Trepet[6], David W Macdonald[3], Mohammad S Farhadinia[1,7]

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Abstract

This study explored differences in the predation behaviours of rewilded and wild Persian leopards (Panthera pardus tulliana), focusing on handling time, interkill interval and prey selection. Using GPS and field data, we studied six wild leopards in Iran and thirteen rewilded leopards in Russia applying generalized linear mixed and cumulative link mixed models. We assessed factors such as origin, season, sex, prey size or type, distance to humans, and terrain ruggedness. We found rewilded leopards had longer handling time with prey (3.4±0.2 days) than wild leopards (2.1±0.1 days, $p<0.001$), influenced by season and prey size. Rewilded leopard’s interkill intervals (10.0±0.6 days) did not differ significantly from wild leopards (9.3±0.6 days, $p=0.4$). Prey selection of ungulates, domestic prey or small carnivores was influenced by proximity to human settlements. These findings provide insight to advance our understanding of rewilded predation patterns and ecology to assist future conservation initiatives.

Body Size as a Predictor of Habitat Perception in Forest Specialist Butterflies

Beatriz M Lima, Brendha Alvares, Márcio Z Cardoso

Universidade Federal do Rio de Janeiro

Abstract

Habitat perception is the ability of an organism to detect elements in a landscape. However, generalities, such as the effect of body size on habitat perception, are lacking. Using release experiments at 50 and 100 meters from a habitat patch edge, we tested how body size affects perceptual range and flight patterns in forest specialist, fruit feeding butterflies. We found that body size predicts both perceptual range and success in reaching a habitat patch. Larger species consistently oriented towards the habitat patch, while smaller and mid-size species were more prone to disorientation. The probability of reaching the patch decreased with distance for all body sizes but was two times lower for smaller species than for mid-sized or larger species. Flight patterns were highly directional but not related to body size or release distance. For fruit feeding butterflies, the functional connectivity of a landscape is body-size dependent.

Migratory snail species of the genus *Neritina* (Gasteropoda: Neritidae) as bioindicators of microplastics in estuaries of Puerto Rico

Prof Edgar Lozada-Gómez, Dr Omar Pérez-Reyes

University of Puerto Rico - Río Piedras

Abstract

Estuaries are transition zones between rivers and the ocean, these mixed ecosystems, are critical points for the accumulation and transport of microplastics (MP). It has been identified that the ingestion of MP by numerous aquatic species results in their retention in the body and digestive tract, negatively impacting their quality of life. In this study, we want to determine the extent of MP contamination; two migratory species of freshwater snails, *Neritina virginea* and *N. punctulata*, will be used as natural indicators to provide information on plastic pollution in estuaries of the Río Mameyes and Río Espíritu Santo in Puerto Rico. Snail tissue samples were digested in this study with 30% hydrogen peroxide. MP particles were identified, counted, and characterized (shape, size, and color) by visual identification under a stereomicroscope. It was found in two-way ANOVA that MP accumulation in gastropods was affected by species and study sites.

Using wingbeat frequency to estimate mass gained in wild seabirds

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Abstract

Energy is a fundamental currency in ecology that is critical to reproductive success, survival and lifetime fitness. Measuring foraging success in wild animals via biologgers has been a long-standing challenge, with techniques including animal-borne videography, mouth-opening loggers, and stomach temperature recorders. For flying animals, Pennycuick (1996) proposed that wing beat frequency (w) should vary with the square root of body mass (m), $w \propto m^{0.5}$, when other variables influencing w are held constant. As an individual gains mass during foraging, it needs to counteract the associated increased gravity by creating additional lift. We present a state-space modelling framework using observations of wing beat frequency estimated from GPS-accelerometers to model instantaneous changes in mass from animal-borne accelerometer data. Estimates of energy intake allow for testing of long-standing hypotheses in foraging ecology. We present examples applying this method to biologging data from thick-billed murres (*Uria lomvia*) and kittiwakes (*Rissa tridactyla*).

Behavioral Flexibility of Wild Boar (Sus scrofa) under human pressures

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Abstract

Wild boars are managed worldwide through hunting to mitigate their damage, but they often alter their activity to avoid human disturbances, making the study of their behavioral flexibility crucial. This study collected data from 181 camera traps near cities, national parks, logged areas, and mountainous regions in South Korea from October 2021 to November 2023. We: 1) compared wild boar activity times with human activity, 2) evaluated habitat preferences, and 3) analyzed piglet counts to compare reproductive differences. Results showed wild boars avoided human activities, demonstrating significant behavioral flexibility. They avoided humans less in national parks, and habitat preferences varied across areas. Piglet counts were higher in national parks, suggesting differences in reproductive success. These findings underscore the importance of understanding wild boars' flexible behavior for effective population management

Parental diet quality affects offspring locomotor activity in the bean bug, *Riptortus pedestris.*

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[2]Department of Agricultural Biotechnology, Seoul National University,-Republic of Korea

Abstract

Parental environments can exert significant influences over offspring phenotype, a phenomenon known as intergenerational plasticity (IGP). The parental consumption of suboptimal diet is associated with abnormal offspring hyperactivity in vertebrates. However, no equivalent diet-mediated IGP has been studied in invertebrates. Here, we tested whether the quality of parental diet would affect offspring locomotor activity and fitness-related traits in an insect, *Riptortus pedestris* (Heteroptera: Alydidae). Locomotor activity was recorded from early-instar nymphs whose parents were fed either soybean (optimal diet) or peanut (suboptimal diet). The offspring of peanut-fed parents exhibited significantly higher locomotor activity than those of soybean-fed parents. Interestingly, the offspring with suboptimal parental diet history grew faster and had better body conditions than those with optimal parental diet history, indicating this diet-induced IGP can be adaptive. This study provides evidence for IGP for locomotion in invertebrates and suggests that parentally-induced offspring hyperactivity is conserved across the tree of life.

Who goes there? Using bioacoustic machine learning methods to investigate identity and context in long-tailed tit calls.

Dr Alexandra H M Jebb de Calais[1], Dr Adam Stanton[1], Dr Mickaël Jacquier[1], Dr Tom C Lewis[2], Professor Ben J Hatchwell[1]

[1]University of Sheffield. [2]Longleat Safari Park

Abstract

Social species have diverse and often complex organization, with individuals belonging to different hierarchical levels simultaneously. Consequently, the signals individuals use to communicate may encode many kinds of social information making the detection of identity within these a complex issue. Moreover, other contextual stimuli may add complexity to the information provided by such signals. Recent bioacoustics developments allow the application of machine learning methods to individual recognition, facilitating analysis of vocal signals at greater resolution. We applied these approaches to vocalizations collected from a well-studied population of long-tailed tits *Aegithalos caudatus*. We showed through a series of observational and experimental approaches that variation in calls can be attributed to both individual identity and context. We conclude, using our example study, that whilst these methods provide a tool that broadens the scope of what can be achieved with acoustic datasets they are sensitive to sample quantities and require further discussion.

Wild pollinators of coffee respond positively with the visits of managed honey bees.

Mr M Hariraveendra, Dr Palatty Allesh Sinu

Central University of Kerala

Abstract

The decline in pollinators threatens the stability of terrestrial ecosystems and crop yields. Pollinators are largely managed by the augmentation of domesticated and often exotic honey bees. How this impacts the wild pollinators is largely obscure. The available literature, though it brings neutral and positive effects, has negative trends pronounced. Coffee is a pollinator-dependent and deficient crop. Planters manage the deficiency by adding colonies of native domesticated bees of Apis cerana. We tested a hypothesis that the abundance of wild bees on flowers reduces with the number of A. cerana boxes and the visits of domesticated honey bees on the flowers. The proportion of A. cerana visits in overall visits increased with the number of bee boxes in the field. However, contrary to our expectations, the visits of A. dorsata and stingless bees the two dominant wild pollinators, increased with the number of visits of A. cerana to the flowers.

Evaluating Foraging Behaviour of Guillemots and Razorbills in Tidal Energy Development Sites

MRes Alice E Connell[1], Professor Luca Borger[1], Dr Novella Franconi[1], Professor Emily L, C Shepard[1], Steve Dodd[2], Dr Michael MacDonald[2]

[1]Swansea University. [2]RSPB

Abstract

Tidal stream energy is a promising renewable source, but tidal environments are vital for many marine species. We investigate the potential impact of marine renewable energy (MRE) installations on the foraging behaviour, space use, and dive patterns of auks, which are particulary vulnerable to interactions with tidal energy devices. In 2024, we deployed 30 GPS and time-depth recorder tags on 15 guillemots and 15 razorbills at RSPB South Stack, Holyhead, to track their movements within and outside the Morlais Tidal Demonstration Zone (MDZ) off Anglesey, Wales. We recorded a total of 2,136 dives over 222 tracking days. Using Generalised Additive Models (GAMs) and Hidden Markov Models (HMMs), we will map movement paths and foraging, commuting and resting behavioural phases, and quantify dive frequency, duration, and diurnal changes in diving activity. Using this baseline data, we will assess how tidal energy devices may impact the auks' use of the MDZ.

Interspecific Competition Between Sympatric Ravens in a Human-modified Desert Ecosystem

Rachel Landesman, Dr. Miguel de Guinea, Prof. Ran Nathan

The Hebrew University of Jerusalem

Abstract

Many corvid species thrive under human-induced environmental changes. Yet, the Israeli population of Fan-Tailed Ravens (*Corvus rhipidurus*, FT) has drastically declined, currently confined to the Judean Desert. In contrast, the sympatric and larger, Brown-Necked Raven (*C. ruficollis*, BN) has expanded its range and population. To unveil whether these contrasting population trends could have resulted from interspecific competitive interactions and anthropogenic effects, we conducted behavioural observations at feeding sites and GPS tracking of 32 FTs and 18 BNs (2022-2024). BN presence at feeding stations negatively affected FT feeding, suggesting interference competition. FTs had smaller home range sizes, higher ecological nest-site constraints, and a notably higher preference for foraging at anthropogenic sites. These findings suggest that through interference competition, BNs have forced FTs to rely mostly on anthropogenic resources, contributing to their decline. This study underscores the importance of assessing interspecific competition in the context of human-induced environmental changes for effective conservation.

Neck-otiating hills: implications of topography on giraffe habitat suitability and population movement.

Miss Jessica Granweiler[1], Prof Francois Deacon[2], Prof Jonathan Codd[1], Prof William Sellers[1], Dr Christopher Basu[3], Prof Susanne Shultz[1]

[1]The University of Manchester. [2]University of the Free State. [3]University of Surrey

Abstract

Population management rely on accurate habitat use models to capture suitable niche characteristics. Currently, giraffes niche traits focus on vegetation, predation and human disturbance. The influence of topography on giraffe distribution is currently understudied and absent from translocation habitat requirements. This study investigates the influence of slope on GPS-collared giraffe distribution across reserves in South Africa. Giraffes avoid steeper slopes, with a preference for terrain between 0°- 6°. However, NDVI is a mitigator of slope tolerance and if better browse is present at higher slopes, giraffes prefer gradients of up to 12°. Giraffes did not use areas with a higher slope than ~20°, due to high energetic costs and fall risk. Slope significantly impacts giraffe distribution and should be considered in habitat suitability models. A large proportion of giraffes ranges in countries like Namibia and Tanzania may be unusable by giraffes due to steep terrain, affecting conservation and carrying capacity.

Morse Toad: Decoding the role of larval behaviour for the conservation of an endangered amphibian

Ms Eleanor K Tinsley

Zoological Society London. University College London

Abstract

Amphibians represent the most at-risk vertebrate taxon, vulnerable to multiple, complex, and co-existing anthropogenic threats. Despite occupying an aquatic larval stage, tadpoles are woefully neglected in conservation research, and little is known about the behavioural impacts of interacting environmental stressors. *Alytes muletensis*, a species typified by a prolonged larval phase, is an endangered European anuran threatened by climate change and an invasive predator species. The behavioural impacts of these threats, in isolation and in combination, have not been studied in *A. muletensis* larvae. *A. muletensis* conservation is mostly managed *ex-situ*. Despite this, the maintenance of captive welfare and, specifically, the impact of routine husbandry procedures on behavioural welfare indicators expressed by larvae is poorly understood. Hence, I will discuss hypotheses and present work relating to these knowledge gaps and the application of Machine Learning technology with the intention of informing amphibian conservation practices and management protocols in the future.

Movement optimisation and chirality of European Dung beetles under various light conditions in the Planetarium

Vera Kaunath, Prof. Dr. Jana A. Eccard

Animal Ecology, University of Potsdam, Potsdam, Germany

Abstract

Navigation of flying insects is disturbed by artifical light at night. We investigated if animals known to follow chemical cues are using celestial information and whether they are disturbed by ALAN, using Anoplotrupes stercorosus.

We observed movement in a planetarium under 4 different light conditions: without illumination, with projection of stars, with projection of stars & milky way, and with ALAN source. Beetles (n=76) were released facing North at centre of round arena and movement paths were analysed. Directionality of movement was investigated by comparing the exit angles from the arena.

The longest, most intricate paths were found under dark & limited stars. Paths under illumination of lamp or stars & milky way were less intricate, faster and straighter. Majority of beetles left the arena in a westerly direction with an increasing concentration of exits with increasing illumination. Directional findings may be a consequence of a spiralling search movement or external directional cues.

Defining Quality in an Ant-Aphid-Tree Foraging Network

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[1]University of York. [2]University of Cambridge. [3]The National Trust

Abstract

Quality distance trade-offs shape foraging dynamics, but defining quality can be complex.

Ants ‘farm’ aphids to collect honeydew, a significant food source for *Formica lugubris* wood ant colonies. Previous modelling and empirical data indicate that ant colonies do not invest equally in all trees where honeydew is foraged: they treat different trees and their associated aphid populations as being higher or lower value food sources. Honeydew composition varies based on tree and aphid species. Ants could be looking for specific sugars, amino acids, plant defence compounds, or other components of aphid honeydew. Using worker investment as an indicator of a site’s value to the colony, we aim to molecularly define “quality”. We collected samples from trees (phloem), aphids (honeydew), and ants (crop contents) on low and high investment sites. Through metabolomic analysis, we are investigating the metabolites flowing through the tree-aphid-ant processing pipeline and the final composition of crop contents.

Nutritional Contributions of Plant Galls to the Diet of Black-and-White Ruffed Lemurs in Madagascar's Ihofa Rainforest

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Abstract

Frugivores often consume leaves, flowers, and twigs to supplement their nutrient and energy intake from fruits. Some also eat plant galls, abnormal growths caused by insects, though their dietary contribution is not well understood, especially in tropical forests. This study documents the consumption of plant galls by black-and-white ruffed lemurs (*Varecia variegata*), in Madagascar's Ihofa rainforest, and examines how this affects their daily acquisitions of energy and nutrients. We found that galls are similar to fruits in color and nutrient content (protein and sugar), and this lemur species acquires significantly more protein from plant galls daily compared to ripe fruits and leaves. They also showed a preference for consuming fruits from trees with galls, beyond what would be expected based on tree availability. These findings enhance our understanding of frugivores' nutritional needs and food selection, which can have implications for developing strategies to maintain lemur populations in their natural environments.

Listening to the bees: bioacoustics studies to reveal hidden behaviour responses to environmental disturbances

Dr Philip Donkersley, Mrs Jenny Roberts

Lancaster University

Abstract

Although we have known for over 25 years that bumblebee populations are in decline, there are still foundational questions that remain unanswered about bumblebee biology. Pollinator conservation has focused on bees flying outside of the nest searching for food sources. Behavioural studies inside the nest are rare, their nest population (50-100 individuals) makes recording behavioural ethological research extremely time consuming, as monitoring each of these individuals over periods longer than a few minutes becomes exponentially harder. Realistic behaviour studies are of critical importance given the effects of chemical pesticides like neonicotinoids on the bee brain and behaviour. Through the combination of our 3D printed nestbox for bumblebees and hyperspectral microphones, we provide a world first bioacoustics-led assessment of how bumblebee nest behaviour is affected by controlled disturbances. Our results show significant shifts in diurnal behavioural patterns, as well as proportional changes in high frequency audio patterns consistent with bee flight.

Vessels, construction, and tourism – oh my! Bottlenose dolphin occurrence and behaviour in Scotland's largest port

Dr Sarah A. Marley[1], Iona MacLeod[1], Nadia Murphy[2], Giverny Maidlow[1]

[1]Scotland's Rural College (SRUC). [2]University of Edinburgh

Abstract

This study investigated environmental and anthropogenic drivers of dolphin occurrence and behaviour within the Port of Aberdeen. Between 2022-24, over 150h of land-based observations were conducted. Scan sampling showed that dolphin occurrence and behaviour were significantly related to tidal state, with foraging most prevalent during falling tides. In particular, a tidal front in the harbour mouth created by freshwater flow as the river meets the sea is strongly associated with dolphin foraging activity. Interestingly, dolphins remained present irrespective of vessel number. However, focal follows revealed subtler behavioural responses to vessel traffic, particularly with regard to the presence of tourism activities. Overall, dolphin occurrence within the Port of Aberdeen appears primarily prey-driven, and animals may be displaying a degree of habituation to vessel activity in this urbanised area. However, this study also demonstrates the importance of monitoring subtler behavioural responses to potential human disturbance.

Designing artificial flowers for automated pollinator monitoring.

Abra Ash[1,2], Dr. Tom August[2], Prof. Stephen Hallett[1], Dr. Claire Carvell[2], Prof. Leon Williams[1]

[1]Cranfield University. [2]UK Centre for Ecology and Hydrology

Abstract

With the recent rise in automated insect monitoring that use machine learning, there has been a demand for more effective and standardised attractants under the camera. One answer is 3D printed artificial flowers with multimodal attraction cues that last long term under an automated insect monitoring camera trap. In summer 2024, 3D printed artificial flowers with different combinations of attraction cues such as colour, scent, ultraviolet, and nectar guides were placed in a field site in Krka National Park, Croatia. The goal will be to see which combination of attraction cues attracts the largest diversity and abundance of insects and provides the most effective population count under the insect camera trap. The experiment will compare volunteer counted data to the camera traps showing the benefits and disadvantages of each. The outcome will show which combinations of attraction cues are the most effective at attracting insects for automated insect monitoring.

Behavioural responses to extreme temperatures in the Eurasian kestrel: the importance of microclimate refugia

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Abstract

As global temperatures continue to increase and extreme weather events become more frequent, it is of key importance to understand how individuals may respond and whether they can adapt to these challenging, rapidly changing conditions. Individuals may adopt a variety of behavioural strategies to avoid or mitigate the negative effects of exposure to extended periods of high temperatures or climate extremes. This study focuses on the use and availability of microclimate refugia at the warm edge of Eurasian kestrels' distribution in Europe. We use GPS tracking data to quantify the extent of use and availability of microclimate refugia in areas used by tracked individuals under different temperature conditions and during the warmest periods of the year. Our results enable us to identify habitat features that may be important for individuals to survive extreme temperature events, and therefore, may be crucial for species conservation in the face of climate change.

Phenological plasticity enables six decades of thermal homeostasis in a wild bird population

Dr David Lopez-Idiaquez[1], Dr Ella F Cole[1], Dr Charlotte E Regan[2], Prof Ben C Sheldon[1]

[1]Edward Grey Institute, University of Oxford. [2]Centre for Ecology & Hydrology

Abstract

Shifts in the timing of seasonal events are widely-documented biological responses to climate change, but measuring responses on human calendars reveals little about the underlying biological causes of such changes. We use six decades of individual-based data from the great tit population in Wytham Woods to show that plasticity in reproductive phenology has enabled stable long-term thermal homeostasis at different stages of reproduction, despite marked local warming. We show, further, that reproductive success is maximised at the temperatures tracked, probably because the temperature tracking has ensured optimal timing with respect to a key food source. Finally, we use long-term data from several bird populations across Europe to analyse the generality of the pattern found at Wytham and to test how shifting our perspective to analyse the timing of life-history events relative to environmental gradients can shed new light on the mechanisms and consequences of the population responses to climate change.

Forest, landscape heterogeneity, and water bodies promote rich bat species assemblages in farmland mosaics in southern Scandinavia

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Abstract

Science-based landscape management is essential for promoting conservation and restoration of habitats. Bats are ecologically important and threatened, and we aim to understand how landscape parameters affect different bat species.

We sampled bat species assemblages in southeast Sweden by deploying acoustic stations at 128 sites across all major land cover types and identified 42530 passes of nine species. Multiscale spatial analysis using 100-3000 m buffers revealed that different species respond to distinct landscape parameters at various scales. Overall, the distance to water, habitat heterogeneity, and percentage of forest cover were the most important parameters influencing habitat use by bats. Deciduous forest was more important for bats than coniferous forest, despite being less abundant (14% vs 36% cover).

To foster rich bat species assemblages in Scandinavian farmland mosaics, it is particularly important to promote landscape heterogeneity, protect water bodies, and expand deciduous forest cover.

'How do social spiders hunt collectively?': prey preference and spatiotemporal strategies of group foraging in *Stegodyphus dumicola*

Snata Chakraborty[1,2], Etienne Lein[2], Alex Jordan[2]

[1]University of Portsmouth. [2]Max Planck Institute of Animal Behavior

Abstract

Social spiders seem to follow a stop-and-wait motion when approaching prey. Previous studies suggest early attackers spend more energy subduing prey through extra-oral digestion and can feed longer. Using animal tracking and BORIS ethograms, I analyzed videos of live feeding trials of *Stegodyphus dumicola* in Namibia. Latency to attack flies is lowest followed by grasshoppers and ants, a less preferred prey. Further, the probability of attack (Pa) of a prey (hopper and fly) is higher when 0 and 1 spider (coef. -0.9002, $p<0.05$) is at the prey but dropped steeply when two spiders are already attacking a fly, as the distance of spiders from prey varies. This study demonstrates that collective hunting in social spiders is likely a combined effect of prey type, proximity to prey, and the rank of individual attackers when multiple conspecifics are on the web and at varying distances, listening to prey, and conspecific vibrations.

Mammals show faster recovery from capture and tagging in human-disturbed landscapes

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Abstract

Wildlife tagging provides critical insights into animal movement ecology, physiology, and behavior amid global ecosystem changes. However, stress induced by capture, handling, and tagging can impact post-release locomotion and activity and, consequently, the interpretation of study results. Here, we analyze post-tagging effects on 1585 individuals of 42 terrestrial mammal species using collar-collected GPS and accelerometer data. Species-specific displacements and overall dynamic body acceleration were assessed post-release to quantify disturbance intensity, recovery duration, and speed. Over 70% of the analyzed species exhibited significant behavioral changes following collaring events. Herbivores traveled farther, while omnivores and carnivores were initially less active and mobile. Recovery duration proved brief, with alterations diminishing within 4-7 tracking days for most species. Individuals in high human footprint areas displayed faster recovery, indicating adaptation to human disturbance. Our findings emphasize the necessity of extending tracking periods beyond one week and particular caution in remote areas, specifically in smaller mammals.

The impacts of anthropogenic activities on cheetah habitat selection and movement pattern

Mr Dennis G. Minja[1,2], Dr. Thomas Morrison[1], Prof. Grant Hopcraft[1], Prof. Chris Carbone[2], Prof. Sarah Durant[2]

[1]University of Glasgow. [2]The Institute of Zoology London

Abstract

Cheetahs (*Acinonyx jubatus*) navigate landscapes shaped by ecological and human influences, responding to anthropogenic factors at multiple spatial scales. This study explores cheetah habitat selection and movement in southern Serengeti, analyzing GPS telemetry data from 10 cheetahs (2022–2024) using Generalized Linear Mixed Models (GLMMs). We examined the effects of anthropogenic factors (e.g., distances to lodges, roads, Maasai bomas) and ecological variables (e.g., woody cover, slope, elevation, vegetation greenness, distance to rivers). Cheetahs avoided roads and lodges during peak tourist seasons and steered clear of bomas during dry periods, favoring areas with dense tree cover, flat terrain, and proximity to rivers. Fine-scale integrated step selection analyses showed relatively strong avoidance of human infrastructure during the day, with minimal response at night. These findings highlight cheetahs' adaptability to human presence, varying by time of day and season, and inform conservation strategies to enhance coexistence and support cheetah survival in the Serengeti.

Investigating the Acoustic Disturbance of Bat Behaviour and Activity near Solar Panels

Ms Maya Griffin[1,2,3], Dr Emma Stone[3], Ms Paola Reason[2], Dr Paul Lintott[1]

[1]University of the West of England. [2]RSK Biocensus. [3]University of Bath

Abstract

Although it is established that many bat species avoid or alter their behaviour near solar farms, relatively little is known about bats' interactions with the smooth-surfaced solar panels. In this poster, we will discuss the preliminary findings from our experimental research which tested bat responses to smooth and textured solar panels at different distances (1, 10 and 20 m) from vegetated field boundaries. Using thermal imaging and acoustic detectors we were able to determine how the presence of solar panels impacts both bat behaviour and activity. We also investigated the impact of panels at different angles (0° and 35°) and whether this affects potential collision risk. Understanding how solar developments impact bats is vital to inform effective mitigation strategies to minimise bat habitat fragmentation whilst supporting a transition towards renewable energy.

Using machine learning to detect long range, low frequency seismic vibrations generated by elephants in Kenya.

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Abstract

Elephants use seismic vibrations through the earth to communicate, however little is known about the purpose of this mechanism. One theory is low frequencies could enable long-distance communication as they propagate further through the ground than the air. Manually extracting thousands of hours of seismic traces would be arduous and time-consuming. Furthermore, being able to automatically detect seismic rumbles several kilometres away could contribute to a real-time monitoring system to limit human-elephant conflict. Here, we present a machine learning model which accurately classifies seismic rumbles captured within a 3.5km^2 array of >1200 seismic sensors situated in the Mpala Research Centre, Kenya. The results contribute to the understanding of how seismic signals generated by elephants propagate in natural conditions and to what extent these signals are used for intraspecies communication. Answering these questions is crucial for gaining a deeper understanding of elephant behavioural ecology and has direct implications for conservation management.

Burrow approach routes reveal cognitive processes of shearwater navigation.

Mr Lewis Fisher-Reeves[1], Mr Patrick Lewin[1], Mr Leighton Newman[2], Mr Joe Morford[3], Miss Anna Garcia[1], Miss Layla Sklar[1], Miss Bridget Harrington[1], Dr Oliver Padget[4], Prof Tim Guilford[1]

[1]University of Oxford. [2]Welsh Wildlife Trust. [3]University of Rochester. [4]University of Liverpool

Abstract

Shearwaters are extremely efficient wide-ranging navigators, commuting long distances over open ocean with pin-point accuracy. Little is known, however, about their navigational strategies over short distances, specifically at extremely fine scales such as the movements taken after landing on their colony to find their burrows. At this colony level, shearwaters are free from almost all environmental influences that may alter their trajectories at sea, whilst also finding themselves surrounded by an array of geographic features, potential tools that are rarely available in pelagic contexts. Here, using infrared camera footage coupled with automated tracking software, we identify the routes adopted by shearwater pairs during their movements across the colony. Using the trajectories of natural and manipulated burrow approach routes, we investigate the potential for individually consistent homing routes during burrow approach and discuss the cognitive processes that may underpin these observed movements.

Movement patterns of downstream migrating adult trout encountering a flow guidance solution at a hydropower dam

Dr Georgia Macaulay[1], Dr Daniel Palm[1], Dr Patrik Andreasson[2], Gustav Wendin[2], Eric Lillberg[2], Dr Karin Nilsson[1]

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Abstract

Brown trout (*Salmo trutta*) can spawn multiple times and often require passage solutions in regulated rivers to complete spawning. Most fish passages are biased towards upstream migration and fail to consider post-spawners migrating downstream. We investigated if a large underwater pump could guide downstream-migrating adult trout away from a hydropower intake in Sweden. We studied the effect of pump operation on fish movements using acoustic telemetry. The pump's flow was directed toward the spillway with an operation schedule of 1-hour-on, 1-hour-off throughout downstream migration. Fish length and sex had no effect on total time spent above the spillway. Final detections of trout indicate most fish exited the dam via the hydropower intake instead of passing over the spillway. Control fish (pre-pump conditions) showed similar spatial preferences to treatment fish (pump conditions). Analyses are ongoing but current results show minimal effect of pump operation in preventing entry into the intake.

Detecting queenlessness in honeybee colonies using explainable AI

Stella M Felsinger[1], Dr Huw Evans[2,3], Sandra Kordić Evans[3], Professor Beth Mortimer[1], Professor Geraldine A Wright[1]

[1]University of Oxford. [2]BeeHero. [3]Canetis SRL

Abstract

Honeybees are essential pollinators for ecosystems and agriculture, both in the UK and abroad. However, colony lifespans are declining due to a combination of factors – among them queen loss, which interrupts brood production and can lead to colony death. Monitoring queen presence is a vital beekeeping task.

Honeybees generate vibrations within the hive as communication signals and byproducts of behaviours like fanning. These vibrations provide a non-invasive method for monitoring hive health. While acoustic hive monitoring has gained attention with advances in AI, many studies lack generalisability across different hives.

Our study analyses sound data from ten honeybee hives to detect queen loss. We show how the acoustic signature of the queenless state and model performance vary between hives and demonstrate the importance of testing on unseen hives. Using Shapley values, we biologically interpret model outputs, linking specific acoustic patterns to queenless and healthy hive states.

Pollinator behaviour and crop pollination: the implications of nectar robbing for field beans

Dr Katie LW Burns, Dr Dara A Stanley

University College Dublin

Abstract

Pollinators are important contributors to the production of 75% crops globally. However, how pollinators behave when visiting crops may influence their effectiveness. Using field based observations and manipulations, we evaluate the contribution of different pollinators to the production of field beans (Faba variety) in Ireland and the implications of nectar robbing behaviour. Over 80% visits to the crop were to rob nectar rather than legitimately visit flowers. Manipulative experiments showed that nectar robbing has a neutral impact on pollination once the crop is also legitimately visited. Of the insects providing legitimate visits, we show that wild bumblebees (especially the long tongued *Bombus hortorum*) contribute 70% of the economic value of pollination to Irish beans. Together this demonstrates the importance of considering behaviour when estimating the contribution of pollinators to crop production, and that wild bumblebees should be conserved in bean producing landscapes to ensure the sustained delivery of pollination services.

Mapping Microclimatic Heterogeneity and Exploring Behavioral Thermoregulation of Ants Across Adriatic islands

Marko Bračić, Jelena Bujan

Ruđer Bošković Institute, Zagreb, Croatia

Abstract

Predictions of species' ability to withstand global warming often rely on temperature averages, underestimating microclimatic availability and potential for behavioural thermoregulation. Such thermoregulation of ectotherms is especially influenced by heterogeneity of thermal landscapes. Leveraging the natural temperature gradients across islands of different sizes, we studied islands' thermal heterogeneity and behavioural thermoregulation of multiple ant species.

We are currently quantifying thermal heterogeneity across 16 Adriatic islands using drone thermal imaging paired with thermocouple measurements. Preliminary findings reveal significant variation in thermal heterogeneity between different habitat types and time of day. To investigate the link between heterogeneity and behavioural thermoregulation, we are assessing how ants change their foraging depending on fine-scale differences in temperature. Additionally, by comparing differences in foraging between populations on the colder and warmer islands, we are testing thermoregulatory adaptation potential. Uniting microclimatic and behavioural data at a large scale will uncover insects' potential to cope with climate change.

Unravelling the role of memory to thermoregulate in a rapidly changing desert

Dr Miguel de Guinea, Rachel Landesman, Prof Nathan Ran

Movement Ecology Lab, The Hebrew University of Jerusalem

Abstract

Arid ecosystems are particularly vulnerable to rising global temperatures, challenging species' abilities to access cooling microhabitats. While human expansion often negatively impacts wildlife, infrastructure development in these regions may offer thermal refuges. However, an individual's ability to exploit human-related cooling sites depends on both risk-taking tendencies and memory for spatiotemporal thermal patterns. Here, we studied Fan-tailed Ravens (Corvus rhipidurus, "FTs") along Israel's rapidly changing Dead Sea coastline, where tourism is expanding. First, we trapped individuals and assessed risk-taking behavior across four contexts under controlled laboratory conditions. Second, we released and tracked them in their natural habitat for periods between 4 months and 4 years. Third, we used satellite imagery (30m² resolution) to map the predictability of thermal patterns (i.e., constancy, contingency) across the landscape. Our findings revealed that thermal predictability increased in proximity to tourist sites and influenced positively FTs' revisiting patterns for both risk-taking and risk-averse individuals.

Born to be wild? The post release behaviour of rehabilitated European hedgehogs Erinaceus europaeus

Miss Kate Davies[1], Prof Dawn Scott[1], Dr Antonio Uzal[1], Dr Dmitry Kishkinev[2], Dr Sophie Lund Rasmussen[3]

[1]Nottingham Trent University. [2]Keele University. [3]University of Oxford

Abstract

Retaining wildlife in captivity, such as that required for rehabilitation, has a number of implications from a welfare position, including stress in captivity, reintroduction stress, increased mortality risk and impaired or altered ranging behaviour, as well as costs for the rehabilitation centres. This study focuses on the European hedgehog, which is the most commonly admitted mammal to wildlife rehabilitation centres within the UK. The majority of which are juveniles admitted in the autumn and housed in captivity overwinter, prior to release in the spring. The study utilises GPS technology to monitor the fine scale behaviour of rehabilitated hedgehogs post release, in comparison to their wild counterparts. Analysis will focus on inferring behaviour from movement data to investigate how captivity may affect them post release, and their ability to reintegrate back into the wild. Understanding this will help to inform rehabilitation practices to both improve hedgehog welfare and rehabilitation efficiency.

Comparative analysis of Wild and Captive Asiatic lion vocalizations

Miss Helly Hirenkumar Vyas[1], Dr. Meena Venkataraman[2], Dr. Sougata Sadhukhan[1]

[1]Bharati Vidyapeeth (Deemed to be University) Institute of Environment Education & Research, Pune. [2]Carnivore Conservation & Research

Abstract

Abstract

Lions use vocalizations for social bonding and territorial defense, yet limited research has explored how these differ across environments. This study compared the vocalizations of wild (n = 16) and captive (n = 17) Asiatic lions, focusing on environmental, sex-based, and age-related differences. The objectives included analyzing the fundamental and peak frequencies of roar components (moans, climaxes, grunts), assessing variations between wild and captive lions, and examining changes in individual vocal patterns. The study also explored male and female acoustic differences, such as pitch and frequency. A total of 33 individuals' vocal recordings were analyzed using Raven Pro software, with statistical assessments conducted through ANOVA and t-tests. The observed variations in vocalizations are discussed with reference to their conservation and management implications. By identifying unique vocal patterns, this research contributes to wildlife science and bioacoustics, offering a comparative study of vocal behaviors.

Exploring causal relationships between bee sonication frequencies, bee demographic information, and floral species

Marzia Golini, Alixandra Prybyla, Professor Graham Stone

University of Edinburgh

Abstract

Sonication is a specialised pollination technique in which a bee vibrates its thoracic muscles to stimulate pollen release from a flower's poricidal anthers. Despite there being several crops that can only be pollinated using sonication buzzes, little is known about what shapes a sonication buzz frequency: researchers have long questioned whether sonication is determined by bee size, floral shape, floral species, and so on, or if it is a learned behaviour. This study aims to explore the relationship between these variables by analysing sonication buzzes from one solitary bee (*Anthophora plumipes*) and five *Bombus* species across five *Pulmonaria* species in the Royal Botanical Garden Edinburgh. The bees were recorded, caught, measured and then released. The audios were analysed in Audacity. Using ANOVA and linear regression models we have preliminarily determined that bee weight and flower slecies are likely driving factors for shaping sonicagion buzz frequency.

Visual cues in isolation facilitate the recognition of sneaker males in the corkwing wrasse (*Symphodus melops*)

Benjamin A Ellis[1], Dr Tonje K Sørdalen[2], Dr Mark Briffa[1], Dr Anne Berit Skiftesvik[3], Dr Alexander DM Wilson[1], Dr Kim T Halvorsen[3]

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Abstract

Alternative reproductive tactics (ARTs) are consistent intra-sexual differences in behaviour that maximise reproductive success. In corkwing wrasse, ARTs manifest as dominant and sneaker tactics. Larger dominant parental males build nests and provide parental care, while smaller sneaker males mimic female visual morphology and attempt to steal fertilisations. We investigated the importance of this visual mimicry in facilitating the deception of parental males. Parental males were presented with models depicting unfamiliar females, sneakers and rival parental males and their agonistic responses were recorded. Parental males exhibited different levels of agonistic response towards the female, sneaker, and parental male models, directing most aggression towards females and the least towards parental males. This suggests that visual cues may play a smaller role in this deception than previously thought. Given that deception is a successful strategy this result highlights the importance of alternative sensory modalities potentially employed by sneaker males to deceive parental males.

Foraging trade-offs for lunar lovers; how nightjar foraging behaviour aligns with the moon and other environmental correlates.

Dr Lucy J Mitchell

Ghent University

Abstract

Identifying environmental correlates of foraging behaviour can help to understand the drivers of animal foraging decisions and the potential fitness consequences should conditions change. We used Hidden Markov Models and Generalised Additive Models to analyse nocturnal activity of the European nightjar, how they allocate their time and whether these decisions might be influenced by habitat change.

Nightjar movement patterns, including changes in behaviour, were driven by vegetation structure, including NDVI, and the lunar cycle, with some influence of temperature. Birds responded to the moon, indicating a trade-off between prey availability and visibility that may reflect reduced effort. All behaviours differed significantly between sexes.

Most importantly, foraging time increased when more cleared habitat was available within nightjar home ranges, potentially reflecting reduced effort or increased competition by conspecifics that may infer higher habitat quality and therefore a need for managers to maintain sufficient areas of these habitat types.

Does kin selection modulate female fighting in fruit flies?

Mr Andrew J Spires, Dr Ashleigh Griffin, Dr Ellie Bath

University of Oxford

Abstract

Aggression is a highly complex social behaviour. Aggression allows individuals to compete against same-sex conspecifics for limited, valuable resources that increase their reproductive success. Yet theory dictates that individuals can instead maximise their inclusive fitness by exhibiting aggressive restraint towards their kin. However, there have been few empirical tests of this, and in particular, females have been overlooked. Firstly, we performed a fully-factorial design with the effects of relatedness (full-sibs vs unrelated) and familiarity (reared in the same or different environment) on intrasexual aggression, in both male and female *Drosophila melanogaster*. Secondly, to study the plasticity of aggressive responses, we studied the effects of focal and competitor mating status and their interaction with relatedness on female aggression. Finally, we experimentally tested for kin discrimination when females display aggression towards a mating pair. Currently, our results are being analysed although preliminary results suggest females do not regulate aggression towards kin.

Impact of hybridization and temperature on *Formica* wood ant aggression

Patrick J Heidbreder

University of Helsinki

Abstract

The effects of climate change on species are often determined by temperature-related traits. Hybridization, interbreeding between related lineages, may yield adaptive phenotypes, or hybrid vigor. In *Formica* wood ants, hybrids have thermal preferences and tolerances varying from the parent species. I present preliminary work quantifying differences in ant nest thermal regulation between hybrids and parent species, and present the first direct measures of the effect of temperature on ant aggression, an important trait in resource acquisition. I measured daily nest thermal cycles of ant nest interiors and surfaces using iButton loggers and an IR camera, and quantified aggression with 1 on 1 assays. I expect that hybrids vary from F. aquilonia in nest temperature, and that temperature impacts brood warming strategy and aggression. This will provide a first look at how hybridization impacts ecology and behavior in ants, and if these are likely to be important with changing climate.

Building streetscape habitat to enrich biodiversity

Miss Philippa L Bell, Dr Georgia E Garrard, Proffessor Kirsten M Parris

The University of Melbourne

Abstract

Urbanisation is occurring at an extraordinary rate and scale, and the resulting habitat destruction and fragmentation is considered a major threat to biodiversity worldwide. Here we take advantage of a commonly under-utilised space ubiquitous across cities, road verges, to build habitat for urban insects.

We implemented a paired before-after-control-impact (BACI) design to assess the value of habitat gardens on road verges for bee, beetle and butterfly biodiversity in Melbourne, Australia. These gardens were curated specifically for the insects known to inhabit the area and included resources for adult and juvenile nutrition, nesting and shelter.

Species richness and abundance of insects was substantially higher on impact sites after establishing the gardens. Most notably, native bees benefitted greatly from these gardens, increasing from 0 individuals before the treatment to 371 individuals following the treatment.

These data provide strong support for the use of road verges for insect conservation in cities.

Role of filters in the community assembly of freshwater fishes across the subtropical montane riverscape of Eastern Himalayas

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Abstract

Freshwater fish communities differ widely across spatial scales due to environmental filtering and limited dispersal. Species traits may further help to predict species niches and co-occurrences. We aimed to model the occurrence as a function of environmental covariates and distance, testing for the effects of traits and phylogeny on species niches and co-occurrence patterns. Over multiple years, we fitted two joint species distribution models to a dataset of fish sampled across the Teesta-Jaldhaka basins of the Eastern Himalayas. The effects of environmental filtering were more potent than those of spatial distance. Traits explained relatively little variation in species niches and co-occurrences, and their effects differed among basins. However, residual phylogenetic signal in niches indicates that unmeasured traits likely play a more decisive role. Environmental filtering plays a primary role in structuring lotic fish communities. The relative importance of covariates and the nature of trait-niche relationships vary, resisting generalization.

Direct and indirect effects of invasive earthworms on ecosystem multidiversity and multifunctionality

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Abstract

Global change threatens biodiversity and ecosystem processes, with invasions among the most prominent drivers. While most studies focus on single facets of biodiversity and ecosystem functioning, only few studies deal with multiple biodiversity facets and functions simultaneously, even though this would facilitate a holistic understanding of the ecosystem-scale consequences. Synthesising data from an observational multi-site study on northern North American forest soils, we assessed earthworm-invasion impacts on multidiversity and multifunctionality with structural equation modelling. We found both negative direct and indirect effects of earthworms on multidiversity and multifunctionality. Indirect effects were mostly mediated via environmental variables such as soil water content. Dividing multidiversity into animal, plant, and microorganism components, we found animal multidiversity to dominate these negative effects. For single processes, soil microbial biomass, carbon and nitrogen concentrations strongly decreased with earthworm invasion. Our synthesis identifies mechanisms by which invasions drive substantial changes in native biodiversity and ecosystem multifunctionality.

Frogs in space: Using call triangulation to map frog distributions in three dimensions

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Abstract

During our recent expedition to Ngounie Province, Gabon, from August – November (2024), we conducted comprehensive surveys of amphibians and reptiles from ground to canopy. The research site was within an area of contiguous primary rainforest, with a canopy height of 35 m. Employing a range of methods including pitfall traps, stream surveys, audio surveys, and arborist-assisted canopy surveys, we documented a rich array of species across different strata. Our findings reveal a community continuum, with species occupying a variety of vertical niches. Notably, several amphibian species were exclusively detected through pitfall trapping, while many reptile species were discovered only via canopy access. This research contributes valuable natural history data for many understudied species and provides an updated inventory of herpetofauna species in the region. Furthermore, we underscore the importance of multi-strata approaches in biodiversity studies of tropical forests and highlight the complex ecological dynamics within Gabon's forests.

Hot topics in butterfly research: filling gaps in our knowledge of the vulnerability of butterflies to climate change

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Abstract

Climate change is a growing threat to global biodiversity, yet our current knowledge of species vulnerability contains critical gaps, even in well-studied taxa. As a result, we are at risk of making ill-informed decisions to protect biodiversity before it is lost. Butterflies are a particularly well-studied taxon, however the majority of our knowledge of this group comes from temperate adults. Here I present data on two under-studied groups, larvae and tropical species, focusing on their capacity to thermoregulate. We found substantial differences between life stages, highlighting the importance of research across the life cycle, and how the timing of extreme weather events will play a critical role in determining how species respond to climate change. Thermoregulation ability showed relatively consistent patterns between temperate and tropical species, with similar traits influencing thermoregulation and therefore vulnerability across regions.

Low evenness inverses richness-productivity relationship in experimental grassland communities

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University of Graz

Abstract

Species richness shapes many ecosystem properties, but species richness is only one biodiversity facet – evenness also has major impacts on these but is often neglected in biodiversity research. We seeded 8 grassland species in different combinations of evenness and richness and exposed them to a 2-week drought after a growing period. We monitored biomass and microclimate with a self-developed sensor network in high temporal resolution. We show that high evenness communities are more productive than uneven ones with high richness, but the contrary is true in low richness plots, where uneven communities are more productive than high even communities. Evenness is insignificant in the response to drought, where high richness plots are less affected by drought than low richness plots, independent from evenness. These results demonstrate that evenness and richness can each influence distinct aspects of ecosystem properties and suggest that evenness is important in designing ecosystems for future climates.

The biological soundscape of temperate reefs: characterizing natural and artificial reefs

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Abstract

Monitoring coastal marine habitats is challenging, and using multiple approaches can strengthen habitat status assessments. Passive acoustics offers a complementary technique to document, describe, and monitor coastal habitats through soundscapes, which are distinct due to specific features and biological communities. Passive acoustic monitoring (PAM) is a low-impact, innovative method for long-term habitat monitoring. Marine soundscapes have not been described for the Wadden Sea, where reef habitats have changed due to human impacts. We documented biotic acoustic signatures at shellfish reefs and neighboring sand habitats. Recordings from natural reefs were compared to recently deployed artificial reefs, revealing greater biotic acoustic diversity at both reef types compared to sandflats. These results demonstrate fine-scale differences in habitat soundscapes within a small geographic area. This study lays the groundwork for further quantitative research using PAM to monitor soundscape dynamics and understand the role of sound in changing coastal ecosystems.

Microplastics alter the functioning of marine microbial ecosystems

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Abstract

Microplastics pervade ocean ecosystems. Despite their effects on individuals or populations are well documented, the consequences of microplastics on ecosystem functioning are still largely unknown. Here we show how microplastics alter the structure and functioning of pelagic microbial ecosystems. Using experimental pelagic mesocosms, we found that microplastics indirectly affect marine productivity by changing the bacterial and phytoplankton assemblages. Specifically, the addition of microplastics increased phytoplankton biomass and shifted bacterial assemblages' composition. Such changes altered the interactions between heterotrophic and autotrophic microbes and the cycling of ammonia in the water column, which ultimately benefited photosynthetic efficiency. The effects of microplastics on marine productivity were consistent for different microplastic types. This study demonstrates that microplastics affect bacteria and phytoplankton communities and influence marine productivity, which ultimately alters the functioning of the whole ocean ecosystem.

The development of ecological systems along paths of least resistance

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Abstract

A long-standing question in biology is whether there are common principles that characterize the development of ecological systems, regardless of organismal diversity and environmental context. Classic ecological theory holds that these systems develop following a sequenced orderly process that generally proceeds from fast-growing to slow-growing taxa and depends on life-history trade-offs. However, it is also possible that this developmental order is simply the path with the least environmental resistance for the survival of the component species and hence favored by probability alone. Using theory and data from bacterial and metazoan systems, we show that the order from fast to slow-growing taxa is the most likely developmental path for diverse systems when local taxon interactions self-organize in light of environmental resistance. The capacity of simple principles to explain the trend in the developmental order of diverse ecological systems paves the way to an enhanced understanding of collective features of life.

The direct and indirect influences of forest area and edge effects on the numbers and diversity of dung Beetles.

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Abstract

Dung beetles are very sensitive to forest loss and fragmentation, and the abundance of mammals providing the dung. Accordingly, we evaluated the influence on the numbers and diversity of dung beetles of the changes in forest area and edge effects, by themselves, and with the number of mammals in the forests.

We worked in 12 forests in Tana River, Kenya. Counted the number of mammals, and identified 87 species from 113,955 beetles, sampled in 288 plots. Our optimal, fully latent Structural Regression, SEM explained significant variance in the numbers (26%) and diversity (89%) of the beetles. All influences of forest area and abundance of mammals were positive;- direct on the number of beetles and indirect on diversity. In contrast, influences of edge effects were all negative; - direct on number of beetles and indirect on diversity. Ultimately, the number of beetles influenced their diversity in a positive and direct way.

Three's Company: Human infrastructure accentuates meso-carnivore interactions in a shared savanna landscape of western India

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Abstract

Meso-carnivores in human-use landscapes must balance food provisioning opportunities with risks from dogs and road accidents; our understanding of these responses in resource-restricted tropical environments is limited. We studied golden jackal *Canis aureus*, jungle cat *Felis chaus*, Indian fox *Vulpes bengalensis* and desert cat *Felis lybica ornata*– their spatio-temporal responses to each other, and to anthropogenic factors in a semi-arid landscape of India. Meso-carnivore pairs showed both spatial avoidance and spatio-temporal association. Dogs did not affect meso-carnivores' space-use, but Indian fox and desert cat avoided them temporally. Spatio-temporally overlapping species generally showed fine-scale aggregation. Settlements, roads and wind turbines differentially impacted meso-carnivore presence, reducing species' spatial co-occurrence. We argue that increasing human infrastructure can elicit competition driven loss of sensitive species, leading to homogenization of the meso-carnivore community. Our results highlight the need to consider species-specific responses and the complex interplay amongst species to conserve multi-carnivore systems across shared landscapes.

Does creating native wildflower pocket prairies aid bee conservation in a legacy city?

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Abstract

As people leave legacy cities, abandoned homes are demolished and transformed into vacant lots. These greenspaces have been demonstrated to provide habitat for urban wildlife and supply ecosystem services to communities. In the legacy city of Cleveland, Ohio, U.S.A., approximately 37% of the state's bee fauna has been collected within vacant lots. Our goal was to determine if planting native wildflowers on vacant land ("pocket prairies") would improve urban vacant lots as bee habitat. Using pan traps and hand vacuums, we sampled bees from June to September 2019. We collected 1,087 bees representing 24 genera and 81 species. Pocket prairies supported a higher bee abundance, diversity, and species richness than urban vacant lots. Despite the substantially smaller extent of the pocket prairies, these habitats supported a similar bee abundance to surrounding natural preserves. Our results suggest that greening vacant land can improve legacy cities as bee habitat.

Temporal beta diversity of terrestrial species post-dam collapse: biodiversity and conservation insights

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Abstract

Human pressures on ecosystems range from acute to chronic disturbances, often interacting within landscapes and complicating the identification of impact sources, especially without prior data. The collapse of the Brumadinho iron ore tailings dam in southeastern Brazil impacted a landscape historically affected by mining, agriculture, and urbanisation. We assessed temporal beta diversity (changes in species composition over time) in six areas adjoining the mudflow, comparing them with six reference and eight protected areas. Data was collected quarterly over three years for nine taxa: plants, ants, beetles, butterflies, termites, amphibians, reptiles, birds, and small mammals. Temporal beta diversity remained constant, but gains were higher in areas near the mudflow, indicating rapid colonisation after the event. Although we lacked pre-collapse data for the affected areas, our results suggest that the immediate surroundings of the mudflow showed minimal acute and chronic effects, likely due to an ecosystem already shaped by human impacts.

Diet of riparian carabid beetles along stream courses

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University Kaiserslautern-Landau (RPTU)

Abstract

Riparian habitats are characterised by food webs that link aquatic and terrestrial resources. Although there is evidence that riparian spiders can be highly dependent on aquatic insects as prey, little is known about the dietary preferences of riparian carabids. To fill this research gap, we sampled carabids at three sections (upstream, midstream, downstream) in each of five streams in southwest Germany. All sample sites were near-natural riparian habitats with a shallow, gently sloping shore and surrounding woodland. Carabids were sampled by pitfall trapping and hand collection in May and September 2023. Pitfall-trapped carabids were stored in 80% ethanol and hand-collected were frozen at –20°C. DNA was extracted from ~580 individuals, including 27 species, using the high-salt method. The 205 pb Vamos primers, validated for gut content metabarcoding, were used. Here, we present our first results of the metabarcoding of the gut contend of a wide range of riparian carabids.

Partitioning beta diversity demonstrates the importance of species replacements when habitat degradation levels in boreal forest lichen, polypore and bryophyte assemblages

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Abstract

Understanding how habitat degradation affects local assemblages is essential for understanding biodiversity change with anthropogenic pressures. Partitioning beta diversity into nestedness, relating to species losses, and turnover, relating to species replacements, offers detailed insights into the mechanisms behind biodiversity change with increasing habitat degradation.

Using an extensive assessment of lichen, polypore and bryophyte species composition in 240 boreal forest locations across Sweden and Finland, we examined how beta diversity, nestedness and turnover vary when comparing assemblage pairs from the same or different habitat degradation levels.

We found higher beta diversity, nestedness, and turnover, between habitat degradation levels for lichens, but not for polypores or bryophytes. Beta diversity patterns were driven mostly by changes in turnover rather than nestedness. Our results show the usefulness of partitioning beta diversity to understand biodiversity change, as doing so demonstrated the importance of local scale species replacements with habitat degradation.

The effects of long-term fertilization and grazing exclusion on flower abundance, community composition and diversity in Arctic grasslands

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Abstract

The flowers of insect-pollinated plants are key resources for flower-visiting insects. Soil nutrient enrichment and grazing can alter the abundance, diversity and community composition of insect-pollinated plant communities. This study investigates the effects of long-term fertilization (N, P, K) and grazing exclusion on flower abundance, diversity and community composition in herbaceous plant communities at two grassland sites in NW Finnish Lapland (montane grassland and tundra grassland). We observed that the impacts of fertilization and grazing exclusion varied between the sites. In the low-productive tundra grassland, grazing exclusion and NPK fertilization additively increased flower abundance, whereas in the productive montane grassland, they exhibited a super-additive interactive effect, significantly increasing the numbers of flower units. However, combined NPK fertilization and grazing exclusion reduced flower species richness, particularly in the tundra grassland. Our findings suggest that grazing, together with nutrient addition and site conditions shape floral resources, which are crucial for pollinator interactions.

Weakening niche partitioning in damselfly communities approaching the northern range limit in the UK

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Abstract

Environmental filtering is the process where reginal pools of species are filtered by the abiotic environment into distinct ecological communities. However, local adaptation towards the edge of species ranges may erode this effect, broadening species niches and weakening niche partitioning.

To test this, a comparison between damselflies communities at the range limit in Scotland and core range in England, was conducted.

Results highlighted strong niche partitioning within the core range, with 5 distinct damselfly communities observed. While in Scotland, only 3 loose communities were observed, made up of a broader range of species than in England. In both England and Scotland significant effects of waterbody size on community type was seen.

Here, results suggested damselfly communities are structured by the abiotic environment (waterbody size), which filters the communities. However, this is weakened at the northern edge of the community's range, likely the result of local adaptation allowing species to coexist.

Effect of Coral Restoration on Fish Abundance and Species Composition in Spermonde, Indonesia.

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Abstract

Coral reefs are amongst the most valuable ecosystems on Earth, yet increasing climate change intensity and anthropogenic disturbances threaten many reef-associated species. Billions of dollars are spent every year on coral restoration efforts worldwide, but restoration success is usually only quantified in terms of coral growth. We lack understanding of the impact of coral restoration on other reef-associated species. In particular, reef fish communities are crucial for evaluating the success of restoration programs and assessing their ability to contribute to ecosystem services. This study uses underwater visual census to survey fish communities at one of the world's largest coral restoration projects, comparing healthy, restored, and degraded reefs. We analyse the composition of fish communities, demonstrating some functional recovery of restored reefs, and some ways in which restored reef communities differ from naturally healthy systems. These results can inform restoration efforts that aim to recreate fully functional reef ecosystems.

Floristic composition, diversity, and conservation status of tropical forests along a rainfall gradient in Ghana

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Abstract

Although widespread species losses are expected in the tropics, few studies have quantified variation in the conservation status of forest communities that are widely distributed across divergent environments. We assessed biodiversity patterns, conservation importance, and environmental relationships for disjunct forest communities in wet, moist and dry forest zones of Ghana. Across the study region, 3471 trees belonging to 242 species were censused. Approximately 17.4% of the identified species are presently threatened or near threatened. The wet forest was the most diverse community type, supported the largest proportion of at-risk taxa, and was attributed with the highest conservation score. Species diversity in the region is maintained by adequate soil moisture and nutrient availability and inhibited by severe vapour pressure deficits. The sensitivity of tree species to water limitation suggests that a possible future magnification of drought intensity in the region may compromise the integrity and continuity of these highly diverse systems.

Conservation value of skeleton forests: Is the spruce bark beetle an ecosystem engineer?

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Abstract

In recent years, there have been extensive outbreaks of the spruce bark beetle (*Ips typographus*) in Europe, causing mortality of Norway spruce trees. This has negative effects on forest production. However, areas of dead spruces, also known as skeleton forests, provide a significant amount of deadwood that could be used by deadwood-dependent organisms that have been negatively affected by the greatly reduced amount of deadwood in intensively managed production forests. The aim of our project is to assess the role of spruce bark beetles as ecosystem engineers. Using multi-taxa data, we are investigating the effect of site (nature reserve or production forest), number of dead trees and time since tree death on the diversity and species composition of insect communities. Our study is conducted in southern Sweden and focuses on Coleoptera, as well as less studied orders such as Hymenoptera, Diptera and Raphidioptera.

Spatio-temporal assessment of microplastic contamination in a Tropical river basin

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Abstract

Microplastic contamination is of major concern globally. However, studies in Tropical ecosystems are scarce, mainly descriptive and lack a long-term analysis. We used a 25-year dataset from the third biggest metropolitan region in Brazil to investigate microplastic contamination in freshwater systems. We used small-sized fishes as proxies of microplastic contamination in four different freshwater systems (i.e. headwater streams, large tributaries, main river stem, lagoons) to assess spatial patterns of microplastic contamination. We analyzed the gastrointestinal tract of 249 individuals from three species. Our preliminary results show a prevalence of microplastics in fish from all systems, even from the reference condition river. Fish from lagoons were the most contaminated. Our next steps will be to incorporate land use and land cover information, as well as population density, in our analysis. Additionally, we will evaluate temporal trends in microplastic contamination over the past 25 years using fish from the main river stem.

Intraspecific chemical composition of plants at local scales is driven by neighbours, not consumers

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Abstract

Previous work on plant chemical diversity and maintenance has emphasised the role of herbivorous consumers, but the impact of direct plant-plant interactions on this relationship remains unclear. We studied phytochemical responses of the C4 grass *Andropogon gerardii* and the legume *Lespedeza capitata* to changes in neighbour diversity and consumer pressure using a fully crossed field experiment over fifteen years. The two species responded differently: *A. gerardii* showed no chemical response to either neighbourhood diversity or consumer manipulation, while *L. capitata* phytochemistry significantly changed in response to neighbourhood diversity, with signs of metabolic stress (lower sugar and higher amino acid production) in diverse communities compared to monocultures. While theory and empirical work has focused on coevolution with consumers as a driver of phytochemical diversity, our results suggest that at community ecological scales, interactions with neighbours are more important than consumer pressure in determining local phytochemical composition for some species.

Heterotroph consumer impacts on grassland community composition depends on past processes

Seraina L Cappelli, Eric Seabloom, Elizabeth Borer

University of Minnesota

Abstract

Heterotroph consumers are ubiquitous and have negative impacts on their hosts. Empirical evidence on how these impacts shape the composition of host communities remains scarce. Here we leveraged two long-term heterotroph exclusion experiments to study how heterotroph consumers shape the functional composition of plant communities at different stages of the community assembly process.

Especially fungal pathogens acted as a biotic filter in the community assembly process, causing community shifts towards larger community weighted mean (CWM) for leaf nitrogen content and seed mass, and smaller CWM for leaf dry matter content and plant height, mainly by suppressing legumes. When past filtering processes are not explicitly considered in the experimental design, the impact of heterotroph consumers is likely underestimated.

Neighbour removal results in flowering time shifts, particularly for early flowering grassland plant species

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[1]Algoma University. [2]Queen's University. [3]University of New Brunswick

Abstract

Soil fertilization generally results in later flowering. Here, we test whether the removal of neighbouring plants, expected to reduce competition, consistently results in target plants flowering later (as with fertilization), and whether shifts impact pollinator visitation. Specifically, we compared flowering time for eight entomophilous forb species in a grassland when they have neighbours versus when neighbours were removed, and conducted pollinator observations. Neighbour removal resulted in a significant change in mean flowering time and the duration of flowering; most plants flowered later; however, species that flowered earliest with neighbours, shifted most when neighbours were removed. Pollinator visitation did not differ between the neighbour and no-neighbour treatment for six species, was lower for one species and higher for another when neighbours were removed. Competition among plants for soil and/or light resources can alter flowering time and has the potential to impact pollination.

Three decades of directional change in species abundance distribution of global waterbird

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Abstract

Understanding species and community changes is crucial for addressing the biodiversity crisis, but current global assessments focus on species metrics, overlooking community dynamics, which hinders grasping ecosystem function loss. Here we use a fundamental ecological concept, species abundance distribution (SAD), which has been used as an indicator of disturbances and natural successions, to analyse waterbird community changes at over 11,000 sites from 1990 to 2018. We find a conveyor belt to extinction, in which previously locally abundant waterbird species decline faster than rare species, and rare species are more likely to become locally extinct. More species were gained than lost from wetlands. With fewer increasing species, the proportion of rare species has increased and led to the more right-skewed SAD shapes. Waterbird assemblages have thus degraded across the world in the past three decades, which may be a consequence of widespread deterioration of the world's wetlands.

Ecological Coexistence: In Theory and Practice

Prof. Adam T Clark

University of Graz

Abstract

Coexistence is one of the most fundamental concepts in ecology, and one of the most difficult to define and quantify. This talk seeks to unify existing coexistence metrics and concepts, with the goal of making them more empirically tractable. We will first review four classes of community dynamic behaviours: (i) feasible steady states, i.e. where all coexisting species retain positive abundances over time; (ii) local attractors, that draw communities towards a feasible steady state from within a restricted set of starting conditions; (iii): global attractors, that draw communities towards feasible steady states from any feasible starting condition; and (0) a null transient state. Next, we discuss how these behaviours relate to common metrics for classifying and quantifying coexistence, including time to extinction, parameter sensitivity, asymptotic return rates, and invasion growth rates. Finally, we delve into the scope and limitations of each definition and metric, with a focus on empirical applications.

A parasite plant *Cuscuta campestris* promotes the coexistence of two annual plants

Naoto Shinohara[1], Riku Nomiya[2], Akira Yamawo[1]

[1]Kyoto University. [2]Hirosaki University

Abstract

Consumers can influence competitive outcomes of prey species in various ways. Modern coexistence theory predicts that consumers can promote prey coexistence by preferably targeting a competitively superior one, thereby reducing fitness differences. However, previous studies yielded mixed conclusions. In this study, we tested the hypothesis that a parasitic annual plant *Cuscuta campestris* facilitates the coexistence of two common annual plants. We performed field surveys and parasitism experiments to parameterize a plant competition dynamics model. The model suggested a competition-defense tradeoff: the legume *Lespedeza striata* was a better competitor than the grass *Setaria faberi*, while it was more susceptible to the parasite. Moreover, an empirical hosts-parasite dynamics model, extended from the plant competition model, predicted their coexistence within broad, biologically reasonable ranges of parameters. This work provides field evidence of the coexisting-promoting role of a parasitic plant, as caused by stabilizing feedback between host and parasite densities.

Can Beavers create a buzz and a flutter for pollinators?

Mr Patrick Cook, Dr Alan Law, Dr Zarah Pattison, Professor Nigel J Willby

University of Stirling

Abstract

Beavers are second only to humans in their capacity to transform landscapes. Biodiversity responses to their habitat engineering activities are well studied but rarely 'beyond the pond'. Potentially profound effects on pollinator communities and the delivery of pollination as an ecosystem service may therefore be overlooked. In this study we compared pollinator communities around beaver ponds and human-created ponds, specifically if these pond types differ in (1) pollinator species richness and abundance and (2) structure of their plant-pollinator networks. We found hoverfly richness and abundance was 56% and 121% higher around beaver ponds and responded to flowering species richness and maximum flower coverage. Moth abundance was 160% higher around human created ponds but showed no response to flowering plants. Our results show that having both pond types in the landscape would support more diverse pollinator communities and networks, but currently only creation of human-created ponds is supported through agri-environment schemes.

The role of biodiversity in mitigating drought stress in plant communities

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Abstract

Climate change is rapidly increasing global surface temperatures and altering drought patterns worldwide. Biodiversity may help mitigate the negative consequences of drought, but recent work has highlighted differences in how biodiversity operates during soil moisture deficit vs. atmospheric moisture deficit. In this study, we examined whether complementarity effects (facilitation and niche differentiation) or selection effects underlie the relationship between biodiversity and drought. We experimentally manipulated soil moisture, relative humidity, and diversity of California native herbaceous species. We found that higher diversity plant communities had significantly cooler average temperatures, higher relative humidity, and lower vapor pressure deficit. We also found that complementarity effects were higher in plant communities that lowered the microclimate vapor pressure deficit compared to those that did not. Soil moisture did not have the same effect. Future work will need to utilize a holistic approach to assess drought effects and how biodiversity can mitigate against environmental change.

rarestR: an R package using rarefaction metrics to estimate α- and β-diversity for incomplete and inconsistent samples

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Abstract

Abundance-based samples of mobile organisms are often incomplete, resulting in bias when calculating the α and β-diversity. Rarefaction offers an estimation method, where α-diversity is calculated for standardized sample sizes. Rarefaction theories can also be used for β-diversity calculations for standardized sample sizes. We developed a new R package, rarestR, designed to calculate abundance-based α- and β-diversity measures for incomplete and inconsistent samples using rarefaction metrics. Additionally, the package offers parametric extrapolations to estimate species richness. We showed how this method is accurate and precise in detecting the true differences in species richness and dissimilarity for incomplete and inconsistent samples.We provided a working example, illustrating how the package offers parametric extrapolations to estimate the total expected number of species within a single community and the total expected number shared between two communities. Additionally, we demonstrated how the package provides visualization for the curve fitting associated with these estimators.

Post-Fire Recovery of Odonata in a Neotropical Savanna: Insights from a Bi-Annual Survey

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Abstract

The study aimed to see how a wildfire in October 2021 affected the Odonata community in a Neotropical Savanna area in Brazil. The research lasted two years, starting in May 2022, with collections done every two months in a pond that was divided into flowing and still water. 677 Odonata individuals were collected, showing a decrease in the second year. The study found 22 different species of Odonata, with the most common ones being *Zenithoptera lanei*, *Erythrodiplax latimaculata*, and *Acanthagrion truncatum*. The researchers noticed more individuals when the temperature ranged from 25-30°C and during moderate rainfall (50-100 mm/month). Species and abundance varied between standing and flowing water. Compared to a study made ten years ago, there were nine fewer species. This study gives valuable insights into how Odonata communities react to wildfires in Cerrado areas and shows the importance of long-term monitoring for understanding recovery patterns -CAPES-001; CNPQ-403647/2021-5.

Warming-induced Body Size Reduction in Aquatic Animals is Greater at Late Life Stages

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Abstract

Warming is increasingly impacting aquatic animals, reducing both body size reduction and fitness. However, there has been no quantitative analysis across diverse aquatic animals of the magnitude and direction of how warming-induced body size change varies across ontogeny. I incorporated data from published literature and performed meta-analysis to examine the magnitude and direction of the warming effect on asymptotic size of continuously growing species and their size-at-maturity. Results showed that warming reduced the asymptotic size more than size-at-maturity in field observations (-16.47% and -2.96% body size reduction per 1 ℃ respectively). But little evidence was found that warming reduce either asymptotic size or size-at-maturity significantly in a smaller sample from lab experiments. Warming reduced body size significantly more at later age in lab experiments significantly, but the reduction is insignificant under field observations. This research quantitatively estimated warming effects on size across different taxa, environmental settings, and different ontogenetic stages.

Can landscape patterns explain vegetation characteristics along successional gradients in post-mine spoil heaps?

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Abstract

There is limited knowledge of how surrounding land cover may influence species composition, community assemblage, functional diversity, and phylogenetic relatedness structure of vegetation developing spontaneously on post-coal mine spoil heaps. Using the recent CORINE landcover data, we investigated the influence of different landscape types in the proximity of 400 sample plots at various successional stages on taxonomic, functional, and phylogenetic diversity in Upper Silesia, Poland. Using generalized mixed-effect models, we estimated predictors of diversity indices along successional gradients. While species richness and Shannon diversity decreased with age, these responses increased on heaps with the proportion of agricultural and transport corridors. Heaps surrounded by agricultural and transport corridors are functionally similar. However, these landscape predictors negatively affected phylogenetic indices, suggesting less diverse and more clustered communities. Phylogenetic indices increased with age of spoil heaps. Our study could help understand predictors of succession and provide strategies for the management of post-mine vegetation.

Effects of urbanization on intra- and interspecific variability in two tropical frog metacommunities

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Abstract

Cities are altering eco-evolutionary dynamics worldwide, but little is known about how the phenotype of multiple species vary in cities with different sizes and ages in the Tropics. Here, we tested if urban environments constrain the phenotypic variability of frogs. We estimated the contribution of urbanization rate and local environmental variables to the variation in body size, relative leg length, and head width and length of frogs in a set of ponds along urbanization gradients in two Brazilian cities. We also tested the the relative contribution of species turnover and intraspecific variation to phenotypic variation. Intraspecific variability was low for all traits and the main source of phenotypic variability was species turnover.Leg length was the only trait affected by urbanization. No trait had clear spatial pattern. Our results add new evidence for the effect of urbanization on multispecies phenotype in Tropical young cities distinct from the Global North.

Is habitat or climate the dominant driver of caterpillar community composition?

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University of Edinburgh

Abstract

In this era of rapid anthropogenic change, two major impacts on biodiversity are climate change and habitat alteration. Understanding the relative magnitude of their effects on community structure is crucial for predicting future scenarios. Impacts on habitat are expected to be especially important in systems where the habitat dictates the resource, e.g., the plants available to a herbivore. We use a multi-site multi-year dataset of 35 caterpillar species; and test whether the main drivers of variation in caterpillar abundance are climatic variables (spring/winter temperature and rainfall) as is often assumed in species distribution models, or host tree species. We find tree species is a much stronger driver of caterpillar community composition than climate, and critically that the impact of climate is over-estimated when tree species is omitted from the model. This highlights the importance of modelling using relevant habitat predictors for projecting short-term climatic impacts.

Microclimate and Facilitation Trade-offs Along a Los Angeles Urban Gradient

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[1]California State University, Los Angeles. [2]University of Toronto

Abstract

Urbanization is a stressor that can exacerbate climate change impacts. In particular, urban ecosystems are hotter and drier than their rural counterparts and this can modify plant community dynamics. Here I examined how plants in 81 plots in the greater Los Angeles region can ameliorate heat and water stress. I identified two focal plants and placed temperature/humidity sensors near each. I also measured plant growth, soil moisture and the light concentration above and below the canopy of each plot. I found that in the plots where neighboring vegetation cooled the microclimate the most, and the sites where precipitation was the lowest, plant neighbors experienced the most facilitation. This work will inform decisions about managing greenspaces in city centers in a changing climate; if the hottest urban sites experience the most facilitation, we can manage these sites to maximize microclimate effects, and this may also improve ecosystem stability.

Soil Moisture, Diversity, and Atmospheric Humidity: Its Effects on Powdery Mildew

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Abstract

Climate change and global biodiversity loss are altering plant pathogenic disease burden worldwide. Plant pathogens often decrease with drought and increase with loss of plant diversity (dilution effects). These global change factors can also indirectly affect pathogen load by changing host density. Here we manipulated soil moisture, diversity, and atmospheric humidity in a native herbaceous community in Southern California. We measured powdery mildew load on *Eschscholzia californica* within this experiment. We found that powdery mildew decreased with both humidity and soil moisture (opposite of what we expected) but was not directly related to diversity. Instead, diversity-driven changes in host abundance, and host effects on microclimate humidity, created feedbacks that drove pathogen load. Overall, these results emphasize that the interplay between atmospheric drought, soil moisture, and diversity plays a key role in shaping disease outcome.

Spread of ecological effects across space: mechanisms and empirical insights from a large-scale plant-frugivore community

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Abstract

Species can directly and indirectly affect others across communities and habitats, yet the mechanisms and spatial scales over which such effects spread remain unclear. Here I propose that we can advance that challenge by characterising ecological communities as spatially-explicit interaction networks. I first discuss the mechanisms by which indirect effects (or disturbances) propagate in ecological networks, looking at species, interactions, and landscape characteristics that are relevant to the propagation of indirect effects. I then explore using novel metrics how indirect effects propagate across space in a large-scale plant-frugivore network projected across the territory of Aotearoa New Zealand. In that study, generalist birds and plants spread indirect effects efficiently at the local scale, whereas a widespread distribution further allowed species to propagate effects across the landscape. Overall, these results suggest that a combination of landscape and community factors and methodologies is necessary to better understand ecological effects of species across space.

From diversity to homogeneity: how herbicides reshape weed communities in agroecosystems

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Abstract

Weeds play a crucial role in agroecosystems by supporting biodiversity, enhancing soil health, and preventing erosion, but agroecosystems face disturbances, such as pesticide application. While it is evident that herbicides reduce weed diversity and abundance, it is unclear whether the shifts in communities caused by pesticides are gradual and induce turnover, or whether there are tipping points and threshold effects. To address this, we analysed data from 98 conventional cereal fields over four years to examine the effects of varying gradients of herbicide, fungicide, and insecticide intensities on weed communities. Using the Treatment Frequency Index and Quantity of Active Ingredient, we assessed community changes, including nestedness and turnover. Our findings suggest that as herbicide use increases, weed communities become more homogeneous, selectively removing sensitive species and allowing crop-competitive species to thrive. Furthermore, the quantity of herbicides applied, rather than the frequency of application, drives the gradual shift in weed communities.

Assessing competition between domesticated honeybees and wild pollinators in Scottish uplands

Ms Maisie F Brett, Prof Jane Memmott

University of Bristol

Abstract

Domestic honeybees can compete with native pollinators for resources such as nectar and pollen. Under what conditions competition occurs is debated, however, and community-level approaches are scarce. Here we assess pollinator competition in Scottish Upland Heathlands, considering the entire pollinator community and flowering season.

We performed an experimental introduction of hives to 20 two-hectare 'apiary' and 'bee-free' sites. We compared plant-pollinator networks and bumblebee pollen foraging between treatments, and detected significant network changes during hive introductions. We also found that for bumblebees, the protein content of foraging trips was maintained at sites with apiaries despite changes in diet, suggesting adaptive behaviour.

Interestingly, we found that land management interacted with bee introductions, with apiaries having a stronger effect on pollination networks at 'regenerating' sites than at 'muirburn' sites. Muirburn sites are historically subject to burning and grazing pressures, which may maintain floral diversity at important times of year for pollinators.

Seed bank composition reflects relative vegetation resilience to large herbivore presence

Prof. Merav Seifan

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Abstract

Desert vegetation endures harsh conditions like water scarcity and high temperatures, allowing only well-adapted species to coexist. Since vegetation is a food source for herbivores, it is limited by both desert conditions and herbivore activity. However, plant adaptations to arid environments may also help them tolerate herbivores. The Asiatic wild ass (Equus hemionus) serves as a model to study this, as it relies on artificial water sources, leading to varying herbivore intensity. To test these effects, we sampled the local seed bank in the Negev highlands, reflecting long-term impacts on vegetation. Structural Equation Modeling (SEM) showed that distance from water sources, and thus herbivore pressure, did not affect species composition; only topography influenced it. This suggests that desert vegetation is highly resilient to herbivore presence, even in extreme habitats.

Variation in precipitation drives differences in short-term transient dynamics between grassland functional groups: a multi-functional-group stage-structured approach

Mr. Aryaman Gupta[1], Dr. Samuel Gascoigne[2], György Barabás[3,4], Dr. Man Qi[1], Dr. Erola Fenollosa[1], Dr. Rachael Thornley[1], Dr. Christina Hernández[1], Prof. Andrew Hector[1], Dr. Roberto Salguero-Gómez[1]

[1]University of Oxford. [2]University of Aberdeen. [3]Linköping University. [4]Institute of Evolution

Abstract

Climate change is expected to increase the frequency and severity of precipitation extremes: droughts and flooding. Consequently, grassland communities, which occupy 40% of global land surface, are forecasted to become increasingly unstable. Predicting grassland responses to precipitation changes is challenging because community models typically assume near-equilibrium conditions. They therefore simulate long-term (asymptotic) performance, which is rarely validated during the normally short tenure of experiments. Here, we use data from an experimental precipitation manipulation performed over eight years to model short-term (transient) responses of three functional groups – grasses, legumes, and forbs – to precipitation extremes. We use multi-functional-group Integral Projection Models (IPMs) and pseudospectra theory, thus evaluating communities away from equilibrium. Our simulations indicate that the percentage-cover-stage-structure of functional groups shapes their transient stability, and that inter-functional-group interactions are competitive under increased precipitation but facilitatory under decreased precipitation. IPMs and pseudospectra enable forecasting of how functional-group-stage-structure drives community responses to climatic extremes.

A comparison between passive acoustic and active visual monitoring: evaluating sampling protocols for Neotropical anurans

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Abstract

There is an urgent need to monitor neotropical anurans given the scarcity of data and imminent threats. To help guide these efforts, passive acoustic monitoring (PAM) and active visual monitoring (AVM) were evaluated in Trinidad and Tobago in terms of the number of species detected. PAM detected more than twice as many species than AVM and the Chao2 species richness estimator was also greater for PAM (16.4, SE 0.95) than for AVM (9.2, SE 4.31). Further, our PAM surveys detected taxa with a wider range of life histories. By applying a pattern-matching algorithm to our PAM data, we show that early in the rainy season is a key time to conduct surveys, with no new species after seven days of recordings. Resources permitting, it is recommended that PAM be used to survey anurans in Neotropical forests to detect a wider variety of species more effectively.

Assessing the impact of substrate simplification on the diversity of stream benthos

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Abstract

Invertebrate assemblages on gravel and exposed bedrock were monitored to assess the impact of substrate simplification due to stream straightening works on the diversity of stream benthos. Artificial tiles with contrasting simple and complex surface structures were also used infield colonization experiments. The results indicated that the gravel substrates had higher taxa richness and Shannon-Wiener diversity index (hereafter H') of invertebrate assemblages than bedrocks. The gravel substrate had seasonally varying benthic taxa, while three species of dipterans dominated the bedrocks. Among eight environmental factors, two factors relating to substrate complexity significantly affected taxa richness and H'. Complex titles had significantly higher taxa richness and biomass than simple ones in summer season. The results demonstrated that bedrock exposure had a negative impact on the diversity of stream invertebrate assemblages leading to poor fauna.

Heat stress outweighs host plant phenology in driving subalpine aphid phenology

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[1]Chiba University. [2]Tokyo Metropolitan University

Abstract

Alpine ecosystems are isolated and, as a result, particularly vulnerable to climate change, making them ideal model systems for predicting the effects of the change on organisms. Substantial contributions from arthropods, especially subalpine aphids which are essential food sources for birds, have been observed in an alpine food web. In alpine regions, various environmental factors vary significantly along the elevation, e.g. leafing occurs later at higher elevations. In this study, we examined how *Euceraphis* aphids are influenced by temperature and host plant (*Betula ermanii*) phenology on Mount Norikura, Japan. Over three years, the relationships among aphid and plant phenology, and environmental factors were assessed by field surveys at different elevations. Laboratory experiments also evaluated how host plant leafing and temperature affect aphid populations. The results demonstrate that aphids are significantly affected by heat stress, implying that global warming may have profound adverse effects on alpine ecosystems.

Hydropeaking effects on river environment in regulated rivers: Impacts on riparian plants

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Abstract

Hydropeaking refers to short-duration and high-frequency fluctuations in river flow caused by the operation of stored energy hydroelectric plants and may lead to the effects on plant communities. However, research on the hydropeaking effects of plants remains relatively limited. This study investigated the riparian vegetation of hydropeaking rivers in the Xiangjiang River Basin and conducted a rapid ecological assessment by field sampling survey, focusing on community structure and diversity. Particular attention was paid to the expression of plant communities in the water level fluctuation zone and the highland area of the affected river course, and the spatial heterogeneity of hydropeaking was identified. In river reaches with significant hydropeaking characteristics, plant communities are more likely to undergo simplification at the water level fluctuation zone and to exhibit lower plant diversity. Nevertheless, the impact of the highland region is not invariably detrimental, and there is a potential for enhancing biodiversity.

Linking taxonomic and functional diversity: insights from the community dynamics of Finnish forests understorey

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Abstract

To understand the dynamics of forest understorey communities, taxonomic and functional diversity are often used interchangeably. However, whether taxonomic changes translate into shifts in the functional community composition remains unclear.

By integrating two decades of understorey vegetation data across Finland and functional traits, we compare taxonomic and functional species turnover. Using a modified Price equation, we partition changes in functional diversity into the functional contribution to the community of species loss, gain, and persistence.

We found that, while functional diversity follows the trend of taxonomic diversity, increasing in the south and decreasing in the north, species turnover had surprisingly little effect, with compensatory species loss and gain. Instead, changes in functional diversity were mostly driven by abundance shifts in the community.

With this framework, we make a first step towards better assessing biodiversity change across time and space, and improving our understanding of its link to changes in ecosystem functioning.

Cross-taxa analysis of long-term data reveals a positive biodiversity-stability relationship with taxon-specific mechanistic underpinning

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Abstract

Anthropogenic environmental change is altering biodiversity at unprecedented rates, threatening the stability of ecosystem services on which humans depend. However, most of what is known about biodiversity-stability relationships comes from experimental studies making extrapolation to real ecosystems difficult. Here, we ask whether the shape and underlying mechanisms of the biodiversity-stability relationship vary among taxa in real-world communities. Our study harnesses the power of six terrestrial and aquatic long-term monitoring datasets, encompassing entire assemblages at hundreds of georeferenced sites providing 20 years long community measurements and covering a 1200 km latitudinal gradient across Finland. In general, we detect a positive relationship between species richness and stability. Structural equation modeling reveals that this relationship is modified by the functional trait community composition, with the specific mechanisms varying among the taxa. Our study highlight the importance of functional traits in elucidating both general and taxon-specific impacts of biodiversity on community stability.

Re-investigation of the Farm Scale Evaluation data – assessing drivers of plant species communities?

Ms Savanna N.K. van Mesdag, Dr Helen Metcalfe, Prof Jonathan Storkey

Rothamsted Research

Abstract

The United Kingdom's Farm Scale Evaluation (FSE), between 2000 – 2003, assessed the differences in biodiversity between conventionally cropped fields and those using genetically modified crops (GMHT). The wealth of data collected for this project, which have since been utilised in additional studies, still have untapped potential to inform on drivers of plant diversity. With increasing problems of herbicide resistance and global biodiversity loss, understanding the impacts of crop management on in- and off-crop plant communities is increasingly important. We studied the factors explaining variance in plant communities recorded in the FSE, including habitat (boundary, margin and verge), crop, and cropping type (GMHT or conventional). By taking a phytosociological approach, we characterised plant communities typical of different habitats and/or management, and their value for ecosystem function. Our investigations will lead to further development of a large database of species, sites and functional traits of plants found in agricultural habitats.

Ecological metabolomics of tree communities along a tropical elevational gradient: Implications for chemically mediated biotic interactions and species diversity

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Abstract

Plant secondary metabolites mediate plant-enemy interactions and may increase biodiversity through chemically mediated niche differences. However, the role of plant chemistry in shaping biodiversity remains largely untested across large-scale ecological gradients. We used ecological metabolomics to quantify foliar metabolomes of 473 tree species in 16 forest plots along a tropical elevational gradient in the Bolivian Andes to test the hypothesis that stronger selection by natural enemies in warmer and wetter climates increases tree species diversity. Chemical dissimilarity among co-occurring species had positive direct effects on local species diversity, and warmer and wetter climates had positive indirect effects on species diversity by increasing chemical dissimilarity. Chemical phylogenetic signal had negative effects on local species diversity, indicating faster evolution of metabolites in more diverse communities. We highlight implications of these findings and ongoing studies for understanding the role of chemically mediated biotic interactions in determining species diversity along elevational and latitudinal gradients.

Legumes exhibit lower soil freezing tolerance than other species in herbaceous plant communities

Hugh A. L. Henry, Samuel L. Rycroft

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Abstract

Interspecific variation in freezing tolerance could drive shifts in plant community composition in response to a changing winter climate. Our objective was to explore whether legumes, an important functional group for soil nitrogen inputs, exhibit lower freezing tolerance than other species in herbaceous plant communities. We manipulated soil freezing via snow removal for three plant communities. We estimated aboveground biomass the following growing season and compared snow removal plots to ambient snow plots to quantify the soil freezing effect. In two communities, both dominated by non-native species, reductions in legume biomass caused by snow removal exceeded those of grasses and non-leguminous forms. However, in the native prairie, there was no disproportionate effect of freezing on legumes. These results suggest that non-native legumes exhibit low freezing tolerance relative to other species in our region, which may have important implications for the nitrogen budgets of these ecosystems in response to changing winters.

Not so tough after all: strong competitors engage in facilitation more frequently than weak competitors

Emily M Holden, James F Cahill

University of Alberta

Abstract

Plant interactions are theorized to structure plant communities, but it is unclear if strong competitors can also facilitate the growth of other plants in some circumstances. We ask if strong competitors ever facilitate neighbours' growth. Utilizing data from a mesocosm experiment where 13 grassland species grew in all possible pairwise combinations and two nutrient contexts, we calculated the net neighbour response (NNR) for species grown with neighbours. When NNR was negative (competitive), we ranked neighbours' suppressive abilities from greatest to least, noted the frequency of positive NNR (facilitation) for every species, and regressed this frequency against the species' competitive rank. Most NNR were negative, but 19% and 12% were facilitative in fertilized and unfertilized conditions, respectively. 12 out of 13 species engaged in some facilitative interactions, and stronger competitors facilitated more frequently. These results suggest that "specialist" competitors are rare, and plants do not engage in exclusively negative interactions.

The role of herbivory in plant metacommunities

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Oulu University

Abstract

Plant biodiversity depends on the interplay between spatial factors, like dispersal, connectivity and habitat size, and local biotic and abiotic factors, like trophic and competitive interactions. However, these are rarely studied simultaneously, and we lack comprehensive understanding of their relative contributions to biodiversity. We used plant abundance, functional traits, and environmental data from 90 spatially distributed grasslands, originating from a real-world grassland metacommunity system in the Åland archipelago in Finland, to investigate the relative roles of mammalian herbivory and spatial context for community assembly, species distributions and diversity. We found that grazing significantly increased plant species richness and diversity in local communities. The effect of grazing also depended on habitat size, being more positive in larger habitats. Connectivity exhibited an unimodal relationship with plant diversity, resulting in the highest diversity in intermediately connected grasslands. These results highlight the importance of well-connected large and grazed grasslands in maintaining plant biodiversity.

Climate change effects on tree growth are mediated by local average climate in tropical moist forests

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Abstract

Tropical moist forests (TMF) are vital to biodiversity and the global carbon sink but are increasingly vulnerable to climate change. This study assesses the causal effects of climate anomalies on TMF tree growth across the tropics, focusing on temperature ($TEMP_{an}$), evaporative demand (VPD_{an}), solar radiation ($SRAD_{an}$), and water deficit ($MCWD_{an}$). We use a causal inference framework and Bayesian multilevel models with data from 89 permanent plots across South America, Africa, Southeast Asia, and Oceania. Results show that increasing $TEMP_{an}$, $MCWD_{an}$, and $SRAD_{an}$ negatively impact tree growth, with $TEMP_{an}$ effects primarily mediated by VPD. Growth decline is more pronounced in warmer TMFs, with no clear biogeographic differences. These findings suggest that the productivity of warm moist tropical forests may be threatened by climate change and underscore the need to study the interplay between anomalies and historical climates while using causal inference frameworks to avoid spurious associations.

Shifts in community structure triggered by short term environmental change in saline lagoons

Miss Amelia F Jones, Mr Miguel Lurgi

Swansea University

Abstract

The geographical distribution of species depends on environmental factors, such as water quality food availability and shelter. In saline lagoons water quality is highly variable due to their small volume and periodic influxes of salt and freshwater. This variability allows many species to colonise these habitats across spatial and temporal scales; including marine, estuarine and freshwater species. Little is known however, about how lagoon communities react to the environmental changes they experience. We show how the aquatic community of a saline lagoon responds to rapid temporal changes in the environment, transitioning across distinct states throughout season and flooding regimes. We link these transitions to changes in temperature, dissolved oxygen, pH and turbidity influencing community structure. Our results demonstrate the varied impact of environmental factors on community structure in saline lagoons. This emphasises the need for tailored management strategies in naturally stressed environments to address their unique conditions.

Population dynamics in fragmented landscapes: the key role played by the connectivity elements beyond the habitat inter-patch distance

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Abstract

Fragmented landscapes pose significant challenges to species dispersal and population persistence. While some studies suggest that corridors and stepping stones enhance dispersal between habitat patches, others argue that they may have neutral or negative effects on population persistence. To assess their effectiveness in fragmented landscapes, we established a laboratory experiment using a soil microarthropod model. We manipulated fragmentation levels by varying the distance between four habitat patches surrounded by a hostile matrix, introducing corridors or stepping stones, but also tube networks using traditional metapopulation designs. Increasing the distance between patches reduced colonization, reproduction, and survival in all setups. However, all connectivity elements increased colonization rates and population sizes in target patches. Birth rates were highest in networked designs, while corridors promoted larger population sizes and adult survival. Our findings suggest that traditional metapopulation models may underestimate the benefits of connectivity elements, advocating for more nuanced approaches in studying landscape fragmentation.

Linking temperature niches to trait redistribution in Lepidopteran communities under long-term climate change in Finland.

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Abstract

As global temperatures rise, understanding adaptive mechanisms in ecological communities is crucial for predicting how species respond to climate change. This study explores the ecological relevance of the commonly used temperature niche measurement (mean temperature of a species' distribution). Using 30 years of high-resolution Lepidopteran monitoring data along Finland's latitudinal gradient, we investigate how communities are responding to the rapid climatic warming in the Arctic. We focus on the relationship between temperature niches, morphological traits (wing colouration and muscle mass) and variation in phenology. Our analysis, incorporating new Lepidoptera phylogenies, reveals latitude-dependent variations in thermal traits, with distinct relationships between wing colour and temperature niches across diurnal and nocturnal communities. Species with broader thermal tolerances exhibit more significant phenological shifts in response to warming. These findings underscore the importance of temperature niches as key indicators of community dynamics and offer insights into identifying species at risk to climate change.

The impacts of conversion of tropical forest to oil palm plantation on arthropod-entomopathogenic fungus interactions.

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Abstract

Anthropogenic habitat change is causing biodiversity loss and altering species interactions, with negative impacts on the world's ecosystems. However, the impacts on arthropod-entomopathogenic fungus interactions are not well-understood, despite their ubiquitous distribution and potential ecological importance. Here we investigate the impact of habitat change on this interaction in Borneo. The abundance of arthropods infected by entomopathogenic fungi was significantly higher in forested habitats (both logged and unlogged) than in oil palm plantation (64 vs 3 arthropods /m2). Interestingly, infected arthropods were found higher in the understory in oil palm than in other habitat types. This was potentially due to changes in the taxonomic composition of the infected arthropods, with infected ants (which are found consistently low in the understory) being absent from oil palm. Our results could help improve the efficacy of fungi as biological control agents and assist in predicting future synergistic effects of habitat change on this interaction.

Temporal origin of nestedness in plant-pollinator networks

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Abstract

Nestedness is a common property of mutualistic networks. In networks with high levels of nestedness, the link positions of low-degree nodes (those with few links) form nested subsets of the link positions of high-degree nodes (those with many links), leading to matrix representations with characteristic upper triangular or staircase patterns. Recent theoretical work has suggested that nestedness is a structural by-product of the skewed degree distributions often found in plant-pollinator interactions data. However, mechanisms for generating nestedness remain poorly understood. We show that a simple probabilistic model based on phenology – the timing of copresences among interaction partners – can produce nested structures and correctly predict around one-third of interactions in 22 plant–pollinator networks. Notably, the links most readily explained by frequent actor copresences appear to form a backbone of nested interactions, with the remaining interactions attributable to opportunistic interactions or preferences for particular interaction partners that are not routinely available.

Riverine dikes harbour diverse wild bee communities of conservation interest in the Netherlands

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Abstract

Linear landscape elements are valuable areas for pollinator conservation. In the Netherlands, dikes are one such element, with waterboards increasingly seeking evidence-based nature management advice. We collected wild bee surveys from 157 dike grasslands in the Netherlands to characterize their communities and study the relationship between wild bees and local flower species richness. Data revealed that dike grasslands harbor rich wild bee communities, with remarkable numbers of ground nesting bees and their kleptoparasites in spring. Wild bee abundance and species richness increased with increasing flower species richness and widespread species occurrence correlated strongly with the presence of their pollen resources. However, non-Bombus wild bees (the majority of bee diversity) showed saturating relationships with flower species richness, suggesting they quickly benefit from increases in flower species richness, but floral resource limitation is quickly alleviated. Together, these results highlight the unique potential of dike grasslands for wild bee conservation in the Netherlands.

Urbanization alters the relative importance of local and landscape factors affecting plant communities in the Tokyo megacity

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Abstract

Plant communities are impacted by local and landscape factors. While many studies have shown that the relative importance of these factors in understanding plant community dynamics due to urbanization, little is known about how they are altered by urbanization. This study evaluates the relative importance of local environmental (local factors), landscape, and spatial (landscape factors) variables that influence plant communities in 34 urban green spaces comprising two different habitats (forests and grasslands) along the urban–rural gradients in the Tokyo megacity, Japan. Our study found that the relative importance of both local and landscape factors decreased with urbanization, while that of local factor for native species in forest habitats and that of landscape factors for native species in grassland habitats increased. Collectively, these findings suggest that city size and habitat characteristics must be considered when predicting changes in plant communities caused by urbanization.

Colonization and extinction lags explain non-linear compositional shifts in high elevation plant communities exposed to experimental climate change

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Abstract

Shifts in plant species ranges and community composition are occurring much slower than the pace of climate change. To explain variation in the pace, and predictability of the trajectories, of plant community change, we assembled a dataset of 44 transplant experiments. In these experiments, whole plant communities were transplanted from a higher to a lower elevation site in mountains across the northern hemisphere, exposing them simultaneously to warmer climate and to colonization by lowland species. Transplanted communities increasingly resembled communities at the lower elevation transplant sites over time, driven mainly by novel species colonization and shifts in abundance of generalist species found at both low and high elevation sites. But non-linear trajectories of community change revealed both substantial lags and deviations from convergence towards the low elevation community composition that we expected based on "space-for-time" predictions. This implies that novel community compositions might persist for long periods as climates warm.

Spatial Patterns of Non-Native Vascular Plant Diversity in Norway

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Abstract

Non-native species form an expanding part of vascular plant communities. Increasingly, non-native plants spread from urban areas to inland in Norway and consequently impacting native communities, thereby influencing landscape-scale biodiversity patterns.

To understand how non-native species impact native communities and thus ecosystem resilience, we constructed a multi-locus phylogeny for 1105 Norwegian native and 1021 non-native species, compiled their functional traits, and integrated publicly available occurrence records. We then calculated the diversity metrics species richness, functional richness, and phylogenetic diversity, and examined environmental drivers of spatial biodiversity patterns.

Non-native species' contribution to all diversity metrics was positively affected by temperature, net primary productivity, precipitation and human activity. However, randomising spatial patterns suggests that their overall impact remains minimal. Despite anthropogenic influences, Norway's native floral communities remain largely intact, promising stable and resilient communities. Our study provides a roadmap for future research in other regions impacted by the spread of non-native plants.

Competitive plants favor less-competitive neighbors by root exudation

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Abstract

Root traits showed a fast-slowing spectrum similar to leaves so that competition are likely asymmetric. Yet, the competitive roots also release more carbon to increase soil nutrient availability and benefit its less-competitive neighbor. Thus, how plants adjust root traits and respond to their neighbor is less known. We grew seedlings of six tropical woody species in monoculture or in two-species mixture under green house condition for five months. The target species showed distinct root functional traits in monoculture. The competitive species turned to be conservative in mixture with a neighbor less-competitive than itself showing coarse diameter, lower SRA and less root nitrogen and root exudation. We also found that a species of more root exudation deposition had a positive effect on the growth of its neighbor. Our results showing that strong competitors attenuated competition pressure. This will bring new insights to rethink species coexistence at the whole plant level.

Beaver-engineered habitats link land-water ecosystems

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Abstract

Conservation action for freshwater biodiversity is needed due to losses in habitat area and quality. Ecosystem engineering by beavers could support restoration efforts and increase land-water ecosystem linkages. However, the effects of beavers on terrestrial biodiversity and communities at the land-water boundary are largely unknown. We hypothesise that beaver activities change biodiversity patterns in aquatic and terrestrial communities, increasing overall landscape diversity while providing resource hotspots for other organisms. Our results suggest context-dependent effects on different species communities and ecosystems. For instance, while fish and bat communities showed higher abundance and species richness in most beaver-engineered systems, arthropods showed a more complex response. These responses differentiate with human influence and are species-specific. The results of this study can provide evidence for future freshwater biodiversity conservation while deepening the understanding of how ecosystem engineers can shape biodiversity and ecosystem processes.

Weakened growth compensation explains amplified demographic disturbance effect under physical stress

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Abstract

A key challenge for ecologists is predicting how multiple stressors impact population stability. Physical constraints (e.g., drought, inundation) limit intrinsic growth rates, while disturbances (e.g., herbivory, fishing, poaching) remove individuals from populations. These combined effects influence population buffering capabilities and are critical for predicting stability under global change. We conducted an experiment on the annual succulent *Suaeda salsa* in the Yellow River Delta, manipulating initial seedling numbers along an elevation gradient to simulate varying herbivory and drought-induced soil salinity stress. Our results show that under low physical stress, biomass loss from demographic disturbances can be fully compensated by the increased growth of surviving individuals due to strong negative density dependent effect. However, under high physical stress, these compensatory mechanisms are weakened, leading to amplified effects of demographic disturbances. Thus, increased physical stress reduces population resilience by weakening negative density-dependent effects, intensifying the impact of demographic disturbances.

If you plant it, will they come? Beetle communities in secondary woodlands

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Abstract

Beetles play critical ecological roles in woodland systems, underpinning important ecosystem processes, including nutrient cycling, herbivory and predation. The colonisation and establishment of beetle communities in new woodlands potentially depend on complex interacting factors, including habitat preference and local and landscape characteristics. Given the renewed global attention on habitat restoration, we require further understanding of how and where to target woodland creation to maximise biodiversity gains. Building on a long-term and large-scale natural experiment (the WrEN project), we investigate the colonisation of 60 UK secondary woodlands across an age gradient of 10 -160 years. Using Structural Equation Modelling to determine the relative and combined effects of local and landscape characteristics on beetle abundance and diversity, we show that agricultural land impedes colonisation and establishment of beetles in planted woodlands. Our findings highlight the critical role of surrounding land use in the success of woodland creation projects.

Trait Plasticity vs. Species Turnover: Grazing Effects on Temperate Grasses in the Scottish Uplands

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Abstract

In Europe, low-intensity grazing is increasingly used to maintain natural grasslands, preserving rare species and enhancing wider biodiversity. While grazer type and intensity are known to influence grassland structure, the relative impact of species turnover versus intraspecific phenotypic plasticity in grasses is less understood. For instance, intense grazing often lowers inflorescence height, but it's unclear whether this is due to shifts to shorter species or trait shifting towards shorter heights within species. Here we investigated these dynamics in a 20-year grazing experiment in the Scottish Uplands, collecting trait and composition data from 18 plots with varying grazing intensities. We found grazing intensity influences these grass communities but structural changes are largely the results of existing species adapting their trait values to varying grazing rather than community shifts towards grazing-adapted species. This has implications for land managers who can diversify grazing levels in different areas to enhance landscape heterogeneity and biodiversity.

Plant diversity effects on grassland invertebrates vary over time

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Abstract

Despite the diversity and importance of invertebrates, no long-term studies have examined their response to plant diversity over time. We addressed this by quantifying grassland invertebrates, leaf damage, and predation across 80 plots with varying plant diversity over a 13-year period. Using these data, we explored whether (1) *temporal changes in invertebrate communities and associated functions depend on plant diversity*, (2) *plant diversity effects on invertebrates vary or even become stronger over time*, and (3) *changes in these relationships affect associated functions*. We observed annual declines in species richness, abundance, and biomass over time, more pronounced in early than late summer. Plant diversity consistently had a positive effect on consumer communities and their functions, though this effect fluctuated across years and seasons, weakening in early summer but strengthening in late summer. Overall, our study highlights the complex and dynamic interactions between plant diversity and invertebrate communities over time.

Land use shapes the migratory vs. sedentary equilibrium of avian breeding communities along an elevational gradient.

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Abstract

Land use is a major threat to avian communities, and particularly migratory species, representing >20% of world's species. Yet, its impact on how long-distance migrant and sedentary species assemble remains uncertain because pervasive interactions between land use and environmental conditions such as elevation have never been addressed simultaneously. We used a participatory science database from Southern France (5×5km squares) to examine the changes in migratory vs. sedentary equilibrium in avian breeding communities along interactive gradients of land use, elevation (surrogate of climate), and species richness. We found that increasing species richness significantly alter the migratory status, with mainly long-distance migrants adding to the community above ca 100 species. Elevation also systematically affected how migratory vs. sedentary equilibrium respond to land use: while negative effects of forest cover and habitat equitability, are intensified or reduces; negative impact of habitat diversity in hilly and mountain belts becomes positive in the subalpine.

Does grazing management modify plant biodiversity responses to drought in Eastern Mediterranean ecosystems?

Maud S Moes[1], Prof. Dr. Merav Seifan[2], Prof. Dr. Katja Tielbörger[1]

[1]University of Tübingen. [2]Ben-Gurion University of the Negev

Abstract

The Eastern Mediterranean, a global biodiversity hotspot, is facing reduced precipitation and more frequent extreme droughts, which are likely to impede biodiversity and disrupt the functioning of rangeland ecosystems. Mediterranean rangelands are considered resistant and resilient to drought and grazing, but with increasing drought and grazing pressure, this stability may collapse. In our study, we conducted a novel field experiment to test whether plant abundance and diversity under two grazing manipulations (early vs. late) exhibit a nonlinear response to gradually increasing drought (30% to 90% rainfall reduction in 10% intervals). We found that increasing drought led to a gradual reduction in plant abundance, richness, and diversity, with these effects being more pronounced under early grazing. This indicates that stability and productivity of these species-rich rangelands may be actively managed by adaptive timing of grazing.

Why is the early bird early? An evaluation of hypotheses for avian dawn-biased vocal activity

Dr. Vijay Ramesh[1,2,3], Pavithra Sundar[2], Meghana Srivathsa[2], Dr. Laurel Symes[1]

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Abstract

Bird species vary widely in their diurnal vocalization patterns and the drivers of this variation are not well understood. Using passive acoustic monitoring, we examined species-specific vocal activity patterns at dawn and dusk for a tropical bird community in the Western Ghats biodiversity hotspot in India. We tested whether environmental factors and social factors best explained diurnal variation in vocal activity. We found that species-specific vocal activity was significantly higher at dawn ($p < 0.05$) and that territoriality and diet both predicted stronger dawn-biased activity. Highly territorial birds ($p = 0.045$) and omnivores ($p = 0.054$) had higher levels of vocal activity at dawn. Our multi-taxon approach allowed us to assess the vocal activity patterns for an entire tropical bird community. Future research must combine visual and aural observations to better understand the drivers of diurnal variation in vocal activity.

An empirical test of Modern Coexistence Theory to forecast time-to-extinction under rising temperatures

Dr Chris Terry

University of Oxford

Abstract

Interspecific interactions are expected to be an important part of ecological responses to climate change but pose a considerable challenge to include into species forecasts. 'Modern' coexistence theory (MCT) predicts the outcome of competition between species pairs under specified conditions from parameterised models and is being increasingly applied to understand responses to climate change. However, MCT makes many simplifying assumptions and has rarely been directly tested. I will present results from multi-generational *Drosophila* mesocosms testing if MCT can accurately predict time-to-extirpation in the face of rising temperatures in the context of environmental stochasticity and competition from a heat-tolerant species. In these trials, the temperature coexistence was forecast to be lost at approximately aligned with the observed extirpation time, despite breaking many assumptions. Although predictive precision was low, MCT captured key processes and these results support the careful, scale-aware, use of coexistence theory for near-term forecasting.

Elevation and Interspecies Synchrony in Masting Patterns of Pacific Northwest Conifers

Eléonore D Perret

ETH

Abstract

Masting, the episodic and synchronous production of large seed crops, plays a crucial role in forests. In the Pacific Northwest, conifers experience fluctuating seed production, with prolific "mast years" followed by low output years. This has significant implications for forest regeneration, wildlife dynamics, and ecosystem management. Over 16 years, our research team, in collaboration with Mt. Rainier National Park, monitored seed production of 10 conifer species across 18 sites spanning a large elevation gradient. We used this data to characterize masting dynamics, assess interspecies synchrony, and explore the influence of elevation on masting patterns. Preliminary results show masting is prevalent, especially at low elevations, with co-masting across focal species common. Such masting could enhance seedling recruitment by satiating seed predators, increasing germination success. This research could inform forest management practices as forest regeneration becomes ever more important to maintaining healthy forests under anthropogenic pressure.

More strongly coexisting communities deliver higher ecosystem multifunctionality

Dr. Caroline Daniel[1], Dr. Oscar Godoy[2,3], Dr. Noémie Pichon[4], Mathis Gheno[1], Prof. Dr. Eric Allan[1,5]

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Abstract

High biodiversity levels promote higher ecosystem functioning. Mechanisms promoting species coexistence might themselves promote multiple functions, i.e., multifunctionality. However, few studies have experimentally tested whether communities that coexist more strongly (i.e., those that are able to tolerate higher levels of perturbation before one species goes extinct) also supply higher levels of multifunctionality. We used competition coefficients from a previous study to experimentally set up 48 communities predicted to differ in their overall strength of coexistence, as well as in their underlying mechanisms of niche differences and indirect interactions. We then sampled within these communities seven common ecosystem functions. We found that communities predicted to have greater coexistence strength attained higher levels of multifunctionality, even though niche differences and indirect interactions promoted multifunctionality independently. This is the first study to show an empirical link between coexistence conditions and ecosystem multifunctionality.

Nutrient stoichiometry shapes the biodiversity of Eurasian herbaceous communities

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Copernicus Institute of Sustainable Development, Utrecht University

Abstract

Nutrient enrichment is a major driver of biodiversity change and the anthropogenic release of nitrogen (N) has disrupted the balance between other nutrients (nutrient stoichiometry) essential for plant growth, such as phosphorus (P) and potassium (K). This disruption interacts with other global change drivers, yet a comprehensive understanding of these interactions in herbaceous ecosystems remains limited outside experimental contexts. Therefore, we use a newly extended dataset of ~4000 herbaceous communities across Eurasia to study the role of nutrient stoichiometry in these ecosystems. Our results show that the biomass N/P ratio modifies the biodiversity-productivity relationship, with the highest species diversity at balanced N/P ratios. N/P variability promotes species diversity at larger spatial scales. Lastly, we demonstrate that N/P modifies the relationship between traits and climate. These findings highlight the importance of considering nutrient stoichiometry when understanding and predicting the impacts of global change on biodiversity.

Population structure is key to community stability

Àlex Giménez-Romero[1,2], Christina M. Hernandez[2], Meritxell Genovart[3], Rob Salguero-Gómez[2]

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Abstract

The relationship between ecosystem complexity and stability remains unresolved. Classical theories often predict instability in large and diverse systems, but empirical observations provide contrary evidence. Recent work has shown that differences in the foraging capacity and predation risk of juveniles vs adults within populations result in larger, more complex communities than predicted by unstructured models. Here we approach the more general question of which is the role of population structure into community stability. We develop a general framework to integrate population structure into community stability analysis and show that stage-asymmetric interaction types are key to stability: while cross-stage predator-prey interactions provide stability, competition is destabilizing. Our results offer new insights into the stability-diversity paradox, emphasizing the critical role of population structure in ecological resilience, an often-times neglected feature of natural systems. We finally propose a road-map for future research, including applications to real communities and extensions to transient dynamics.

Spider community response to early-stage wood pasture establishment.

Mr Jamie D Brewster, Dr Anne Oxbrough, Dr Ashley Lyons

Edge Hill University

Abstract

Gathering evidence for the effectiveness of conservation efforts is crucial to wider support and adoption. This is particularly true in the case of wood pasture creation, a management option supported by countryside stewardship and gathering global attention but lacking in established guidance regarding implementation and design. Spiders are an excellent indicator taxon given dispersal ability and habitat sensitivity. This study uses pitfall trapping and structural measurements of vegetation to determine whether early-stage wood pasture establishment on agricultural land, driven by accompanying changes to grazing regime, influence taxonomic and functional diversity of epigeal spiders. It compares intensively sheep-grazed pasture with two treatments of wood pasture: grazing exclosures planted with tree and shrub species and inter-joining matrix grazed rotationally by English Longhorn cattle. The study looks at management blocks of varying establishment age (0.5-3.5 years). The poster will present preliminary results.

How do pollinators perceive floral abundance?

MS Han Yan[1], Professor Jane Memmott[1], Dr Ian P. Vaughan[2]

[1]University of Bristol. [2]Cardiff University

Abstract

Null models offer a baseline against which ecological hypotheses can be tested and foraging behaviour not accounted for by neutral processes or sampling biases can be identified. They have been used to test whether pollinators visit flowering plant species more or less frequently than expected based on flower abundance? Null models require estimates of flower availability and counting flowers is not straightforward given their highly variable structures. This project used *Heracleum sphondylium* as a model system to test how floral abundance data counted could affect the efficacy of null models. Plant-pollinator interaction data was collected from three field sites and *H. sphondylium* floral abundance was measured using three different methods: counting individual flowers, floral units, and umbels. Analysis shows that there were few changes in keystone status for *H. sphondylium* between the floral unit and umbel counting methods, however when individual flowers were counted, changes in keystone status was observed.

Detecting ecological anomalies on the Great Barrier Reef and beyond

Dr Timothy L Staples, Professor John M Pandolfi, Dr Sun W Kim

The University of Queensland

Abstract

Human impacts on ecosystems are more pervasive and intense than any past time, creating anomalous ecological systems. Traditional metrics to assess ecosystem condition, such as cover and diversity, can overlook profound changes in community composition. To address this, we adapted a density-based method to detect "anomalies" and applied it to long term time series data from the Great Barrier Reef. We found models of coral cover and diversity only explained 40% of variation in reef anomaly, and consistently underestimated anomaly in one-third of reefs. Our results provide further evidence many reef communities are deviating into anomalous states even when coral cover recovers from disturbance. The systematic, standardised comparisons of anomaly detection methods offer improvements to management and monitoring efficacy. In addition, these methods integrate into core ecological concepts, such as beta diversity, increasing their relevance to the rapid ecological and environmental change of the Anthropocene.

Increasing novelty in North Atlantic Ocean plankton communities

Emer T Cunningham, Dr Timothy Staples, Professor John Pandolfi

The University of Queensland

Abstract

Global change is pushing biodiversity towards "novel" ecological states. Across our world's oceans, we are witnessing and forecasting a change or loss of biodiversity and ecosystem function under rapid climate change, but we are yet to understand how patterns in taxonomic novelty may coincide with or predict understudied instances of functional and environmental novelty. Here, we characterise and investigate the emergence of taxonomic, functional, and environmental novelty through time using Continuous Plankton Recorder surveys from the North Atlantic Ocean between 1958 – 2019. We employ an innovative, standardised novelty detection framework to quantify novelty based on a plankton community's species composition, distribution of organismal traits, and environmental context. We uncovered that taxonomic novelty emerged most frequently, while environmental and functional novelty were commonly linked. Most notably, we observe a steep increase in North Atlantic novelty within just the past decade, drawing attention to a future likelihood of novelty emergence.

Plant – consumer interactions as cause and consequence of long-term BEF relationships

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Abstract

Plant-consumer interactions both drive and result from long-term biodiversity-ecosystem function (BEF) relationships, yet long-term studies on plant diversity's impact on arthropod communities are limited. This study examines how plant species loss affects consumer communities and functions in grassland ecosystems. Using long-term data and manipulations of plant community age, we found that plant diversity consistently benefits consumers at the community level, though effects vary by species. Plant traits significantly shape plant-consumer interactions, and history effects contribute to temporal variation rather than driving directional change. Consumer communities degraded over time, fluctuating across seasons and years, but the strength of plant diversity effects varied depending on calendar years, seasons, and plant community age. Our findings underscore the dynamic role of plant diversity in shaping plant-consumer relationships and emphasize the importance of maintaining high plant diversity to preserve multitrophic biodiversity.

Landscape-scale experiment shows that habitat loss effects outweigh those of fragmentation on ground-dwelling arthropods

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Abstract

Habitat loss and fragmentation are considered to be one of the main causes of terrestrial biodiversity decline worldwide. The effect of fragmentation at a given level of habitat amount is however debated, and experimental tests remain scarce. To discriminate the effects of both quantity and fragmentation *per se*, we designed a landscape-scale experiment in which a wide range of habitat amount (9 levels from 1% of habitat to 100%) is crossed with three levels of fragmentation (from clumped to fragmented). Here, we investigate the response of ground-dwelling arthropods to the experimental design over the first three years. The number of captures of all arthropods and some specific groups declined significantly with increasing habitat loss. The effects of habitat fragmentation were predominantly neutral with some significant impacts on the occurrence of certain taxa (e.g. wolf spiders, ground spiders, and *A. sericea*).

Conserving Pollinator Diversity at the Landscape Scale: The Role of National Parks - A Case Study of France's NP System

Mr George Allen[1], Prof Michael Garratt[1], Dr Deepa Senapathi[1], Dr Ben Woodcock[2], Dr Lucy Ridding[2], Dr Joann Sy[3]

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Abstract

National parks (NPs) are protected areas established and maintained to conserve species, habitats, and natural systems, including pollinating taxa. However, the ecological effects of NPs on pollinating insect populations and their potential role as sources of pollinator diversity remain poorly understood. Using the NP network in France as a model, I aim to quantify pollinator communities and networks in response to the presence of a national park within the broader landscape. By comparing pollinator diversity at local, landscape, and regional scales, I hope to understand how NPs contribute to the maintenance and resilience of these communities. Combining field observations from France's newest NP with citizen science records from all other parks in France, my research will explore how pollinator taxonomic, functional, and phylogenetic diversity responds to NPs across multiple spatial scales and help inform NP management and designation in the future to maximise their contribution to pollinator conservation.

Rooting for function: Trait-functioning relationships are common but the community-level root economic space is not

Dr. Kathryn E. Barry[1], Justus Hennecke[2,3], Prof. Dr. Alexandra Weigelt[2,3], Prof. Dr. Liesje Mommer[4]

[1]Utrecht University. [2]Leipzig University. [3]German Centre for Integrative Biodiversity Research. [4]Wageningen University and Research

Abstract

Humans are driving unprecedented biodiversity change. Yet, biodiversity supports many crucial ecosystem functions. At the local scale, changes in species composition may be the most common form of this biodiversity change. These changes in community composition change the relative proportion of functional traits represented in the community which may have comparable effects on ecosystem functioning to direct species loss. We examined the relationship between community-level root traits and nine belowground ecosystem functions and aboveground biomass. We found that links between community root traits and ecosystem functioning are more common than expected though they have low explanatory power. However, the community-level root trait distributions that we observe vary strongly across sites. These findings suggest that when biodiversity loss is characterized by changes in the relative abundance of species, we can expect for it to alter many ecosystem functions belowground.

Polycultures can better resist air and soil drought through complementary functional traits in a grassland experiment

Yuheng Chen, Prof. George Kowalchuk, Dr. Yann Hautier, Dr. Hugo de Boer, Dr. Kathryn E Barry

Utrecht University

Abstract

Extreme drought is threatening ecosystems worldwide. Biodiversity may provide ecosystems with some protection from extreme drought. Yet, observational and experimental studies disagree about how much and why biodiversity increases ecosystem resilience to drought. This difference may arise because drought simulation experiments (e.g. rain-out shelters) largely ignore ambient conditions (e.g. humidity). Here we use a mesocosm experiment in Ecotrons to manipulate both humidity and soil water content to disentangle the effects of air and soil drought on the functional traits of grassland plants in monoculture and polyculture. We found that species with different root trait niches can enhance the productivity of polycultures under both soil drought and air drought conditions. These findings suggest that under future drought scenarios biodiversity can enhance the resistance of communities to both above and belowground drought through complementary root trait combinations.

Soil legacy effects of plant diversity and functional diversity on performance.

Aline Sonderegger, Prof Eric Allan, Prof. Madhav Thakur, Dr. Gemma Rutten

Universität Bern

Abstract

Soil legacy effects can be important drivers of plant performance, however, it remains unclear how they are moderated by community diversity and functional composition. The growth-defense trade-off and dilution effects predict that fast-growing and low diversity communities accumulate most soil pathogens.
Here we tested legacy effects using soils from communities differing in diversity (one vs. six-species) and fast-slow functional composition (dominance by low or high specific leaf area plants), in the PaNDiv Experiment.
We found legacy effects were driven by an interaction between fast-slow and diversity history. Surprisingly, soil from fast monocultures increased subsequent plant performance and soil from slow monocultures reduced it, while SLA history had no effect on performance in soils with a mixture history. A sterilization treatment showed that these effects were mediated by microbes.
This indicates that changes in functional composition and species diversity cause soil legacy effects, which has implications for restoration and agricultural practices.

Environmental changes alters the interactions between plants and fungi across the Arctic realm.

Bastien Parisy[1], Niels M. Schmidt[2,3], Alyssa R. Cirtwill[1,4], Edith Villa-Galaviz[5], Mikko Tiusanen[6], Jukka Siren[7], Cornelya F.C. Klütsch[8], Paul E. Aspholm[8], Katrine Raundrup[9], Eero J. Vesterinen[10], Helena Wirta[1,11], Tomas Roslin[12,13]

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Abstract

Our understanding of the belowground world and on how climate change may impact interactions between plant and soil communities remains limited. Focusing on spatial variations in plant-fungus interactions across the Arctic, we quantified the effects of bioclimatic environment in plant–fungus networks by combining network analyses with general dissimilarity modelling and null models. Firstly, we found that plants and fungi changed their interaction partners more than what we would expect by chance, even when they are still co-occurring within different locations. Secondly, we found that pH and temperature strongly influence changes in plant-fungus network structure. Yet, which specific interactions are formed at a particular site remained poorly predictable. Altogether, our results indicates that an interaction between plants and fungi does not necessarily occur whenever two species that can interact meet. Rather, their interaction probabilities vary with the environment - ultimately suggesting that these networks may be strongly impacted by climate change.

Ecology and Biodiversity of the Coastal forests of Kenya: Role of Sacred forest fragments in biodiversity conservation

Dr Maria M Fungomeli[1,2], Dr Fabrizio Frascaroli[3], Professor Marcus Cianciaruso[4], Dr Piero Zannini[2], Professor Alessandro Chiarucci[2]

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Abstract

Kenya's coastal forests, which include sacred forests and forest reserves, are crucial biodiversity hotspots under threat from population growth and species loss. Research on these fragmented forests has been limited, for a biogeography conservation approach. This study investigates forest structure and species diversity across 25 fragments (18 sacred forests and 7 reserves) using 158 plots. A total of 600 taxa across 343 genera and 80 families were recorded. Findings reveal significant differences in forest structure and species diversity between sites and within protection status, with sacred forests showing characteristics of old-growth forests and higher phylogenetic diversity. Endemic species also exhibited increased phylogenetic diversity as their conservation status worsened from least concern to endangered level. Multiplicative beta partitioning revealed higher beta diversity across fragments than within plots and subplots. The study underscores the importance of incorporating sacred forests into conservation strategies, emphasizing their role in maintaining biodiversity at broader biogeographical scales.

Defining, identifying and understanding the value of Ancient Grasslands in Britain.

Miss Katherine A Judson, Professor Paul A Ashton, Dr Ashley Lyons

Edge Hill University

Abstract

Ancient grasslands, defined as grasslands with a long continuity of management, are considered to hold great conservation value. This is a product of such habitats having had time to accumulate a rich assemblage of locally adapted taxa of high genetic diversity. Despite their value, ancient grasslands lack a formal definition nor are they afforded statutory protection.

In this study we aim to provide a definition of an ancient grassland utilising time as the key criteria alongside biodiversity and distinctiveness when compared to non-ancient grasslands. This will initially be achieved via literature review, reference to archive maps and the formulation of an ancient grassland indicator species and attribute list of various taxa to facilitate field testing of these criteria.

Subsequent work will assess potential additional characteristics of ancient grasslands. These include botanical genetic diversity, edaphic factors and microbial and invertebrate communities.

Urbanization increases heterogeneity of wild plant communities in urban gardens

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[1]Technical University of Munich. [2]Berlin Museum of Natural History

Abstract

Urbanization's influence on beta diversity is not yet fully understood. It remains debated whether urbanization drives homogenization or diversification in ecological communities. Here, we use four years of data on plant communities in urban community gardens across two cities, Berlin and Munich, to assess the degree to which urbanization influences biotic homogenization – both across urbanization gradients, and between cities. We find that urbanization is associated with increases in beta diversity, and that this effect is particularly strong for wild plant taxa, whereas there is a null effect for cultivated taxa. Additionally, we find the plant communities between the two cities to be significantly different – in both urban and more rural gardens. Again, this effect is strong for wild taxa, but weak for cultivated taxa. Our results demonstrate that urban plant communities can be highly diverse and unique from one another, both within and across cities, especially among wild plant taxa.

Where can we find strong Early Warning Signals in food webs?

Mr Thomas Malpas[1], Professor Lorraine Maltby[1], Professor Andrew Beckerman[1], Dr Claudia Rivetti[2], Professor Dylan Z Childs[1]

[1]University of Sheffield. [2]Unilever

Abstract

Early warning signals (EWS) have been developed to predict tipping points using the emergent behaviour of species timeseries approaching them, such as increasing autocorrelation. In food webs, where many species interact, the strength of EWS is variable between species.

Previous efforts to identify species which display strong EWS require monitoring all species, which from a practical perspective is almost impossible. This study models tipping points in food webs subjected to stress, produced by a reduction of producer growth rate, to identify the network properties generally associated with species that produce stronger EWS. We find that species with strong warning signals have high interaction strengths, associated with lower trophic levels and specialist interactions. This suggests that when monitoring food webs for tipping points, focusing monitoring efforts on these species gives the best chance of receiving warning of upcoming tipping points.

Shrub encroachment reduces herbaceous diversity via enhancing light competition across China's main grasslands

Yao Xiao

Lanzhou University. University of Bern

Abstract

Grasslands are critical ecosystems but are threatened by shrub encroachment, due to human activities. However, the mechanisms by which shrub encroachment affects herbaceous diversity across climate and soil fertility gradients, remain unclear. Here, we surveyed 101 grasslands with shrub encroachment, spanning 4,000 kilometers across China, covering annual temperature and precipitation gradients of -4℃ to 10℃ and 109mm to 1007mm, respectively. We found that light competition between the herbaceous species was greater in wetter, more fertile regions and further enhanced by shrub encroachment. Shrub encroachment generally favored fast-growing herbaceous species and excluded slow-growing ones, leading to a loss of diversity. Shrub encroachment also caused individual species to grow taller and thinner. Thus, shrub encroachment can amplify diversity loss driven by light competition under increasing precipitation and eutrophication. Our findings suggest that the common practice of shrub planting for grassland restoration may reduce natural grassland diversity.

Fly, stop, listen, move: Robotic acoustic sensors can deliver cost-effective, scalable, and reliable species monitoring.

Ms Peggy A Bevan, Dr Sarab S Sethi

Imperial College London

Abstract

In terrestrial remote sensing surveys such as Passive Acoustic Monitoring (PAM), deployment and retrieval of sensors is a labour-intensive aspect of field work. Here, we explore the potential of autonomous Unmanned Aerial Vehicles (UAVs, drones) equipped with acoustic recorders to conduct PAM surveys. Using a large, labelled acoustic dataset (26411 hours, 289 sites) from Costa Rica, we simulated UAV-based surveys with varying sampling strategies (random, systematic, or adaptive). We investigated whether known avian community diversity and spider monkey occupancy were detectable across a gradient of forest cover with UAV surveys, compared to a conventional survey design. We found that habitat-use patterns could be detected by a single UAV. However, a systematic, multi-sensor sampling protocol was essential for gathering statistically robust data for inferring species diversity or occupancy. Our findings envision a future where robotic sensors can perform automated biodiversity surveys, providing ecosystem assessments and precise detection of species' occupancy.

Heat stress response of two dung beetle species with different elevational range

Ms Nadia Noureen, Dr Rosa Menendez, Dr Mike Roberts

Lancaster University, UK

Abstract

Climate change is forcing species to experience heat stress, resulting in ecological shifts. In this study we investigated how two dung beetle species with varying altitudinal distribution, an upland cold-adapted species and a lowland warm-tolerant species, respond to heat stress. The effect of heat on species survival and body weight was assessed by rearing larvae of both species in three temperature treatments, low, medium and high corresponding with those experienced in the field at different elevations. Results indicated that the lowland species survived better than the upland species in all temperatures. Surprisingly, survival and body size of the upland cold-adapted species increased with temperature while no significant differences were observed for the other species. The study showed that survival of upland cold-adapted species was low as hypothesised, but the increase in survival and body size at high temperature is contrary to expected ecological trends and needs further investigation.

Morphological traits predict habitat selection and climate responses in UK Butterfly (Lepidoptera) communities.

Aisling M G Wort, Robert Fitt, Sarah Dalrymple

Liverpool John Moores University

Abstract

Predicting how species will respond to climate change is difficult. Species traits, such as melanism or size which are linked to species performance under different climates may offer a mechanistic framework by which insights into interspecific variation in climate change responses can be predicted.

By comparing how butterfly populations in three distinct habitats – grassland, woodland and scrubland, have responded to short term weather differences between 2023 and 2024; and by comparing melanism and size traits between species we aim to highlight the role of psychological traits in species filtering.

Butterfly communities varied both between years and habitat types. Moreover, species were filtered across habitat and year by both melanism but not size. With more melanistic species typical in shadier habitats, but size was not significantly associated with habitat choice.

Here we show that species traits can predict how species utilise both different habitat and responses to short term weather events.

Factors influencing cavity occurrences in the tropical forests of the Western Ghats, India

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Abstract

Tree cavities are critical habitat resource and keystone structures for cavity-dependent fauna. The factors influencing tree microhabitats and tree cavity formation were documented in the evergreen and moist deciduous forest stands. The diversity and occurrences of tree microhabitats was higher in the evergreen habitat. In evergreen, occurrences of injuries (16.64±6.31 per ha), epiphytes (20.48±12.02 per ha) and growth forms (20.65±3.96 per ha) was high and associated with cavities (6.58±2.79 per ha). In deciduous, occurrences of fungi (2.75±1.59 per ha) and crown deadwood (6.58±2.79 per ha) was high and associated with the cavities (4.2±1.51 per ha). Species richness and density of host trees increased tree microhabitat diversity and abundance. However, tree cavity occurrence is a factor of presence and abundance of other tree microhabitats such as injuries, snags, crown deadwood, fungi; cavities have strong association with these microhabitats irrespective of the type of habitat.

Patterns in the composition and diversity of forbs, grasses and sedges in montane grassland palustrine wetlands

Dr Peter Chatanga

National University of Lesotho

Abstract

Wetlands in the Southern African Grassland Biome harbour high floristic diversity, often dominated by forbs, grasses and sedges. Nevertheless, little is known about the composition, diversity and distribution of these growth forms. This study assessed patterns in the composition and diversity of forbs, grasses and sedges in the montane grassland wetlands in Lesotho and the associated environmental factors. Data on plant species abundance and environmental factors from three existing datasets were analysed through descriptive statistics, ANOVA and ordination. The study recorded 329 species, comprising forbs (62.61%), grasses (20.36%) and sedges (17.02%). Forbs had the highest species richness, Shannon-Wiener diversity and evenness per plot, while sedges were the lowest. A scatter plot separated the species into three groups: forbs; forbs and sedges; and forbs, grasses and sedges. Environmental factors influenced the composition, diversity and distribution of forbs, grasses and sedges. The study demonstrated the dominance of forbs in the wetland vegetation.

Visible and near-infrared reflectance of butterfly communities in mountain regions of Central Spain changes with temperature

Calista Kou[1], Dr Robert J Wilson[2], Dr Alex Pigot[1], Dr Joseph Williamson[1]

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Abstract

Ectotherm body temperatures are tightly linked to the amount of solar radiation individuals reflect, making colouration is a key functional trait mediating species responses to warming climates. We investigated how visible and near-infrared reflectance of butterfly communities changes with temperature through space and time by combining long-term butterfly abundance data from mountain regions of Central Spain with species-specific butterfly reflectance data. We found that reflectance decreases with rising temperatures, but that near-infrared and visible light differ in the magnitude of their response due to other environmental pressures. Specifically, species with higher near-infrared to visible reflectance ratios were more abundant later in the year, suggesting a trade-off in the ability of species to maintain low body temperatures while protecting themselves from elevated UV radiation. Our findings highlight the importance of near-infrared reflectance in thermoregulation and how reflectance can mediate species responses to rising temperatures.

Global change threatens C4 plants as nutrient addition and shifting atmospheric conditions undermine climate advantages

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Abstract

The C_4 photosynthetic pathway is advantageous under high temperatures and light, and low nutrients, moisture, and CO_2. While climate is a primary driver of C4 versus C_3 dominance, its interaction with other global change factors remains unclear. Using a global dataset from 99 sites across six continents and 47 long-term nutrient addition and grazing exclusion experiments, we show that C_4 plant distribution is strongly related to climate variables, especially the crossover threshold (average maximum temperature of >26°C and 35 mm precipitation). However, nutrient addition significantly reduced C_4 species, while grazing exclusion had no consistent effect. These results suggest nutrient addition and rising atmospheric CO_2 levels may disadvantage C_4 plants despite higher temperatures. These findings are important for predicting vegetation responses to global change, with implications for terrestrial carbon cycling, productivity, herbivory, and food security.

Pollinator response to forest disturbances

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Abstract

Natural disturbances are important drivers of forest dynamics. Large-scale windthrows create novel habitats, which can be beneficial to taxa associated with open canopies, such as pollinators. However, the specific spatial and temporal response of different pollinator taxa to windthrows remains unclear. Three years after a major storm event in the Alps, we sampled several pollinator groups in 35 wind-affected sites varying in local and landscape characteristics. Five years after the storm, we resampled the pollinator communities on a subset of sites to measure their temporal dynamics. We found positive effects of recent windthrows on the diversity of pollinators, but we observed high temporal changes across pollinator communities. The observed diversity and temporal dynamics were not related to any local and landscape characteristics. Windthrows may represent hotspots for the opportunistic exploitation of released resources as the disturbed habitats evolve in the ecological succession.

Afromontane ant communities are responding to climate change

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Abstract

Montane ecosystems are among the most sensitive to climate change. Long-term studies are essential for understanding how functionally critical groups such as insects are being impacted. We investigated community-level changes in Afromontane ant communities over time using the Community Temperature Index (CTI). This index quantifies the temperature tolerance of a community by taking an average of the temperature tolerances of the individual species comprising that community. High CTI values indicate that there more warm-adapted species in a community. We sampled ant communities annually for 18 years on an elevation gradient in the Maloti-Drakensberg Mountains in southern Africa. We found a significant increase in the CTI of the ant communities at the lower end of the gradient over time, where we also recorded a significant increase in temperature. These changes were driven by a loss of cold-adapted species from these communities over time.

Urbanisation favours ground beetle (Coleoptera: Carabidae) species that prefer dry soils and have reduced dispersal capacity: a case study for multi-city sampling.

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Abstract

Species with traits that allow them to overcome challenges associated with urbanisation are expected to be more common in urban areas. General patterns of carabid traits have been identified, however there is a lack of replicated research drawing direct comparisons between geographically close cities that could be expected to show similar trends in traits. We investigated how five traits of carabids vary across an urban-rural gradient in two nearby cities: Liverpool and Manchester, UK. Variation in the community-weighted mean values of traits were analysed along a gradient of % impervious surface cover for the two cities independently and combined. We found that urbanisation favours species that prefer dry soils and have short wings. Had we only sampled either of the two cities, we would have come to different conclusions regarding how some traits respond to urbanisation. We highlight the importance of multi-city sampling and how urbanisation restructures biotic communities.

Temporal changes of aquatic assemblages of keystone shredders due to anthropogenic land use and land cover modifications

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Abstract

Anthropogenic perturbations are changing species composition and abundance of many natural communities. Understanding the causes of assemblage alterations is thus crucial for understanding the impacts of human stressors. Here, we conducted long-term monitoring of assemblages of keystone shredders, freshwater amphipods, in twelve tributary streams of Lake Constance. Over twelve years, we extensively surveyed multiple sites along the course of each stream. We assessed temporal beta diversity of amphipod assemblages through time defined as either the loss or the gain of a species or abundance per species. We then compared these assemblage changes across streams experiencing varying levels of agricultural land use. We found a greater variation in assemblage structure through time in stream catchments dominated by agricultural land cover compared to forested land cover. Our study demonstrates that anthropogenic land use and land cover can destabilise the assemblages of keystone species, with potential consequences on ecosystem functioning.

The role of farm woodlands in supporting wild bee communities

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Abstract

Bumblebees are key crop pollinators, for which woodlands are thought to provide forage and nesting opportunities. However, evidence showing the extent of this provision is scarce, and woodland sampling is rare in Europe. As such, we have a limited understanding of how farm woodlands might support these wild bee communities. Across Norfolk farms, we sampled field margins, woodland canopies and woodland understories, investigating patterns between these habitats according to bumblebee species and caste. We found that some species were consistently more understory-associated than others, and that the reproductive castes were proportionally more abundant in this woodland habitat. Our findings suggest that creating more woodlands within farmed landscapes could help support bumblebee reproduction and community diversity, thereby increasing and stabilizing crop pollination services.

Multi-tool monitoring: Comparing and combining non-invasive methods to monitor terrestrial rewilding

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Abstract

Rewilding, the facilitation of self-sustaining and resilient ecosystems by restoring natural processes, is an increasingly popular conservation approach. However, outcomes of rewilding can be unpredictable and empirical evidence is lacking. Effective, non-invasive and future-proof monitoring is therefore essential to assess impacts. Our recent review of utilising environmental DNA (eDNA) to monitor terrestrial rewilding suggests that combining eDNA with other non-invasive methods provides the most comprehensive biodiversity assessments. We used this approach to assess vertebrate taxa across a rewilding site in Scotland, collecting four types of eDNA samples (water, soil, tree rolling and scat), alongside acoustic and camera monitoring. Acoustics detected the highest diversity, followed by tree rolling and water sampling. Community composition was similar across methods except acoustics, which primarily detected aerial species. These findings demonstrate the necessity of a multi-method 'toolkit' for rewilding monitoring, emphasising that a diverse array of methods is necessary to comprehensively detect all vertebrate taxa.

The impacts of glacier retreat on ecosystem services in mountain regions worldwide

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Abstract

Glacier retreat is accelerating in high mountain areas due to rising temperatures and the sensitivity of these ecosystems to climate change. While most research has focused on changes in plant species richness and soil succession with glacier retreat, the effects on ecosystem service provision remains underexplored.This study systematically reviews the response of ecosystem services provided by plant communities and soil to glacier retreat, using a chronosequence approach to predict changes in ecosystem services. Our findings reveal that glacier retreat alters plant–soil dynamics and their role at supplying ecosystem services. Glacier retreat reduces soil capacity to capture atmospheric nitrogen and carbon dioxide, but enhances biohazard reduction and nutrient storage. Glacier retreat increases plant productivity and biomass accumulation, though it has mixed effects on genetic resources. These changes highlight the important role glaciers play in mediating ecosystem services in sensitive mountain regions, beyond just the presence of ice.

Does the activity of primary consumers (Lepidopteran larvae) vary within three-dimensional oak (*Quercus robur*) canopies?

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Abstract

Traditional methods for studying primary consumer abundance and phenology in woodlands simplify the complex three-dimensional structure of tree canopies into two-dimensions by sampling beneath them (e.g. water trays, frass traps, or branch beating). To explore vertical variation in larval activity, we used a mobile elevated work platform to sample 34 mature oak tree canopies (*Quercus robur*) in Wytham Woods, Oxfordshire. We sampled repeatedly in two years, quantifying larval density, species diversity, and herbivory on branches in the lower, middle, and upper portions of the canopies (ranging from 1-20m above ground). Our results reveal variation in larval activity between canopy levels across the two years, suggesting vertical stratification of primary consumer communities can be important in some circumstances. This has implications for how we understand and quantify phenological (mis)matches with local leaf emergence, predation risk, passerine bird foraging behaviour, and the influence of environmental conditions on differently exposed canopy areas.

Traits or landmarks to account and acess intraspecific trait variation?

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Abstract

The Intraspecific Trait Variation (ITV) is known to play a fundamental role in maintaining biodiversity and in the assembly process of ecological units. This is because the variation of traits within a species expresses a whole range of possible characteristics within a genotype that experiences different environmental conditions. However, as with all levels of biodiversity, environmental filtering induced by human activities can impact ITV through adaptation and abiotic constraints, making this topic an important research target. In view of this, the objective of this research were test which morphometry methodology, linear or geometric, is preferable for accessing ITV information. To this end, were used populations of two fishes species from Amazon Rainforest streams, *Moenkhausia oligolepsi* (Characins) and *Helogenes marmoratus* (Catfishes), in different situations of sample sizes and types of measures.

Investigating community perceptions of human – Andean bear coexistence in the Bolivian Andes.

Miss Kacie Henson

University of Kent

Abstract

Human-wildlife conflict presents a significant threat to species globally. Many factors impact the perception of a species, which ultimately governs tolerance levels and interactions. Andean bear populations are declining, partly attributed to the retaliatory killings by people coexisting with the species. Here, I investigate the perceptions of coexistence with the Andean bear by conducting semi-structured interviews with community members across Tunari National Park. The results suggest that the exceedingly negative perception of the Andean bear is associated with feelings of fear and aversion. The primary reason for these feelings is the *perceived* predation of cows. However, underlying social and political themes emerged, including the role of cultural beliefs, resentment of urban elites, and the park's designation as a protected area. Solutions must be holistic and adhere to the multifaceted influencing factors. This research provides merit to the assertion that human-wildlife conflict resolution is more complex than merely compensating for losses.

Urbanization simplifies and decouples aquatic and terrestrial food webs

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Abstract

In cities, aquatic and terrestrial communities may coexist within close proximity (e.g., a garden containing a pond), creating assemblages of interacting species. While, in natural habitats, these interactions can lead to complex, coupled aquatic and terrestrial food webs, the impact of urbanization on food web dynamics is not well understood. Using environmental DNA metabarcoding and a metaweb approach, we examined food web structure and composition at 54 paired aquatic-terrestrial sites in the city of Zurich, Switzerland, across an urbanization gradient. Urbanization was associated with simpler, less connected, and more modular food webs, in which species increasingly depended on distinct aquatic or terrestrial resources. Conversely, habitat quantity and connectivity positively correlated with species diversity (meso- and top- predators in particular) and overall food web complexity. Our findings reveal that while urbanization can simply and segregate aquatic and terrestrial food webs, careful urban habitat planning can enhance biodiversity and food web complexity.

Urban grassland plant communities assemble according to their productivity and disturbance

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Abstract

Urban grasslands hold underexplored biodiversity potential. To foster grassland biodiversity, we need to understand how plant communities assemble as a function of local and landscape scale factors.

Urban grasslands form mosaics of various open habitats, but their relative contribution to biodiversity is poorly understood. We studied the variation of plant communities in 200 urban grasslands spanning a variety of grassland types, productivity and landscape contexts in the Helsinki region, Finland. The grasslands also included sites created by deliberate biodiversity actions: reducing management intensity in lawns and sowing grassland seed mixtures.

The plant communities varied across two main gradients: productivity and disturbance. Semi-natural grasslands with highest species richness were associated with non-extreme productivity and long-term intermediate disturbance. Most other grasslands, including biodiversity interventions, were characterized by more disturbed generalist communities. Our results underline the importance of long-term grassland management, tackling eutrophication and possibly using assisted dispersal to reach more biodiverse grasslands.

Partitioning the arthropod Armageddon: survival of the heaviest

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Abstract

Global biodiversity loss threatens multiple ecosystem functions. Yet, it remains unclear whether widespread declines of arthropod functioning – often studied through their biomass – are caused primarily by species loss per se, or by the identity of lost species.

Using the ecological Price equation, we investigated how changes in arthropod biomass over 10 years across grasslands of varying diversity and land use intensity are linked to species richness, identity and abundance.

We show that arthropod biomass declines are strongly driven by species richness and abundance losses. However, species identity, particularly under high grassland diversity and low management intensity, causes counteracting effects, as shares of heavyweight species increase over time.

We conclude that species identity and abundance complete the picture of BEF relationships. While lightweight arthropod species diminish, few heavyweight species take over, reducing the communities' functional complexity. Communities under low grassland diversity and high land use intensity show limited adaptation capacities.

ZmILI1 confers salt stress tolerance by regulating genes of phytohormone response in maize

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Abstract

Salt stress is a major abiotic stress that has severe adverse effects on the growth, development, yield and quality of crop plants.Molecular regulatory mechanisms underlying salt stress response in maize are still elusive.Understanding salt stress tolerance mechanisms is essential for the development of high-yielding maize cultivars with improved salt tolerance. Here, we identified a gene, *INCREASED LEAF INCLINATION1* (*ZmILI1*), encoding a bHLH transcription factor, which positively regulates maize response to salt stress.*ZmILI1* is directly or indirectly implicated in maize response to salt stress by regulating the expression of genes involved in jasmonic acid (JA) biosynthesis, such as ZmLOX6, leading to elevated levels of JA hormone in maize under salt-stressed conditions.Our findings not only provide genetic evidence for the role of the bHLH protein family in agricultural production but also reveal potential regulatory mechanisms for the development of salt-tolerant genetic resources, offering new insights into the breeding of salt-tolerant maize varieties.

Responses of understory and terrestrial birds to seasonal flooding in the Peruvian Amazon

Nick Gardner

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Abstract

In Amazonian seasonally flooded forests, faunal community structure is influenced by local topography, with raised 'restinga' patches potentially serving as island refugia. This study tested whether terrestrial birds shift to unflooded areas as waters rise, while understory antbirds' occupancy remains stable. Passive acoustic monitors at 27 sites along the Rio Tahuayo in Peru recorded for the two-month dry-to-flood transition periods of 2023 and 2024. BirdNET was used to detect vocalisations of four terrestrial and five understory bird species. Flooding was low in both years, leaving many previously flooded sites dry. Terrestrial birds differed in their site occupancy: Great Tinamous were primarily detected in sites which normally flood, while other species showed less variation in detection rates between sites. Within understory antbirds, White-shouldered Antbird moved away from low-lying areas with rising water levels while other species remained. Understanding these patterns is crucial for identifying species vulnerable to changes in rainfall patterns.

Trophic interactions in highly diverse fish communities of Amazonian streams

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Abstract

Low-order streams contribute to a great part of the fluvial extension of the Amazon River basin and harbor a high fish diversity, which is not evenly distributed across the landscape. However, little is known about how fish species partition food resources in these diverse systems. Using carbon and nitrogen stable isotopes, we assessed the trophic structure of six Amazonian streams with local fish richness varying from 11 to 21 species. We found greater niche overlap in streams with higher species richness. No herbivorous species were found, and most species were invertivorous. Benthic macroinvertebrates, terrestrial invertebrates, and shrimps were the most assimilated resources. Additionally, macrophytes from two streams displayed unusually depleted carbon isotopic values (around -43‰), which do not seem to be assimilated by fish. These findings highlight the complex trophic interactions in Amazonian streams and offer promising insights into our understanding of the mechanisms driving diversity patterns in the Tropics.

Grime's Competitor-Stress tolerator-Ruderal ecological strategies reveal contrasting patterns in alkaline and loess grasslands

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Abstract

By studying the biomass of loess and alkaline grasslands along a water and salinity gradient, we aimed to analyse species diversity and Grime's (CSR) functional strategy patterns. We aimed to test the following hypotheses: i) The biomass and species richness scores and the species composition are significantly different between the sampled grassland community types. ii) The sampled communities are well separated based on the CSR strategy spectrum. We found the highest species richness, evenness and Shannon diversity in loess grasslands. The communities were well separated in species composition but surprisingly, not that well based on coordinates for CSR strategy types. The sampled communities characterised by a high level of stress were markedly differed in the magnitude of competition and ruderality. These results suggest in highly stressed communities the community composition is strongly dependent on the differences in disturbance intensity and also strongly influenced by the competitive ability of constituting species.

Pathogen sharing in plant species: The role of plant traits

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Abstract

The extent to which biodiversity reduces pathogen infection is the subject of ongoing debate. Biodiversity can reduce infection by pathogens such as foliar fungi through dilution effects, however, widespread spillovers between plant species can result in the opposite pattern. Therefore, understanding the extent of dilution effects or spillovers between different plants, and whether they can be predicted by traits, is key. To assess pathogen sharing between plants, we used a novel phyllopshere feedback approach. We inoculated 18 grassland species with infected leaves from conspecifics and a range of heterospecifcs, collected from a biodiversity experiment. We found that inoculation increased overall infection rates and plants received more infections from conspecifics than heterospecifics. Additionally, resource economics traits impacted pathogen transmission, suggesting these traits are key predictors of spillovers. We found evidence for dilution effects and spillovers and our results advance the debate over biodiversity effects by predicting when spillovers are most important.

Global change alters herbivore damage by altering growth strategies in grassland plant species

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Abstract

Plant-consumer interactions are expected to shift significantly under global change. To understand the ecological processes driving these shifts, we conducted an experiment focusing on warming, drought, and fungal diseases and their effects on herbivory, particularly emphasising within-species patterns. By manipulating plants, but not herbivores, we isolated plant-mediated effects from direct effects on consumption.

We planted 1'440 individuals from 18 grassland species in a meadow, and simulated various warming levels by transplanting plants from different higher altitudes. We also applied drought and fungicide treatments in a factorial design. We continuously measured plant pace-of-life traits as well as severity of foliar disease and herbivory.

Results showed that warming and the removal of fungal pathogens accelerated plant pace-of-life ($p<0.001$, $p<0.01$), while drought slowed it ($p<0.0001$). Plant pace-of-life was positively linked to herbivore damage ($p<0.0001$). Our results show that plant-consumer interactions can shift via plant-mediated responses to climate change and fungal disease.

Terrestrial eDNA effectively captures both rare species and compositional variation in grassland plant communities

dr Jan Plue

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Abstract

Vascular plants are disproportionately represented among threatened species due to habitat loss, climate change, and eutrophication. Managing this crisis requires high-resolution spatial and longitudinal data, which are often lacking for vascular plants. Environmental DNA (eDNA) offers a promising way to rapidly assess plant biodiversity, possibly providing essential data on plant communities over time. However, further research needs to test if eDNA can be a reliable stand-alone tool. In a study of Swedish grassland communities, we investigated if soil-based eDNA could detect both the rare species *Gentianella campestris* as well as changes in plant community diversity and composition. The study found eDNA to be effective in finding G. campestris, uncovering it in the majority of sampled grasslands. While eDNA did not capture the entire visually-observed plant community, it successfully reflected changes in diversity and composition, showing its power and potential for implementation within conservation, restoration and monitoring efforts.

Comparison of Avian Species Community Assembly in Urban and Coastal Areas around Port Harcourt, Nigeria

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Abstract

Urbanization has negative effect on species diversity. This study investigates the assembly of avian species in contrasting coastal and urban habitats. Abundance, diversity indices (*H*) and soil quality was studied. The result shows that coastal area has higher *H* (2.30) and *J* (0.89) compared to urban area *H* (1.75) and *J=0.59*. A total of 559 birds were counted, with higher birds in urban (*N=400*) than in coastal (*N*=159) area. The Spur-winged lapwing (*Vanellus spinosus*) was the most abundant species in the coastal area (Relative abundance= 20.75), while the Intermediate egret (*Egretta intermedia*) dominated the urban area (Relative abundance = 55.77). The Ardeidae family was the most abundant in both areas. Soil analysis revealed variations in physiochemical properties, with higher Zinc concentrations observed in coastal area (8.61 mg/kg) compared to the urban (6.55 mg/kg) area. These findings emphasize the importance of habitat-specific factors in shaping avian community.

Effects of heat waves on marine communities in shallow coastal seas

Dr. Oscar Franken

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Abstract

Increases in frequency and intensity of heat waves are affecting life in shallow seas. Especially locations that are dry during low tide are exposed to extreme temperatures. Animals living in more shallow locations could therefore have a higher risk of dying compared to deeper locations along an inundation gradient. I use existing datasets on benthic species in the Dutch Wadden Sea to see if these benthic species have been affected by heat waves. These analyses are complemented with experiments where we test if the observed changes can be explained by the thermal tolerance of species, and with field measurements on realized temperatures in the sediment. This research therefore quantifies the risk shallow seas face during heat waves, which is important to anticipate on effects of future heat waves.

Functional composition changes in protected areas across elevation

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Abstract

To counter biodiversity and area decline in natural and semi-natural habitats, Switzerland designated around 7000 protected sites of national importance, comprising raised bogs and fens, floodplains, and dry grasslands. Since 2011, changes in the presence and frequency of plant species have been recorded on 10 m2 plots as part of the programme “Monitoring the effectiveness of habitat protection in Switzerland”. In dry grasslands, the early results show a trend towards less nitrophilous plant compositions and an increase in the proportion of habitat specialists. While these changes could be due to lower nutrient inputs and to conservation policy, the results also show a shift towards more thermophilous species compositions, pointing towards the increasing importance of global change across elevation. In addition, the vegetation in raised bogs and fens shifted towards more drought-adapted compositions. These results underline the scientific and applied importance of monitoring programmes and of protected sites for habitat conservation.

Mammal species richness inside and outside Protected Areas in intensively farmed Cerrado landscapes, a Brazilian biodiversity hotspot

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Abstract

Protected areas are essential for conserving biodiversity, particularly in human-modified landscapes dominated by intensive agriculture. These areas interact closely with their surroundings, but the proportion of species richness maintained in surrounding landscapes remains unclear. We investigated the richness of mammal species inside and outside protected areas in intensively managed landscapes of the Brazilian Cerrado, a Biodiversity Hotspot. Our results show a strong interaction between distance from the edge of the protected area and habitat cover: in landscapes with <30% native vegetation, species richness increases from the surrounding to the reserve, as expected; at around 50% native vegetation, richness is similar between the reserve and the surrounding, while in landscapes with >50% native vegetation, the richness in the surrounding is greater than that of the reserve interior. These results highlight the importance of well-managed landscapes surrounding protected areas in supporting or even enhancing regional biodiversity.

Influence of upwelling on the structure of reef fishes assemblages on a marginal reef

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Abstract

Fishes are important components of reef as they play several roles to maintain reef functioning. Understanding what factors drive their distribution is critical to promote effective conservation strategies. We evaluated the effect of local upwelling on the structure of fish assemblages in a Southwestern Atlantic area with two region separated by few kilometres: one directly influenced by a coastal upwelling and one protected from the upwelling. Non-upwelling sites presented significantly higher richness, density and biomass. There, herbivores were more abundant, whereas omnivores and carnivores dominated upwelling sites. Functional richness and dispersion were also higher in non-upwelling sites, but the presence of exclusive functional entities on both regions suggests a low functional redundancy between regions. Our results highlight the differences on fish assemblages on a very small spatial scale driven primarily by the presence of upwelling and underscore the needs for differentiated management measures for the upwelling and non-upwelling regions.

Multiple stressor effects from light pollution and invasive signal crayfish on riparian spiders

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Abstract

Freshwater ecosystems face multiple anthropogenic stressors, whose effects may extend beyond their ecosystem boundaries. Artificial light at night (ALAN) and invasive species are global threats to freshwater biodiversity. We used stream mesocosms to investigate the effects of ALAN and the invasive signal crayfish *Pacifastacus leniusculus,* both individually and in combination, on riparian spiders, hypothesizing altered prey availability (i.e., emerging aquatic insects). The direction and strength of the stressor effects were time- and taxon-dependent. For example, the presence of crayfish reduced insect emergence by 35% after one week of the experiment. The number of riparian Tetragnathidae spiders *Pachygnatha degeeri* and *Tetragnatha extensa* correlated positively with insect emergence, indicating indirect negative effects of the signal crayfish. This study evidences that both stressors can induce cascading effects on riparian spider communities, underscoring the importance of considering cross ecosystem effects and stressor interactions in environmental management strategies.

Structural variability of protist assemblages in surface sediments across Mediterranean marine subregions

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Abstract

Marine sediments host heterogeneous protist communities. Despite their key functions in marine ecosystem processes, their structure and dynamics are largely unknown. In the present study, with a spatially intensive sampling design we investigated benthic protist diversity and function of surface sediment samples from three subregions of the Mediterranean Sea through an environmental DNA metabarcoding approach targeting the 18S V4 gene. Protists were characterized at the taxonomic level and trophic function, both in terms of alpha diversity and community composition, testing for potential differences among marine subregions and bathymetric groups. Protist communities were found to be significantly different in terms of taxonomic composition and trophic function in the three subregions in the alpha diversity estimates based on the detected ASVs ($p<0.01$). This study provided new insights into the taxonomic and trophic composition of benthic protist communities in Mediterranean sediments revealing geographical differences among regional seas.

Predicting community response to warming and heat waves using thermal performance of *Drosophila* and their parasitoid species

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Abstract

Understanding how temperature affects ectotherms is crucial for predicting their community responses to climate change. This study evaluates the thermal performance curves (TPCs) of 11 *Drosophila* species and 8 parasitoid species, using *Drosophila melanogaster* as a common host, plus a set of 3×3 host-parasitoid interactions. Fitness proxies (survival, maturation time, fecundity, and starvation resistance) were assessed across temperatures ranging from 15°C to 33°C. Results show a significant decline in parasitoid viability above 27°C, while *Drosophila* species exhibit variable viability at 32°C, indicating a mismatch in thermal tolerance. This mismatch could impact trophic interactions under global warming. By integrating TPCs into ecological models, we aim to predict community responses to temperature fluctuations, offering insights into species adaptation and ecosystem resilience to climate change. This study highlights the complexity of predicting ecological responses and the need for comprehensive models that account for species interactions and thermal sensitivities.

Investigating the impact of land-use change on the occupancy of tropical montane bees in Malaysia

Miss Zoe S Gough

University of Southampton

Abstract

The wild bee communities of tropical montane forests (TMFs) are highly understudied, with little known about the species that make up these communities, let alone their occupancy, foraging preferences, and other life history traits. And yet, TMFs are being rapidly degraded due to agricultural expansion and urbanisation, removing the natural habitats on which many bee species will depend for both food and nest provisioning. This study assesses bee diversity and distribution across forest fragmented TMF landscapes in Peninsular Malaysia. We sampled across a land-use gradient, including primary and secondary forests, tea plantations, urban and rural sites, to identify important habitat types for different bee families. We also identified the key environmental drivers of bee distribution across these landscapes to better understand the impact of forest loss and subsequent land-use change on these highly diverse bee communities. The results of this study will be used to inform conservation strategies for bees.

Bird community responses to smallholder versus industrial coconut cultivation in Sulawesi, Indonesia

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Abstract

Over 3.34 million hectares of coconut are cultivated in Indonesia, making it the third-largest estate crop in the country, but is rarely discussed for its biodiversity impact than other oilseed crops. Smallholders typically produce coconut in low-yield agroforestry, while large monoculture plantations achieve the highest yields but potentially harm the environment. We implemented point count surveys and passive acoustic monitoring to investigate bird diversity in multiple coconut landscapes in northern Sulawesi, each with different layouts and yields. Multi-species occupancy analysis revealed how bird, functional, and phylogenetic diversity respond to landscape structure and cultivation technique. Indicator species analysis highlighted bird calls for targeted monitoring, with ongoing efforts to automate this process using acoustic classifiers to further investigate the trade-offs between biodiversity and yield. Our findings suggest that varying coconut configurations impact bird diversity, with intensive plantations generally favouring generalist species over specialists, emphasizing the need for further ecological and socio-economic research.

The sweeter the better: A study of ant foraging behavior and resource selection in cities using citizen science

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Abstract

What drives ant foraging activity, and how efficiently do they locate optimal resources? In the citizen science project Ameisenpicknick (2022–2024), children in three German cities (Halle, Leipzig and Berlin) conducted over 160 2-hour baiting experiments across an urbanization gradient to explore how environmental changes affect ant activity. Five sugar-water baits ranging from 0–40% sugar concentration were used, and ant activity was observed and counted at regular intervals. Results show that ant foraging activity is environmentally-dependent and varies throughout the day. Ants selected baits in order of sugar concentration level, recruiting more quickly to high-concentration baits. However, ants would shift their selection to lower concentrations when baits were saturated or competition increased. We furthermore present some early developments of an automated ant camera trap, highlighting the opportunities and challenges of using citizen science and technology separately and combined for ecological research.

Long-term effects of anthropogenic disturbance on adult Odonata (Insecta) assemblages in Amazonian freshwater streams

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Abstract

The Amazon Basin hosts a wealth of biodiversity, but has been severely impacted by rapid land use change. Odonata species are regularly used in assessing the degradation of freshwater ecosystems, but little is known about their responses to temporal changes to Neotropical streams. We collected adult odonates from 43 headwater streams in the Brazilian Amazon in 2010 and 2023. In this interval, riparian forest cover decreased in over 50% of the sites - although its protection is required by Brazilian environmental legislation -, alongside larger-scale deforestation in the catchments. We also detected significant changes in the composition and diversity of Odonata communities. Richness decreased mainly due to loss of Zygoptera species, a suborder often associated with undisturbed areas. Odonata is an effective indicator for monitoring the ecological integrity of Amazonian streams. We provide novel evidence on their temporal change and insights on their future in the Amazon given the pressures they face.

Trends and mechanisms of species gain and loss in Arctic and Alpine plant communities under rapid climate change

Dr. Keita Nishizawa, Dr. Akira S Mori

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Abstract

The increase and decrease in species numbers due to recent climate change has long been a major concern, with ongoing debate about the trends. Arctic plants, adapted to extreme cold climates, are particularly experiencing significant impacts from rapid Arctic warming, yet there is no clear consensus on how plant communities are responding to these changes in the region. To clarify both the trends and mechanisms driving plant community changes, we first examined species gain and loss trends across Arctic and Alpine regions (tundra vegetation) by utilizing existing databases. Furthermore, we identified non-random species gains and losses by comparing observed changes with simulations assuming random species turnover. By incorporating functional traits and distributional range data of plant species into the analysis of species gains and losses, we aimed to understand the mechanisms driving community changes across the entire polar region.

Exposure to multidecadal chronic climate change does not buffer grassland plant communities against extreme drought

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Abstract

We used a 30-year field-based climate manipulation applied to calcareous grassland to test the hypothesis that chronic climate change (drought, warming) would alter ecosystem responses to an extreme naturally occurring drought. We hypothesised that during the extreme drought, climate-induced adaptative processes would confer enhanced ecological resistance (but lower resilience) on plots exposed to chronic drought treatment, with the converse in the warming treatment. We found that plots exposed to chronic drought were not more resistant in patterns of local species loss during the extreme drought, although they were more resistant in their community composition. Their compositional resilience was, however, lower than that of control plots, underpinned by weakened patch-scale colonisation dynamics. Together, the failure of local colonisation to buffer species losses in drought treated vegetation, and their lower capacity for resilience suggests that extreme climate events are likely to accelerate climate-induced ecological change, regardless of preexisting climate regimes.

Multidimensional changes in plant diversity along successional gradients indicate a shift from stochastic to deterministic processes of community assembly: a study in Central Europe

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Abstract

Patterns of biological diversity often represent outcomes of community assembly rules. Using community and functional databases from the Czech Republic, and based on recent advances in diversity metrics and on their proper statistical treatment, we investigated changes in plant diversity along a successional gradient, defined by the community weighted mean of a synthetic variable developed for Czech flora. We found that there is a unimodal response of taxonomic and functional Hill-based diversity actoss succession driven by rare species, in accordance with the Intermediate Disturbance Hypothesis. Rao's entropy effect sizes also followed a unimodal response. Partitions showed that succession led plant communities from dominance- to redundancy-type. Functional hypervolumes decreased during succession, and became more packed with a smaller number of holes. Our results demonstrate significant multifaceted changes in diversity and community structure during succession, indicating a potential switch from stochastic to deterministic community assembly processes.

Carnivore habitat use and human disturbance impacts in the Colorado Rocky Mountains

Isabel DeVito

University of St Andrews. Colorado College

Abstract

Human activity and interspecific competition can shape carnivore movement behavior and activity patterns, but there is no prior carnivore guild level research in the Pikes Peak region of the Rocky Mountains. I used camera trapping to investigate how human disturbances and interspecific activity influence spatio-temporal habitat use by medium and large carnivores in Manitou Experimental Forest, Colorado. I found that two fox species showed opposite relationships to residential disturbance, but otherwise that carnivore habitat use was not impacted by human activity. Overall, carnivore species showed high degrees of spatio-temporal overlap, except among canines, where there was evidence of foxes avoiding the larger coyote. These results indicate that carnivore coexistence is high in the Pikes Peak region, which might be facilitated by finer scale habitat or dietary partitioning. The lack of human disturbance impacts suggests that habitat remains suitable for carnivores despite low-density road and residential development in Colorado forests.

How does the wildebeest migration affect anthelmintic resistance in livestock of the Serengeti?

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Abstract

Wild and domestic ruminants are often considered competitors in the many areas of the world where they share land, but wild ruminants may improve livestock health by introducing naïve parasites into treated parasite populations that have gained anthelmintic drug resistance.

In the Serengeti, Tanzania, ~1.5 million migratory wildebeest (*Connochaetes taurinus*) share pasture annually withlivestock, raising the possibility that migration may improve the efficacy of anti-parasite drug use in livestock.

Using a before-after-control sampling design, we sampled L3 strongyle parasites from cattle, sheep and goats and assessed the composition of species using molecular barcoding.

The dominant parasite was *Haemonchus spp*. We quantified the prevalence of resistance markers using amplicon sequencing of parasites from herds that were, and were not, exposed to wildebeest pre-and post- migration.

Wildlife interactions with livestock could reflect an unknown strength of co-grazing, through decreased prevalence of anthelmintic resistant genotypes in a parasite population.

Warming simplifies marine ecological networks through losses in trophic and non-trophic interactions

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Abstract

Ocean warming and heatwaves can exceed marine species' tolerance limits, leading to species loss and disruption of ecosystem functions. While natural upwelling may offer some relief from heat stress, it can also introduce additional stressors like hypoxia. Understanding the impact of these climatic extremes on coastal ecosystems is crucial. We studied the effects of warming scenarios and upwelling events on benthic communities in mesocosms over a 4.5-month summer period. Warming (0–5 °C) was applied to fluctuating seawater to simulate marine heatwaves, alongside upwelling events that added short-term cooling, nutrient enrichment, salinity changes, hypoxia, and acidification. Intense warming (+5°C), with or without upwelling, led to decreases in community biomass and shifts in community composition at the bottom and top of the food web. This reduced the number of non-trophic and trophic links, connectance, and generality in the networks, indicating a food web simplification with warming.

Best practices for rural women smallholder farmers inclusion in teaching local ecological coping solutions to climate change in Sub-Saharan Africa (SSA)

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Abstract

Background: Sub-Saharan African rural women (RW) contribute 60-80% of the labour used to produce food both for household consumption and for sale. However, they are the most challenged by the impact of climate change (CC).

Methods: A paper search using the Web of Science and google scholar databases was performed following the PRISMA guidelines and the existing best practices promoting RW smallholder farmers' inclusion in ecological solutions to CC were determined.

Results: A total of 30 studies were reviewed. All the studies recognize that RW are essential in mitigating CC and achieving the SDGs. The main best practices for their inclusion are: promote access to education and health care, inclusion in decision-making processes, budget allocations and conservation initiatives, promote access to mobile internet.

Conclusions: We recommend that the governments in SSA take action on support needed by RW for their active participation in promoting ecological coping solutions to CC.

Tracking tropical mixed-species flocks in mixed-use landscapes: are species interaction networks resilient in heterogeneous habitats?

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Abstract

Mixed-species flocks are a mainstay in tropical forests, and allow participating individuals to forage more efficiently and stay safe from predators. However, despite large tracts of forest being converted into plantations, we know little about the effect of heterogeneous landscapes on these species interaction networks. Here, we ask whether the presence of forest fragments and intraspecifically gregarious leader species in a working landscape surrounded by large tracts of primary forest influences flock resilience and species richness. We show that the species richness of flocks in tea and timber plantations are significantly lower compared to forest flocks (Kruskal-Wallis $H = 26.1$, $p < 0.05$), but when a gregarious flock leader species (*Alcippe poioicephala*) is present in a nearby fragment, follower species are able to forage in otherwise unsuitable habitats. This work emphasizes the role of mixed-use landscapes for biodiversity conservation and makes a case for species interaction networks to be conservation targets.

Memories of trees past: stabilization thru persistent Janzen-Connell effects

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Abstract

Unraveling species coexistence in diverse plant communities is key to ecology. The Janzen-Connell Hypothesis (JCE) suggests species diversity is maintained by reducing seedling survival near conspecific trees, but the persistence of these effects after tree death is unclear. We tested for lasting JCEs across multiple sites and species, showing these effects enhance diversity in forest gaps. Seedling survival was lower under living and dead conspecific trees compared to heterospecifics, and persistent JCEs were observed up to five years after tree death. We parameterized pairwise coexistence models with our empirical seedling data and found that stabilizing though not equalizing effects were enhanced by persistent JCEs. Ignoring legacy effects underestimates conspecific density dependence by 40% and future work should consider the legacies of past trees on extant community dynamics.

Grazing impacts on temporal dynamics of Grime's CSR strategies in dune plant communities over a half century.

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Abstract

Grime's competitive, stress tolerant, ruderal (CSR) theory predicts a shift from ruderal to stress tolerant plant communities during succession. We tested this prediction in grazed and ungrazed plant communities in a replicated experiment spanning 50 years in sand dune wetlands (slacks). We found clear succession from ruderal to stress tolerant communities in grazed and ungrazed plots. Grazing altered this trajectory, and the extent of the difference varied across decades influenced by environmental changes. These are one of the rarest habitats in Europe and are under threat, and management for nature recovery is focused on conservation grazing. This study demonstrates the need to understand the impacts of management for nature recovery across long time scales to understand the implications of shifting baselines.

Biodiversity and habitat preferences of butterflies and birds across urban, periurban, and rural areas in Santiago de Chile's Mediterranean climate

Mr Pedro Munoz Santibanez, Dr James Hitchmough

University of Sheffield

Abstract

This study investigates the biodiversity of butterflies and birds across urban, peri-urban, and rural habitats within the Mediterranean climate context of Santiago de Chile. Unexpectedly, urban areas exhibited the highest butterfly diversity, followed by peri-urban and rural areas. Conversely, bird diversity peaked in peri-urban habitats, closely followed by rural areas, with urban areas showing the lowest diversity. Beta diversity analyses revealed distinct community compositions across all habitat types for both taxa. Furthermore, these results suggest that the peri-urban fringe may act as an ecological hinge, supporting a diverse range of habitats and species, thereby connecting urban and rural ecosystems. These findings underscore the need for habitat-specific conservation strategies and provide critical insights into how urban planning can enhance biodiversity in Mediterranean-climate cities.

Using remote sensing for assessing the effects of spatio-temporal heterogeneity of anthropized landscapes on diversity of small mammals in Atlantic Forest

Msc Viviane Brito Dias[1], Dr Felipe Martello[2], Dr Gurutzeta Guillera-Arroita[3], Dr Jesus Aguirre-Gutierres[2], Dr Rita de Cassia Bianchi[4], Dr Milton Cesar Ribeiro[4]

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Abstract

Habitat loss and fragmentation are key drivers of biodiversity loss in hotspots. Recent studies point the potential role of landscape heterogeneity in supporting biodiversity, particularly in human-impacted environments. The use of spectral indices derived from satellite imagery, may offer more detailed assessments of landscape heterogeneity at larger scales compared to pre-classified maps. We used multispecies occupancy models to infer the effects of landscape characteristics on biodiversity of small mammals in the Atlantic Forest, using metrics derived from classified maps, and a texture measure (Contrast) derived from a vegetation indice (EVI) from satellite images. Our results indicate that forest patch density positively affects community occupancy and species richness but negatively impacts functional diversity. The annual variation in Contrast negatively affects community occupancy and richness but enhances functional diversity. These findings underscore the value of combining satellite-derived metrics with pre-classified map metrics to better understand the effects of fragmented landscapes on biodiversity.

Conservation Science and Policy

Searching for ponds from space - How can remote sensing be used as part of the toolkit for rapid pond identification?

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Abstract

Understanding contemporary coverage of ponds is key for conservation efforts, however, there is a need for more accurate pond mapping to enable long term monitoring and enabling effective management strategies to be implicated. We suggest using remote sensing imagery and analysis to be a potentially rapid method of identifying ponds over a large landscape scale.

Remote sensing images of a small (25km^2) and large (catchment-scale) study area within south-west UK were obtained. Both semi-automated (supervised classification) and automated (unsupervised classification) methods have been applied to these images of a range of spatial resolutions. The outputs were then analysed for pond identification accuracy. This research found that supervised classification of high spatial resolution imagery consistently produced outputs that resulted in highest pond identification accuracy.

Having explored the potential for remote sensing in pond identification and classification we evaluated the challenges and cost-effectiveness of widespread application compared to traditional manual mapping approaches.

Determinants and implications of land cover change in and around South African protected areas

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Abstract

Protected areas (PAs) are important in mitigating land cover change and habitat loss and are central to conservation efforts. This study assesses the effectiveness of South Africa's PA network in conserving natural vegetation within their boundaries and within a 5km buffer over the past 30yrs, using satellite-derived land cover data. South Africa's PA network, covering 10% of the country, has effectively conserved natural land cover, particularly in larger PAs and in drier regions, but a 14% decline in natural cover was observed just 1km beyond PA boundaries, mirroring the national average of land cover transformation outside PAs. Significant land cover changes around PAs pose challenges for PA integrity and expansion. Focus outside PAs is needed to meet the 30x30 goal of the Kunming-Montreal Global Biodiversity Framework. We propose an approach in which land is set aside alongside sustainable land use practices, aiming for social, ecological and financial outcomes.

More evidence gaps than grikes: Conservation of British limestone pavements

Professor Carly J. Stevens

Lancaster University

Abstract

The UKs limestone pavements are internationally important. Limestone pavements are Karst limestone features made up of stone slabs (clints) and fissures (grikes). The grikes provide a sheltered, shaded, humid habitat, somewhat protected from grazing, which results in a species rich flora markedly different from surrounding habitats.

Repeating a 50 year old survey of 537 non-wooded pavements in England, Scotland and Wales has revealed extensive vegetation change with contrasting threats from under grazing and increases in tree cover, and over grazing. Indicators of disturbance decreased as a consequence of reduced grazing intensities, as did Ellenberg N values. It has also highlighted the lack of research and evidence base to support management decisions in this habitat and the use of inappropriate monitoring approaches. Limestone pavements fit poorly in existing habitat classification systems, are poorly supported by agri-environment schemes exacerbating the conservation problems.

Combining Social Science and Distribution Models to Estimate Fisheries Bycatch from Small-Scale Inland Fisheries

Mr Daniel A Villar[1], Mr Edwin Guttierez Tito[2], Ms Paola Noriega-Velasquez[3], Ms Anahi Cosky Paca-Condori[4], Prof Edmundo Moreno Terrazas[5], Dr Jorgelina Marino[1], Prof Andrew G Gosler[1]

[1]University of Oxford. [2]SERNANP. [3]Universidad Mayor de San Andres. [4]Aves Bolivianas. [5]Universidas Nacional del Altiplano

Abstract

Small-scale fisheries account for an estimated 40% of the fisheries catch in the world, and is the primary source of protein in much of the developing world. Despite its importance, its environmental impacts are little studied compared to commercial fisheries, especially in inland waters. A major cause for why its understudied is that common methods used in commercial fisheries are not feasible for studying small-scale fisheries. Here we combine interviews and ethnographic work with fishermen with distribution models to estimate fisheries bycatch of a small-scale inland fishery. We use Lake Titicaca, in Peru and Bolivia, and the bycatch of the Titicaca Grebe, as a case study. Lake Titicaca is a unique high altitude freshwater ecosystem in the Central Andes shared between Peru and Bolivia, and the Titicaca Grebe is an endangered endemic flightless grebe, for whom fisheries bycatch is the main conservation threat.

Trait mediation explains decadal distributional shifts for a wide range of insect taxa

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Abstract

Under a changing environment species distributions are reshaped, and response traits are key actors in this process. We present the results of a trait-based machine learning set of models that capture the distributions of 9 insect groups (butterflies, macromoths, odonates, carabids, orthoptera, bees, ladybirds, wasps and hoverflies) across Great Britain since 1990. This represents a total of 1252 species for which we highlight the main environmental drivers behind their occupancy trends, as well as the response traits that mediates the drivers' effects. With this wide taxonomic range, our approach identifies common causes to insect distributional shifts, notably urban sprawl, as well as the key role of voltinism in mediating the effects of increasing temperatures.

Modelling the Ecological Impact of Tree Diseases

Dr Haoran Wu

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Abstract

Emerging tree diseases are doubling approximately every 11 years, threatening the forest ecosystems around the globe. Yet, we know little about their impact on tree mortality, biodiversity, and ecosystem functioning. In this talk I will present my Masters' research on predicting tree mortality by modelling climate-pathogen interactions. I developed an epidemiological model to predict tree population decline under various management scenarios. Climate-pathogen interactions were modelled to examine their joint effect on forest health. I found that climate change would have limited impacts on disease-related mortality through increased pathogen virulence, and that 12% of resistant trees can maximise the potential of removing diseased trees by natural selection. My research provides an example of how ecosystem models help the management of forest health in a changing world.

Major trade-offs between conservation and wellbeing outcomes across Ethiopia's protected area network

Sophie Jago[1], Gebremeskel Gizaw[2], Bezawit Genanaw[3], Joe Langley[1], Ermias Lulekal[3], Joseph White[1], Kumara Wakjira[2], Fekede Regassa[2], Sebsebe Demissew[3,4], Wendawek Abebe[3], Robert Smith[5], James Borrell[1]

[1]Royal Botanic Gardens Kew. [2]Ethiopian Wildlife Conservation Authority. [3]Addis Ababa University. [4]The National Herbarium of Ethiopia. [5]Durrell Institute of Conservation and Ecology

Abstract

Amidst the global biodiversity crisis, protected areas (PAs) are central to the Global Biodiversity Framework's target of protecting 30% of the planet by 2030. However, in developing countries facing major food security and poverty challenges, it is important to understand how PA networks impact local communities and sustainable development. Ethiopia encompasses two global biodiversity hotspots, but is among the world's most food insecure nations. Here, we examine the impact of Ethiopia's PA network on both conservation and wellbeing outcomes. Counterfactual analysis, integrating remote sensing and household panel surveys reveal that Ethiopia's PAs significantly reduce forest loss, agricultural expansion and conserve grasslands compared to carefully matched controls. Conversely, the PAs also have a significantly negative impact on local food security. While these trade-offs are alarming, we also demonstrate that certain management approaches – particularly community-focused biosphere reserves – appear to offer win-win synergies between conservation and wellbeing outcomes.

Minimising trade-offs and conflicts in nature-based solutions: an investigation of value pluralism in nature credit markets

Miss Gail Sucharitakul, Dr Caroline Howe

Imperial College London

Abstract

Nature-based Solutions (NbS) are advocated as a "win-win" solution that can simultaneously address climate change, biodiversity, and sustainable development objectives. Despite this potential, NbS face challenges to scaling up due to limited finance, particularly from the private sector. Nature credit markets are one of the primary ways to increase private finance for NbS. However, these markets can lead to inequitable social and environmental outcomes because of power asymmetries and misaligned values, resulting in "win-lose" or even "lose-lose" outcomes. If these markets are to enable NbS to be "win-win" solutions, they need to minimise ecosystem service trade-offs and conflicts between stakeholders. The aim of this study is to understand how to design these markets to be more effective at delivering social and environmental objectives simultaneously. We apply transdisciplinary methods to investigate ecosystem service trade-offs and synergies in nature credit markets and explore how a values-based approach can minimise conflicts and trade-offs.

Intraspecific variability in seed germination responses to temperature of UK native plants: implications for climate-smart ecological restoration

Efisio Mattana, Lola Andrews, Elena Fouce Hernandez, Leela Watt Poddar, Jamal Rowe-Habbari, Isabel Negri, Christopher Cockel, Charlotte Seal, Ted Chapman

Royal Botanic Gardens, Kew

Abstract

Seed lots stored in conservation seed banks represent an invaluable asset for studying the impacts of climate change on the natural regeneration of wild plant populations and for supporting ecological restoration programmes.

Here we present the results of germination studies carried out on 45 provenances of six UK native species of interest for ecological restoration, stored at the Millennium Seed Bank of the Royal Botanic Gardens, Kew. We investigated their resilience to temperature, by testing seed germination responses from 0 to 40°C, modelling their germination kinetics, and identifying the thermal thresholds for seed germination of multiple provenances of each species.

By assessing the different sensitivities to temperature during the germination phase of each species, we can assess their thermal risk for seed germination under a warming climate, while by detecting differences among populations of the same species we can inform climate-smart ecological restoration programmes.

Using multi-proxies to understand the interaction between human-climate on dry vegetation in Northwestern Madagascar and its relevance to biodiversity conservation

Mr Fetra O Randriatsara[1], Prof Lindsey Gillson[2], Dr Estelle Razanatsoa[1]

[1]University of Cape Town. [2]University of York

Abstract

The western dry tropical forest has been rated as the most threatened ecosystem in Madagascar. Over the past four decades, several studies have pointed out the reduction in forest cover and the expansion of the open savanna biome. Anthropogenic fire and land use have been identified as causes of deforestation and erosion. Consequently, afforestation programs have been established to rehabilitate the degraded landscape and mitigate soil erosion. However, the vegetation dynamics and human-climate interactions are still poorly understood. Engaging in certain activities may threaten the natural environment instead of safeguarding and restoring it. This research uses sediment analysis and remote sensing studies over the last six decades. One aspect of the results emphasized the existence of open ecosystems over time and the correlation between climate and human activities in influencing vegetation dynamics. This provides valuable information on conservation strategies, considering local land use practices and the impact of climate change.

To what extent can life history strategies inform species conservation potential?

Emily A. Stevenson, Dr Isabel M. Smallegange, Professor Philip J. K. McGowan, Dr Louise Mair

Newcastle University

Abstract

To prevent extinctions, conservation planners often need to make urgent decisions about data-sparse species, without the time to reduce uncertainty by conducting monitoring. We investigated to what extent life history strategies could contribute to our understanding of species conservation potential and speed of recovery from disturbances, to support conservation planning. We focused on reptiles, which tend to be underrepresented within conservation literature. We used a dynamic energy budget integral projection model to calculate life history traits for 23 reptile species and applied principal component analyses to structure those traits into life history strategies. We tested if these strategies predicted population performance and conservation status. We found that reptile life history strategies significantly predicted population growth rates and demographic resilience, which has the potential to improve conservation planning by reducing uncertainty about species responses to conservation interventions.

A qualitative study on challenges faced by Indian law enforcement agencies while collaborating with social media intermediaries to counter cyber-enabled wildlife crime

Pradipty Bhardwaj[1,2], H V Girisha[3,4,5], Dr. Jayadevan S. Nair[6,7]

[1]Ph.D. Research Scholar, School of Law, Christ University, Bengaluru, India. [2]Legal and Cyber Intelligence Analyst, Langland Conservation, UK. [3]Indian Forest Service, Government of India. [4]Joint Director, Wildlife Crime Control Bureau, Ministry of Environment, Forest and Climate Change of India. [5]Ph.D. Scholar, Institute of Forestry and Wildlife, Amity University, Noida. [6]Professor, School of Law, Christ University. [7]Dean, School of Law, Christ University

Abstract

The cybersphere has become an endemic mode of wildlife crime and poses challenges for enforcement agencies in collaborating with social media. This study explores the challenges experienced through semi-structured interviews with forest and police officials, non-governmental organizations, researchers, and lawyers. The analysis reveals fifteen key issues, including priority given primarily to flagship species, difficulty in accessing or engaging with nodal officers, convincing a foreign-registered social media intermediary on Indian protected species, removal of illegal content only from Indian servers rather than global, wildlife offences not listed under the reporting options, action taken only based on legally sound notices or court orders, etc. Findings indicate that these factors impede prosecution and preventive enforcement efforts. Hence, this study emphasizes the need for efficient legal and procedural mechanisms along with improved collaboration. It offers valuable insights to policymakers and social media intermediaries on working together and bridging gaps to combat cyber-enabled wildlife crime.

What works to improve species conservation state? An analysis of species whose state has improved and the actions responsible

Ashley T Simkins[1], William J Sutherland[1], Lynn V Dicks[1], Craig Hilton-Taylor[2], Molly K Grace[3], Stuart H M Butchart[4,1], Rebecca A Senior[5], Silviu O Petrovan[1]

[1]Department of Zoology, University of Cambridge. [2]International Union for Conservation of Nature Red List Unit. [3]Department of Biology , University of Oxford. [4]Global Office, BirdLife International. [5]Department of Biosciences, University of Durham

Abstract

Understanding the consequences of past conservation efforts is essential to inform the means of conserving and recovering species. However, this information is spread between disparate sources and rarely evaluate impact, making it hard to identify which and when conservation actions are generally effective. To tackle this, we leveraged data from the largest database on species' conservation information, the IUCN Red List of Threatened Species, for 67,217 comprehensively assessed animal species. We aimed to understand three key questions: (i) which conservation actions have been implemented for different species, (ii) which types of species have improved in state and (iii) which actions are likely to have driven the improvements. In this talk, we will discuss our findings and their implications for conservation practice.

Managing global investment portfolios for conservation

Prof Mark Burgman

University of Hawai'i at Manoa

Abstract

Passive investors look to stock exchanges to advise them on investments that lead to nature-positive outcomes. There is a risk that very substantial amounts of money are ready for investment before the indices are ready to guide investment effectively. This presentation explores the potential for ineffective and perverse outcomes from investment indices that may accelerate extinctions. It proposes some short-term solutions that will avoid serious detrimental impacts and provide breathing space to permit the development of appropriate investment indices.

A decade of annual litter removal from a wood has had little impact on the ground flora

Dr Keith J Kirby

Department of Biology, University of Oxford

Abstract

Leaf litter was often collected from woods under traditional management for use as animal bedding, kindling etc. This could potentially change soil nutrient conditions and hence ground flora composition. In a mixed ash (Fraxinus excelsior) sycamore (Acer pseudoplatanus) stand, between 2013 and 2024, litter was raked off annually from one set of 5 plots and deposited on a second set, with a third set acting as controls. Within each plot the ground flora composition and cover was assessed in a 4 x 2 m sub-plot. After 10 years moss was more apparent in the 'raked' plots; there was a small increase in vascular plant richness but little effect on overall plant composition. A bigger shift in vegetation composition occurred across all plots, e.g increase in Brachypodium sylvaticum, from about 2017 onward which is probably driven by the consequences of the spread of ash dieback.

Assessing European Eel Distribution and Habitat Requirements with eDNA and Remote Sensing to Guide Management and Conservation in Modified River Catchments

Mr Angus I T Monaghan[1,2], Dr Graham S Sellers[1], Dr Nathan P Griffiths[1,2,3], Dr Lori Lawson Handley[1], Dr Bernd Hänfling[1,3], Mr James A Macarthur[1,3], Dr Rosalind M Wright[4], Dr Jonathan D Bolland[2]

[1]EvoHull Evolutionary Biology and Environmental Genomics Group, University of Hull. [2]University of Hull International Fisheries Institute. [3]Institute for Biodiversity and Freshwater Conservation, University of the Highlands and Islands. [4]Environment Agency

Abstract

In response to the recent decline and critically endangered status of the European eel (*Anguilla anguilla*), EU regulations mandate safe downstream passage at hazardous intakes including pumping stations, which pose significant threats to eel migration, despite considerable modification costs. From 2021 to 2023, four eDNA metabarcoding campaigns were conducted across 144 pumping station catchments in the Anglian Fens, UK, detecting eels in 43 (30%) of them. Eel presence at sites was linked to better connectivity to downstream river channels and higher fish species richness ($p<0.01$). Integrating eDNA community data with remote sensing, habitat data, and land manager insights, the study assesses habitat suitability and prioritises pumping stations for "fish-friendly" modifications for upstream and downstream eel passage. The Environment Agency will use these findings to allocate funds for Best Available Eel Protection across the region. Additionally, the project has shed light on rare and invasive species distributions in the Fens.

Validating habitat suitability models for pine marten (*Martes martes*) reintroductions to England and Wales

Dr Eleanor R. Scopes[1], Dr Jenny MacPherson[2], Dr Patrick G.R Wright[2], Dr Catherine M. McNicol[3], Mr Jamie Kingscott[4], Dr Cally Ham[1], Ms Nora Kerecsenyi[1], Dr Matt Guy[1], Dr Chloe Bellamy[1]

[1]Forest Research. [2]Vincent Wildlife Trust. [3]British Association for Shooting and Conservation. [4]Gloucestershire Wildlife Trust

Abstract

Reintroductions of locally extinct species are vital to restore ecosystems in areas where natural colonisation is unlikely. In Britain, pine marten (*Martes martes*) reintroductions have occurred in Wales and the Forest of Dean. Feasibility studies completed before these reintroductions are vital to ensure martens are introduced into areas with sufficient habitat to succeed. Habitat suitability models (HSMs) have been created for the whole of Britain to identify promising areas for future reintroductions, with multiple projects now proposed. We present a study validating and refining the HSM using primary data from the existing reintroduced populations. We find that the existing model can predict marten presences, but not absences from scat transects, and that adding additional environmental information on roads and trees outside of woodlands does not improve model fit. Validating the HSM substantiates its use in ongoing marten reintroductions, hopefully replicating the success of the initial projects.

Early adopters of non-lead ammunition: personal experiences, social norms and external pressures as drivers of pro-environmental behaviour

Ms Emily A Strong[1], Dr Sarah L Crowley[1], Dr Julia L Newth[2], Prof Robbie McDonald[1]

[1]University of Exeter. [2]Wildfowl & Wetlands Trust

Abstract

To improve uptake of pro-environmental behaviours, it is vital to understand what factors influence their adoption. To date, the impacts of lead ammunition on wildlife, the environment, and human health have been well documented. However, little research has investigated what motivates ammunition users to adopt non-lead alternatives. This study uses an inductive approach to a) identify what motivated early adopters of non-lead ammunition to transition away from lead, and b) understand whether and how they overcame barriers to adoption. Interviews were conducted with 22 members of the UK shooting community. Motivations for adoption of non-lead ammunition related to its performance, individual values, and reputational drivers. Numerous barriers were identified, however, including the availability and affordability of ammunition, social norms, and affective factors. This study provides a better understanding of why ammunition users in the UK adopt pro-environmental behaviours and offers insight into how sustainable practices spread within communities.

Lost relics of biodiversity: bridging gaps in the FAIR stewardship of eDNA data

Sydney B Wizenberg[1], Quentin Mauvisseau[2], Tobias Guldberg Frøslev[3], Hugo J de Boer[2], Niels Raes[1], Barbara Gravendeel[1,4]

[1]Naturalis Biodiversity Center, Leiden, The Netherlands. [2]Natural History Museum, University of Oslo, Oslo, Norway. [3]Global Biodiversity Information Facility (GBIF), Secretariat, Copenhagen, Denmark. [4]Radboud University, Nijmegen, The Netherlands

Abstract

eDNA metabarcoding has taken the world by storm, providing a new high-throughput avenue for detecting species and monitoring biodiversity. Despite its popularity, there is no standardized framework for the FAIR (**F**indable, **A**ccessible, **I**nteroperable, and **R**eusable) stewardship of eDNA data, resulting in under-utility of these incredibly valuable datasets. To address this, we developed a scalable blueprint for open-science mobilization of eDNA metabarcoding data, and in doing so have identified key infrastructural gaps that inhibit optimal use of species occurrence data derived from metabarcoding. The resulting lost relics of biodiversity could be the missing piece to improved global ecological monitoring, but making use of these requires large-scale implementation of FAIR data stewardship across scientific domains. Here, we present the Biodiversa+ MetaPlantCode framework for FAIR stewardship of eDNA metabarcoding data and discuss key questions guiding the development of improved infrastructure for mobilizing genetically derived biodiversity data.

Enhancing Conservation: The Role of Evidence Reviews in Informed Decision-Making

Dr Isabel Alonso, Dr Emma Lockley, Mr Will Muckley, Dr Jack Lee, Ms Kathy Peck, Ms Cornelia Bentsen

Natural England

Abstract

For decades, organizations have been trying to maintain and restore habitats and populations. But often in conservation, land managers and policymakers must act without all the evidence. Many interventions are solely based on specialists' advice with potential risk of bias. Experimental designs, interventions, tests, and results are not always well documented, so it can be hard to replicate or built upon. Ideally, the results of interventions are published in peer-reviewed journals. Next best, in reports. Worst, they are not published at all.

Evidence Reviews can help decision making by collating available (published and unpublished) information. They provide policymakers and practitioners with an unbiased, appraised synthesis of all the evidence.

Natural England has a new team to review evidence on our priorities, but we want to collaborate with others doing reviews. We want to see the different types of Evidence Reviews informing policy decisions or raising awareness of the evidence base.

Trends in the distribution of ungulate species hunted as busmeat across forest remnants in South-Benin

M. Jézumèvo Ephrem AKPOLI, Professor Akomian Fortuné AZIHOU

University of Abomey-Calavi, Laboratory of Applied Ecology

Abstract

Forest ecosystems are increasingly being dewilded and there is an urgent need to know which forests still conserve wildlife species in order to develop sustainable and viable conservation strategies. This study, focus on ungulate species hunted as bushmeat across forest remnants in South-Benin, investigated geographical distribution, abundance trends and threat factors to ungulate habitats. Using local ecological knowledge, 72 focus groups with 234 hunters were conducted in 60 villages surrounding 24 moist semi-deciduous dense forests and 19 swamp forests. Data collected included species occurences, trends from 1993 to 2023 and perceived threats. Then, QGIS software was used to map the trends and R software to produce statistical analysis. The results showed that hunters perceived wildlife species experienced habitat contraction from 1993 to 2023. A regressive abundance of the species was noted. Hunting, transhumance, agricultural encroachment strongly threaten this dynamic. This study proposes priority habitats for their rehabilitation and conservation.

Liana removal accelerates the recovery of 3D canopy structure in selectively logged tropical forests

Dr Toby Jackson[1], Ms Lucy Beese[1], Professor Andy Hector[2], Professor Tommaso Jucker[1]

[1]University of Bristol. [2]University of Oxford

Abstract

Restoring degraded tropical forests is a global priority and liana removal has been identified as a cost-effective restoration technique. However, field studies usually only measure the changes in tree trunk diameters, whereas liana removal influences the full 3D canopy structure with implications for habitat diversity, light availability and microclimate. In this study we measure the recovery of 3D canopy structure after liana removal and enrichment planting using repeat LiDAR data over a 500 ha forest restoration experiment in northern Borneo. We found that liana removal was the most effective restoration technique because it reduced tree mortality rates and accelerated the recovery of canopy gaps. Given its low cost, liana removal is therefore a very promising restoration technique, although there are potential negative biodiversity impacts that we were unable to test in this study.

Identifying wildlife connectivity areas to retain biodiversity: summarising analytical steps for combining species distribution models with circuit theory

Dr Carlos PE Bedson[1,2], Dr Ben L Payne[1], Danielle J Greaves[1], Professor Humphrey QP Crick[1]

[1]Natural England. [2]Manchester Metropolitan University

Abstract

Habitat fragmentation and climate change comprise major threats to species persistence. Historic designations of protected areas (PAs) may be insufficient to retain species distributions and biodiversity.

For conservation land use planning, we expound developments in connectivity and wildlife corridor assessment methods.

We consider the White Peak limestone plateau of England which hosts a fragmented network of PAs: limestone valleys, rivers, ash woodland and calcareous grassland amidst low biodiversity dairy farmland. We focus on important vertebrate species (Lepidoptera, birds, mammals).

We develop species distribution models, for current and future climate. Taking predicted model outputs, we apply innovatively sequenced analytical steps, using omni-directional circuit theory analysis, identifying high ecological connectivity value land.

We find the White Peak PAs already represent high connectivity value land. However areas outside this network offer potential to increase connectivity by two-thirds, and under climate change. We showcase upscaling, to link fragmented habitats across England.

Assessing biodiversity in Sumatra's community-managed forests

Mr Liam J Hughes, Dr Matthew Struebig

University of Kent

Abstract

Approximately 28% of tropical and subtropical forests are formally managed by local communities. However, little is known about the role of community-managed forests in protecting biodiversity, limiting our understanding of whether they should be considered viable OECMs. This research gap is particularly pressing in Indonesia, a megadiverse country devolving ~10% of its forest to local communities.

We sampled mammal and birds in two community forest landscapes in Sumatra to assess levels of occupancy and diversity. Each site differed in landscape context but shared a sampling design to compare biodiversity in community-managed forests with protected forest controls. In both landscapes, community-managed forests supported substantial diversity. However, there was evidence that the tenure conditions of the community forests influenced species composition, with more open coffee-agroforest areas associated with lower occupancy of forest-dependent taxa. We are exploring the management factors that influence vertebrate trends, and whether species' responses vary by their functional traits.

Measuring aquatic environments: Upscaling the spatial resolution of biotic index

Dr Rosetta C Blackman[1,2], Dr Luca Carraro[1,2], Dr François Keck[1,2], Prof Florian Altermatt[1,2]

[1]University of Zürich. [2]Eawag: Swiss Federal Institute of Aquatic Science and Technology

Abstract

Aquatic macroinvertebrates are a diverse and ecologically relevant group, yet strongly affected by anthropogenic activities. Many taxa are highly sensitive to environmental change, making them particularly good early warning systems and leading to their intense monitoring. Monitoring of aquatic macroinvertebrates is used to calculate ecological indices describing the state of aquatic systems. In aquatic ecosystems, there are a plethora of biomonitoring approaches, with over 300 assessment methods reported for freshwater taxa alone. Many methods and indices are hard to compare and difficult to scale across time and space. However, novel DNA-based approaches to measure the state and change of aquatic environments offers unprecedented opportunities, including integration toward commonly applicable indices. Here, we move beyond traditional point-based biotic indices with a proof-of-concept for spatially upscaling ecological indices based on environmental DNA, demonstrating how integrating these novel molecular approaches with hydrological models allows accurate evaluation at the catchment scale.

What is a 'Favourable' Conservation Status? A Scoping Review Protocol

Miss Alice M Oswald, Professor Stephen G Willis

Department of Biosciences, University of Durham

Abstract

While traditional conservation approaches have played a critical role in protecting biodiversity, there is a growing recognition of the need for more ambitious and proactive strategies that not only prevent extinction but also ensure that species and habitats thrive in the long-term.

One example of such an approach is the concept of Favourable Conservation Status (FCS), which refers to the situation in which a habitat or species is thriving throughout its natural range and is expected to continue thriving in the future

Despite FCS first appearing in policy over thirty decades ago, examples of its application are rare. However, a systematic evidence synthesis has not been conducted to demonstrate a gap between the current and potential applications of FCS in policy and practice.

This poster will outline the methods for the scoping review that will form the first systematic evidence synthesis on FCS.

Large-scale Ecosystem Recovery Network (LERN): Understanding the role of natural processes in woodland creation over time at large spatial scales

Dr Tom Jameson, Dr Joseph Beesley, Dr Matt Guy, Prof Kevin Watts

Forest Research

Abstract

Woodland expansion is a major part of global environmental policy to tackle the climate and biodiversity crises. However, untangling the relative benefits of woodland creation for biodiversity and ecosystem services is challenging, requiring long-term planning to study change over the lifetime of a woodland. The current push to increase woodland cover across the UK, through a range of innovative approaches from active tree planting to more passive natural colonisation, provides an unprecedented opportunity to study woodland creation in different ecological contexts. Through the Large-scale Ecosystem Recovery Network (LERN) we aim to establish a series of large-scale and long-term manipulative experiments across the UK to investigate the biodiversity and ecosystem service outcomes of woodland creation by natural colonisation under different environmental conditions and management strategies. This project will help us understand the reassembly of nature through natural processes and management approaches that can be used to increase restoration efficiency.

A multi-threat meta-analytic database for understanding insect biodiversity change

Dr Joseph Millard[1,2], Grace Skinner[3], Dr Andrew Bladon[2], Dr Rob Cooke[3], Dr Charlotte L. Outhwaite[4], Dr James G. Rodger[5], Dr Nick J. B. Isaac[3], Prof Andy Purvis[1]

[1]Natural History Museum. [2]University of Cambridge. [3]UK CEH. [4]Zoological Society of London. [5]Stellenbosch University

Abstract

Widespread declines in insects have been attributed to a diverse set of drivers, but the relative importance of these drivers remains unclear. A key reason why is that the effect of drivers depend on many factors, such as taxonomy, geography, sampling method, and biodiversity metric. To better understand the relative impact of different drivers on insects, effect sizes need to be anchored to major sources of heterogeneity, and collected reproducibly through a structured protocol. Such a quantitative synthesis should enable more robust predictions of changes in insect biodiversity. Here we introduce a database of effect sizes that quantify the effect of anthropogenic drivers on insect biodiversity, structured to allow the continual addition of new studies. As far as we know, this database provides a framework for the first global meta-analytic overview of the response of insects to a range of major anthropogenic threats.

Three tests for the effectiveness of protected areas

Hannah F Burger, Alistair G Auffret

Swedish University of Agricultural Sciences

Abstract

Protected areas are the cornerstones of biodiversity conservation. However, the evidence for their effectiveness is somewhat mixed. We will use new datasets quantifying land-use change across both Great Britain and Sweden together with climate data to assess the impact of protected areas and other conservation actions on occurrences of plants, butterflies and bird species in an era of rapid global change. Comparing the situation both before and after area protection, as well as trends in locations both receiving and not receiving protection, we will answer the following questions: [1] Do protected areas prevent the loss of valuable habitat?; [2] Do protected areas prevent local extinctions?; [3] Do protected areas facilitate colonisations of range-shifting species? In doing so, we aim to provide the reliable answers that are urgently needed for effective conservation policy and management.

Augmenting the evidence-base for conservation decision-making using population modelling

Dr Callum J Macgregor, Dr Hannah FR Hereward, Dr Harry Ewing, Dr Rachel C Taylor

British Trust for Ornithology

Abstract

Policy-makers need to understand the likely outcomes of actions prior to implementation, but often lack evidence to support informed decision-making. We explore the use of population models to predict outcomes of conservation interventions.

We describe how combining evidence from the literature, bespoke analysis of citizen science datasets, and multi-expert consensus where data are unavailable, can facilitate evidence-based predictions about the impacts of conservation-relevant interventions to directly inform decision-making.

We illustrate this approach using three recent case studies, showing that (i) licensed lethal control of fish-eating birds for salmonid conservation may impact their conservation status; (ii) Red Kite populations are resilient to planned wind energy expansion; and (iii) baseline demographics influence expected outcomes of Curlew conservation interventions.

We discuss the need to ensure that evidence from population modelling, including uncertainty, is understood correctly and applied appropriately by decision-makers, and the scope for such approaches to be used more widely in conservation.

Conservation translocations in a changing climate: Where next for the UK?

Dr Martin J Gaywood

NatureScot. University of the Highlands and Islands

Abstract

Conservation translocation is the movement of species by people for conservation purposes. The numbers of reintroductions and other types of conservation translocations in the UK and internationally are increasing rapidly. Often they are biologically and socially complex, requiring a range of multidisciplinary and interdisciplinary expertise.

Historically the focus of conservation translocations has been to benefit the conservation status of specific, threatened species. However, increasingly they are also being used to assist the wider restoration of ecosystems through releasing specific keystone species or multiple species to rebuild ecological systems. The contentious 'assisted colonisation' of species with poor dispersal abilities, and at risk of environmental change, is now being considered more. And the use of synthetic biological techniques will bring new biological, social and ethical challenges.

This presentation looks at the creative, new techniques being developed, draws on international experience, and examines the opportunities and challenges that may apply in the UK.

Inadequate protection of international boundaries highlights an urgent need for transboundary conservation

Tiantian Zhang[1], Luke Gibson[2], Jun Ma[1], Rachakonda Sreekar[3], David Lindenmayer[4], Jiajia Liu[1]

[1]MOE Key Laboratory for Biodiversity Science and Ecological Engineering, School of Life Sciences, Fudan University, Shanghai, China. [2]School of Environmental Science and Engineering, Southern University of Science and Technology, Shenzhen, China. [3]Department of Biological Sciences, National University of Singapore, Singapore. [4]Fenner School of Environment and Society, Australian National University, Canberra, Australian Capital Territory, Australia

Abstract

Transboundary conservation is an important component of global efforts to conserve biodiversity, but it may be compromised by differences in conservation efforts and policies on either side of a border. However, little is known about the protection status around national borders at a global scale. Here, we analyzed global distribution patterns of border protected areas and determinants of the protection status of international boundaries. We found that 35.6% of terrestrial national borders were subject to protection on at least one side, with only 11.2% protected on both sides of a border. Borderland conservation extent was affected mostly by socioeconomic factors, rather than conservation needs. Moreover, there was a mismatch between conservation priorities and conservation efforts: 55.5% of national boundaries of high conservation value had no overlap with protected areas. To strengthen transboundary conservation outcomes, we highlight a need to implement conservation policies and decisions at the supranational level.

Playback experiments reveal drivers of anthropogenic disturbance in an endangered and endemic African antelope

Mr Alex Cranston[1,2], Dr Jakob Bro-Jorgensen[1]

[1]University of Liverpool. [2]Natural History Museum

Abstract

Anthropogenic disturbance is a key threat to animal populations globally. Bale Mountains National Park (BMNP) in Ethiopia hosts the most important population of the endangered and endemic mountain nyala, but is exposed to multiple anthropogenic disturbances due to common incursions into the protected area by livestock, humans and domestic dogs. Here, we present the results of playback experiments conducted in BMNP on mountain nyala to assess the impact and relative importance of these disturbances. Disturbance was assessed by measuring vigilance in response to sound stimuli played from a loudspeaker to grazing nyala. We found that all stimuli used (livestock, humans, dogs) caused significant disturbance compared to a control sound, but that dog sounds triggered by far the greatest vigilance. Whilst it is challenging to unequivocally link this to longterm changes in behaviour, we overall consider further evidence that anthropogenic disturbance may be aggravating threats to this already endangered species.

Accounting for land cover in a habitat specific analysis of the responses of British birds to future climate change.

Miss Beckie George[1], Prof Rachel Warren[1], Dr Jeff Price[1], Dr Aldina Franco[1], Dr James Pearce-Higgins[2], Dr Dario Massimino[2]

[1]University of East Anglia. [2]British Trust for Ornithology

Abstract

Species distribution modelling tools are commonly used to explore species' geographical responses to climate change, but usually exclude land cover due to data and modelling constraints. Moreover, landscape composition can impact a species' ability to respond to climate change, and overlooking this can lead to overestimating ranges in otherwise suitable areas. This study modelled the global climate envelopes of 210 British bird species and projected them under future climatologies (UKCP18) centred on six global warming scenarios. Habitat associations were identified for each species, and projected changes in species richness were calculated for each habitat under climate change alone, and climate change and land cover combined. Accounting for land cover influenced the projected exposure of bird communities to climate change, underscoring the importance of considering habitat associations and landscape context when projecting species distributions. This approach also offers insights for enhancing the climate change resilience of biodiversity within land use frameworks.

Combining detection- and motivation-related factors to map wildlife crime risk: an example with wildlife poisoning in Spain

Ms. María Fernández-García, Mr. Jorge Rodríguez-Pérez, Dr. José Vicente López-Bao, Dr. Patricia Mateo-Tomás

Biodiversity Research Institute (CSIC – University of Oviedo – Principality of Asturias), 33600 Mieres, Spain

Abstract

Low and imperfect detection of wildlife crimes hampers resource allocation against these illicit activities. Spatially explicit risk mapping may enhance this process, particularly in improving patrolling activities. Herein, it is crucial to consider the dual nature of wildlife crimes, assessing the differential influence of factors affecting cases' detection and those related with motivations. We illustrate the utility of this approach using an extensive database of >1,300 animals registered as poisoned in 2010-2022 in northwestern Spain, combined with an Integrated Species Distribution Model accounting for imperfect detection and heterogeneous information. Poisoning risk was largely influenced by factors affecting detection (e.g., human density, canine units). Motivation-related factors included agriculture and small livestock. Poisoning hotspots were identified where on-ground efforts should increase, either preventive to discourage this illegal activity or to search for poisoning cases. Our approach can be applied to risks mapping of different wildlife crimes where presence-only data are usually available.

Bat auto-ID: does it help or hinder manual classification of acoustic data?

Miss Samantha J Perks, Prof Anne E Goodenough

University of Gloucestershire

Abstract

Despite rapidly evolving automated analysis tools for bat call classification, manual classification by technicians is still widely undertaken. Moreover, it is recommended to audit automated classifications for validation and error rate estimation purposes. However, manual analysis remains a subjective process, and is typically carried out by technicians with varying levels of skill and experience. Here, 45 recordings of known species were analysed by 32 technicians with skill levels ranging from beginner to experienced. For each recording, a classification was made firstly without, and secondly with, the aid of an auto-ID suggestion. Key findings include a higher prevalence of favourable identification outcomes when the auto-ID suggestion was correct. Additionally, technicians with higher skill levels were more likely to make a correct classification despite an incorrect auto-ID suggestion. These findings highlight a need for caution in using analysis software packages that provide auto-ID suggestions, particularly where used by less experienced technicians.

Carbon or biodiversity? Or both? Or neither? Challenging peatland restoration as a nature-based solution in the natural capital market

Dr Rosie Everett, Rob Tolcher, Capucine Jacob-Chavagnac

Zulu Ecosystems

Abstract

Under the Kyoto Protocol, Natural Capital markets have monetised nature-based solutions (NBS) since 1997. In more recent years, peatland restoration has been leveraged across the UK as a key investment in the $2bn voluntary carbon credits market. In 2024, they became the focus for the (disputed) implementation of nature credit stacking (e.g., carbon and biodiversity credits) because of the ecosystem service opportunities peatlands have been afforded.

Whilst not naturally high in biodiversity, peatlands play a vital role for rare and threatened species, which remains at odds with this forthcoming nature credit stacking. In this paper, we examine how to best reward peatland restoration programmes integrating biodiversity to suit current frameworks and biodiversity standards under development. We emphasise the role of a holistic approach to peatland health that draws on existing metrics to examine a beyond-NBS approach, which may provide a more sustainable approach to understanding success in peatland restoration.

Irrigation as a rehabilitation tool to improve habitat condition for the whorl snail, *Vertigo geyeri*, in Ireland.

Ms Aedín Mc Adams

Trinity College Dublin

Abstract

Protection of habitats alone is not sufficient to combat biodiversity loss. Restoration and rehabilitation techniques offer promising solutions for recovery of degraded ecosystems. The Habitat's Directive protected whorl snail *Vertigo geyeri* is an indicator species of wetland habitat quality. Found in calcareous fens, it is stringent in its habitat requirements and sensitive to hydrological instability. This project, the first in Ireland granted under the EU Habitats Directive Article 6(4) using Imperative Reasons of Overriding Public Importance (IROPI), investigated the efficacy of irrigation to improve hydrological stability and habitat condition in a calcareous fen in the Lough Hoe Bog SAC, Co. Sligo, Ireland. Using a BACI model approach, habitat assessments including botanical composition, openness and wetness were analysed and compared to a reference condition site. Results show that irrigation has the potential to improve habitat condition and increase hydrological stability, allowing for the translocation of *Vertigo geyeri* into the habitat.

Impact of habitat loss on biodiversity is underestimated due to taxonomic shortfall

Ms. Lu Feng[1], Prof. Ferry Slik[2], Prof. Rachakonda Sreekar[3], Dr. Shilu Zheng[1], Dr. Yangqing Luo[1], Prof. Jiajia Liu[1]

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Abstract

Species-area relationships have been widely used to estimate species extinction rates from habitat loss. Previous studies implicitly assumed that all species are accurately described. However, numerous new species are being described annually, undermining this implicit assumption. Whether and how much incomplete species discovery impacts the prediction of biodiversity loss remains unknown. Here we compiled species lists from 234 ocean islands and 57 archipelagos for birds, mammals, and reptiles to investigate the impact of undescribed species on species-area relationships. Our results showed that slopes of species-area relationships increased consistently with species discovery completeness. Specifically, the rate of underestimation is higher for poorly studied taxonomic groups and at larger spatial scales. Therefore, the silent loss of species due to habitat loss is prevalent and needs urgent conservation action. We call for increased ground-based taxonomic efforts to accelerate species discovery, combined with protection of high-diversity and unique habitats to protect yet-to-be-described species.

Spatial prioritization of conservation effort for a rare tree (*Syzygium maire*) endangered by myrtle rust

Sarah M Herbert[1,2], Stephanie A Tomscha[3,1,2], Hao Ran Lai[4,2], Rubianca Benavidez[5], Colan Balkwill[1], Pearl Ruston[1,2], Bethanna Jackson[5], Julie R Deslippe[1,2]

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Abstract

Myrtle rust (*Austropuccinia psidii*) is an emerging pathogen in New Zealand that represents a grave threat to the wetland-obligate tree *Syzygium maire*. We employed a novel combination of high-resolution hydrological modeling and integrated species distribution modeling to identify natural and managed refugia from myrtle rust for *S. maire*. Our models predict that 13% of the study region may offer natural refugia with high quality *S. maire* habitat and lower myrtle rust risk, of which 369 km^2 (5% of the region) is accessible for people to plant additional *S. maire* and restore wetlands. Additionally, 11% of the region offers high-quality habitats with higher myrtle rust risk that are accessible for people to actively manage disease outbreaks. We recommend leveraging the power of people to supplement natural disease refugia by creating, expanding, and protecting habitat for rare species in a rapidly changing world.

Is conservation doing more harm than good to global biodiversity? How can we tell?

Dr David R Williams[1], Dr Thomas S Ball[2], Prof Andrew Balmford[2], Dr Graeme Buchanan[3], Dr Alison Eyres[2], Dr Jonathan Green[4], Dr Fiona Sanderson[3]

[1]University of Leeds. [2]University of Cambridge. [3]Royal Society for the Protection of Birds. [4]University of York

Abstract

Conservation actions often carry opportunity costs (e.g. reduced food production) and can displace environmentally damaging activities to other areas. Global trade could facilitate such "leakage" from relatively low-biodiversity Global North countries to high-biodiversity locations elsewhere, potentially resulting in net biodiversity harm from conservation.

At BES2023 I raised the controversial possibility of biodiversity net loss from ambitious UK initiatives. This led to a lot of lively debate and highlighted the lack of an easily applicable method for investigating this complex issue.

Here I build on these discussions and outline a framework which conservation actors—from individuals to governments—can use to estimate the overall biodiversity impacts of conservation projects, incorporating both on- and off-site impacts.

This is a vital, controversial, and under-discussed topic, and I believe a robust but practical framework of the kind I will present is essential for global conservation to succeed.

Leveraging Large Language Models for Context-Based Information Extraction in Ecological Research: A Case Study using ChatGPT

Dr Sruthi M Krishna Moorthy, Dr. Man Qi, Dr. Roberto Salguero-Gomez

University of Oxford

Abstract

Large language models (LLMs), like ChatGPT, are transforming research workflows across disciplines. However, their effectiveness in extracting context-based ecological information from unstructured text remains largely untested. This study evaluates ChatGPT's ability to extract structured ecological information from scientific abstracts, focusing on the use of drones/robots to monitor ecosystems as a case study. We identified trends and potential research gaps by extracting nine types of ecological information, ranging from basic study locations to complex details, such as specific ecological phenomena or variables measured by drones/robots. Our approach was validated on 200 abstracts, with ChatGPT-4.0 consistently achieving over 75% accuracy across all categories. These findings suggest that, with well-designed prompts, LLMs can efficiently extract relevant information, greatly reducing the time and effort needed to identify research gaps and trends. This method could enhance conservation strategies by rapidly synthesizing knowledge on emerging monitoring technologies and their applications.

The status and future of Scotland's Caledonian Pinewoods

Dr Emily Warner[1,2], James Rainey[3], Darren Wisniewski[3], Prof Andy Hector[1], Prof Nathalie Seddon[2], Prof Yadvinder Malhi[1]

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Abstract

Caledonian Pinewoods are descended from wild Scots pine (*Pinus sylvestris*) that colonised Scotland following the last ice age and are one of Scotland's most ecologically valuable, but also most fragmented and vulnerable, habitats. In 2018-2021 the NGO Trees for Life resurveyed 72 Caledonian Pinewood remnants, assessing tree, vegetation, and herbivore impact metrics in over 1,200 plots. Browsing will shape the future of the forest, reducing tree richness and expansion when pressure is high. Tree richness is typically higher in the earliest stages of tree regeneration, as browsing pressure impacts tree growth to maturity and alters forest composition, with birch (*Betula* sp.) projected to replace Scots pine at some sites. Fencing can reduce herbivore impacts, but significant herbivore impacts still occur within many fenced sites. Increasing tree diversity, continuity of tree cover, and cover expansion will require effective deer management in the future.

A conservation tale: the Tiny Mousetail (*Myosurus minimus*)

Dr. Eva Maria Malecore[1,2], Nadline Kjelsberg[1,2]

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Abstract

The Tiny Mousetail (*Myosurus minimus*) is an annual herbaceous plant species from the Ranunculaceae family. It is native to the Northern Hemisphere and grows in ruderal sandy-loamy sites that are occasionally flooded. *M. minimus* is endangered in several European countries, and threatened with extinction in Switzerland. The main threats are habitat loss and degradation, land drainage, urbanization and changes in water balance. Currently there is only a single viable population left in Switzerland, located in Solothurn.

In order to ensure the survival of the species in Switzerland, we are planning conservation introductions of *Myosurus minimus* to establish one or more new populations. The introductions are backed up by three pre-studies to determine: 1) the genetic structure of the existing population; 2) the role of soil-biota for the species; 3) the presence and effects of specialized phytopathogens. The results of these pre-studies will be presented in this talk.

Ecological restoration of mining sites: After seven years of research, what have we learned?

Dr. Guy Rotem, Prof. Yaron Ziv

Department of Life Sciences, Ben-Gurion University of the Negev, Israel

Abstract

Phosphate strip mining in Negev's Oron-Ziv region, spanning 60 years, devastates the hyper-arid ecosystem. A new reclamation-oriented method, stacking topsoil and overburden separately, aims to restore the original landscape. Our seven years study analyzes differences between natural and restored sites, including soil, microorganisms, plants, and arthropods, and suggests reclamation improvements. Genetic analysis reveals fewer crucial photosynthetic groups like cyanobacteria in restored sites, hindering biocrusts. Germination issues result from missing seed banks in restored sites, and they harbor generalist arthropods versus diverse specialists in natural sites. Our findings guide the mining company's restoration efforts, merging ecological principles with practical strategies for biodiversity and habitat restoration.

Uncovering Spatial Biases in Species Occurrence Data obtained from Contributory Citizen Science in the UK.

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Abstract

Species distribution models (SDMs) often rely on species occurrence data from citizen science, which is spatially biased and affects the accuracy of model predictions. Recent research suggests that occurrence records from infrequent contributors may intensify these biases while prioritising frequent contributors' data could improve SDM accuracy. To investigate this, we analysed 4.8 million iNaturalistUK records (2008-2023), comparing both user groups. We computed the geographic median centre of each user's observations and evaluated these against various spatial and socioeconomic factors. Further, we examined spatial dispersion using standard distance deviation and K-means clustering. Our results revealed no significant spatial bias differences between the groups. The geographic medians of both groups' observations were frequently in built-up areas, regions with high population density, areas of median socioeconomic deprivation, and one-person households. Most user records were concentrated within a 100 km radius and clustered in urban areas. These findings offer implications for enhancing SDM accuracy.

Woodland Creation Scheme in the Yorkshire Dales focuses tree planting on lower carbon soils

Miss Francesca H Darvill[1], Professor Dominick V Spracklen[1], Dr Cat E Scott[1], Professor Pippa J Chapman[2], Professor Mike J Kirkby[2], Dr John Crawford[3], Dr Robert Mills[4], Miss Robyn Wrigley[1]

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Abstract

Space-for-time approaches are commonly used to investigate difference in soil carbon after native woodland creation (NWC) due to commonly missing baseline data. New studies have shown tree-planting in the UK uplands cause soil carbon loss, resulting in no net gain of ecosystem carbon over decadal timescales. We hypothesis that NWC schemes have preferentially targeted lower carbon soils, and space-for-time approaches without baselines can't account for this factor.

We assessed topsoil carbon (0-15cm depth) within three tree-planting densities used at a new NWC scheme in the Yorkshire Dales, UK. Average topsoil carbon stock in the high-density plots (80.4 ± 3.8 t C/ha) was significantly lower ($p < 0.05$) than in the low-density (90.8 ± 3.3 t C/ha) and unplanted control plots (100.4 ± 4.6 t C/ha). These results highlight potential errors associated with using space-for-time experimental approaches when attempting to estimate carbon uptake or loss in the uplands after land-management change.

Conflation of reforestation with restoration is problematic and widespread in non-forest ecosystems

Professor Catherine L Parr[1], Dr Mariske te Beest[2], Dr Nicola Stevens[3]

[1]University of Liverpool. [2]Utrecht University. [3]University of Oxford

Abstract

In this, the UN Decade of Restoration, the African Forest Landscape Restoration initiative (AFR100) aims to restore 100 million hectares through planting and natural regeneration of trees. There is growing concern that restoration that aims to increase tree-cover is widespread non-forest ecosystems, such as savannas and grasslands, yet the scale of the issues is unknown. This matters because open ecosystems can be degraded by too many trees. We therefore examined the AFR100 programme to determine the extent to which non-forest systems are targeted for tree-planting restoration initiatives and what type of restoration is underway. We quantified the total area and determined the proportion of restoration projects in savannas. Agroforestry was the most common type of restoration initiative. Our analysis across Africa highlights that vast areas of non-forest are threatened by inappropriate restoration in the form of tree planting.

A systematic conservation planning approach to expanding England's SSSI network

Rob Critchlow[1], Rob Keane[2], Colin M Beale[1]

[1]University of York. [2]Natural England

Abstract

As the UK meet its commitments under the Global Biodiversity Framework it must expand the protected area network. Systematic Conservation Planning should allow identification of priority locations for informing the Protected Sites Designations Strategy and its contribution to a Nature Recovery Network, but to be effective a diverse range of stakeholders must agree on the process. In this presentation we describe the results of a workshop aimed at developing a systematic conservation plan for England that involved major stakeholders from across the land management and conservation community. We describe the diversity of values across and within the stakeholders, and the analytic process that enabled us to generate a map of England's priority landscapes. We show how different values generate different priorities, but also how reconciliation is possible with low cost to individual goals. Our map shows priority areas fall in both areas for expansion of existing sites and new areas.

Seabirds and climate change in North-West Europe: identifying opportunities for an effective and efficient conservation response

Prof Nathalie Pettorelli[1], Dr Nigel Taylor[2], Dr Henry Hakkinen[1], Prof Bill Sutherland[2], Dr Silviu Petrovan[2], Dr James Butler[3]

[1]Zoological Society of London. [2]Cambridge University. [3]Cawthron Institute

Abstract

Calls are growing for coordinated and collaborative responses to conserve species threatened by climate change, but how this works in practice remains largely unexplored. We carried out semi-structured stakeholder interviews to explore the human context underlying seabird conservation in the face of climate change in North-West Europe, with the overall aim of identifying opportunities for improving our response to this threat. Interviewees highlighted several barriers to conservation work explicitly linked to climate change, pertaining to information, leadership, resources, and values/beliefs. Although seabird conservation networks were found to be generally well-established and harmonious, they were moreover not tension-free. We use our case study to present suggestions to increase the effectiveness and efficiency of wildlife conservation in the face of climate change.

Gardens fill seasonal hunger gaps for farmland bumblebees

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Abstract

Gardens can benefit pollinators living in surrounding farmland landscapes, but the reason for their value is not clear. Gardens are no different from many semi-natural farmland habitats in terms of the *quantity* of floral resources they produce, but the *timing* of their resource supply is very different, which may explain their value. We quantify the phenology of nectar production in farmland landscapes in Southwest UK and show that small clusters of rural gardens can provide between 50% and 95% of total nectar supply during early-spring and late-summer when farmland supplies are low. Gardens can therefore reduce seasonal hunger gaps for bumblebees. An agent-based model reinforces this point, showing that *timing*, not *quantity*, of garden nectar supply enhances bumblebee colony growth and survival. Given that over 90% of British farmland is within one kilometre of a garden, positive actions by gardeners could have widespread spillover benefits for pollinators across the country.

Science Strategy on England's National Nature Reserves

Dr Rosalind A Gleave, Dr Erica Morley, Mr Ben Le Bas, Dr Isabel Alonso-Rodriguez

Natural England

Abstract

Science and monitoring have always been central to the purpose of England's National Nature Reserves (NNRs). This year, Natural England published its first-ever Strategic Plan for Science on NNRs to better coordinate and enhance the scientific work already taking place on these reserves.

We are now in the first year of a five-year plan to implement this strategy. NNRs serve as 'outdoor laboratories,' making them ideal locations to test new ideas, advance our understanding of nature recovery, and address major environmental science questions. We are setting national and local science priorities, improving how we share conservation outcomes and data with the broader conservation community, and training our NNR Reserve Managers in enhanced experimental design. Additionally, we are collaborating on publications for *Conservation Evidence* and expanding our partnerships with academic institutions and other organizations. We invite academic and NGO partners to approach us to collaborate on NNR-based research.

Bibliometrics and Text-Mining Analysis of Pollinators Research Trend in a Warming Climate

Mamta Sharma, Dr. Purushothaman C Abhilash

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Abstract

Warming climate is impacting global biodiversity, including pollinators. However, the research trend in this area is poorly understood. The present study utilizes bibliometric and text-mining methods to explore the research trend in bees and butterflies. A total of 868 articles published between 1991-2023 were analysed. The research production shows a rising trend for both taxa; however, there is a shifting focus towards the bees. Analysis of international collaborations shows a low Multiple Country Publication ratio in the top publishing countries. The taxonomic comparison shows, butterfly group is highly explored than bees. Further, the analysed publication has dispersed structure across genera for butterflies with the main family Nymphalidae, while for bees the studies were primarily on Bombus and Apis genera of the Apidae family. This analysis gives valuable information on studies' localization both geographically and taxa-wise, highlighting the need for research decentralization for global pollinator conservation in times of climate change.

Advancing shark population assessments: a novel approach to estimating absolute abundances with underwater cameras

Miss Isabel L M Black[1,2], Dr Claire Collins[2,3], Dr Tom B Letessier[4], Dr Marcus Rowcliffe[2], Dr Katrina J Davis[1]

[1]University of Oxford. [2]The Zoological Society of London. [3]University of Exeter. [4]University of Plymouth

Abstract

This study introduces a new approach to estimating absolute shark abundances using data from Baited Remote Underwater Video Systems (BRUVs). Given the urgent need for accurate and cost-effective methods to monitor declining shark populations, we work towards a model that overcomes the limitations of current BRUVs metrics, which only provide relative abundance estimates. By integrating time of first arrival (TOFA) data and species-specific swimming speeds with bait dispersion modelling, this research aims to deliver the first applied model capable of estimating absolute shark abundances. The methodology will be tested using video data from the Chagos Archipelago, offering a scalable and accessible tool for global shark conservation efforts.

Poverty and climate-induced migration exacerbate deforestation in protected areas in Madagascar

Dr Herizo Andrianandrasana

University of Warwick, School for Cross-Faculty Studies

Abstract

Human migration in search of better living conditions has significant social and environmental impacts due to the changes in the use of natural resources. We explored potential links between human migration and land use change in the Menabe Antimena protected area, Madagascar, via in-person semi-structured interviews with migrants and spatial changes in forest cover and fire incidents. The number of migrants increased 3.2 times between 2018 and 2022. 63.04% of migrants were directly involved in illegal and non-sustainable agricultural practices. The forest cover decreased by 25.02% while the number of detected fires increased by 23.74%. The 45.65% of migrants have a firm plan to return home when they saved enough money and 13.04% intend to move to more productive areas when the local forest was cleared. We highlight the need to implement effective policies to support migrants to engage with more sustainable agricultural practices given the potential link with deforestation

Monitoring Ecosystem Services in Bornean Tropical Forests: Integrating Drone and Satellite Analysis across Large Spatiotemporal Scales

Kotaro Komatsu[1], Masanori Onishi[1], Ryuichi Takeshige[2], Shogoro Fujiki[3], Nobuo Imai[4], Kazuki Miyamoto[5], Shin-ichiro Aiba[6], Kanehiro Kitayama[1], Sandy T Lui[7], Reuben Nilus[7], Yusuke Onoda[1], Ryota Aoyagi[1]

[1]Kyoto University. [2]NIES. [3]Biome Inc.. [4]Tokyo University of Agriculture. [5]FFPRI. [6]Hokkaido University. [7]Sabah Forestry Department

Abstract

Monitoring of ecosystem services for large areas with fine spatiotemporal resolution is increasingly required for tropical forest safeguarding. Satellite remote sensing is a powerful tool, yet extensive ground truthing is required. Our study explored how drone use could aid ecosystem service monitoring in c. 100,000-ha logged-over tropical forests. We captured >500 ha of drone RGB images in three forest management units (FMUs) in north Borneo, Malaysia, and developed a regression model to estimate carbon and biodiversity values using drone-derived metrics and vegetation plot data. This model was extrapolated to the entire drone images. Carbon and biodiversity values of the entire three FMUs were estimated using machine learning techniques with these values extrapolated from drone images, plot data, and satellite reflectance. The inclusion of drone-derived information significantly improved prediction accuracy. Drone surveys are a promising option to provide satellite remote sensing with ground-truth data for ecosystem service monitoring of tropical forests.

Modelling connectivity of enclosed reintroduced beaver projects in the UK to support population management

Miss Melanie Baker[1,2], Dr Martin Varley[3], Prof Paula Stockley[1]

[1]University of Liverpool. [2]Cheshire Wildlife Trust. [3]RSPB

Abstract

The Eurasian beaver (*Castor fiber*) has been successfully reintroduced into Great Britain via enclosed projects. However, these projects are often isolated, with only 2-4 beavers per site. This isolation presents a challenge for these small populations to connect. It is crucial to understand the potential spread of beavers and connectivity between sites. We map the connectivity of all waterbodies across Great Britain under three dispersal effort scenarios to visualise potential expansion of enclosed beaver projects. We found that 14 reintroduction sites are connected under a scenario involving minimal dispersal effort, but seven remain isolated even with maximum effort. Using LinkageMapper, we identify optimal dispersal paths where future reintroductions may enhance connectivity. Despite geographic isolation, we observed an overall increase in connectivity between 2019 and 2024. Pending changes in government legislation on wild releases, the coordination and planning of enclosed projects will be required to ensure healthy populations develop.

Europe's 'Biodiversity Potential': Holistic nature restoration under global change and European legislation

David Y Shen, Prof. Signe Normand

Aarhus University

Abstract

With the adoption of the Nature Restoration Law in the EU, nature restoration has become integral to the European nature conservation strategy with specific goals to restore 'not in good condition' habitats. Therefore, it is crucial that restoration is implemented effectively for the most beneficial outcomes for biodiversity and society. Many current restoration projects use reference states or baselines based on pristine ecosystems without any human influence. By fixing the goal of restoration to a historical or pristine state, we may be setting fundamentally unachievable goals for restoration that may succumb to global change. We propose an alternative approach, using 'Biodiversity Potential' to represent the biodiversity that could be recovered through restoration, while accounting for drivers of global change. We aim to identify the 'Biodiversity Potential' across Europe and use this to map 'not in good condition' habitats that would benefit the most from nature restoration.

Ecosystem functions of abandoned rice paddies contributing to climate-change adaptation

Jun Nishihiro[1], Ayato Kozu[1], Kazuaki Otsuki[2], Masakazu Hashimoto[3], Rei Itsukushima[4]

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Abstract

Among the risks increased by climate change, flood risk, water quality degradation risk and biological extinction risk could be reduced by utilising wetland ecosystems. In Japan, the area of abandoned farmland is increasing due to population decline and changes in the industrial structure. We studied the ecological functions of rice paddy-derived wetlands, appropriate ecosystem management and the spatial arrangement of wetlands in one lake basin in Japan. As a result, we were able to identify the spatial arrangement of wetlands effective for flood prevention. It was also found that wetlands can reduce nitrogen loading from surrounding agricultural land by controlling water retention times. Furthermore, several endangered species were found to inhabit abandoned paddy fields with improved functionality. The functional assessment indicators developed in a series of studies could be useful for the management of agricultural land and abandoned land in other areas.

Effective biodiversity monitoring of fish in rivers using eDNA metabarcoding: modelling on the River Severn

Clare E Collins[1,2,3], Professor Robert M Dorrell[1], Professor Bernd Hänfling[4], Dr Lori Lawson Handley[3], Professor Dan R Parsons[5], Dr Jonathan D Bolland[2]

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Abstract

Community-wide, spatially-explicit biodiversity monitoring is essential in assessing priorities, progressing nature recovery and providing evidence for policy, action and advice. Environmental DNA (eDNA) sampling of rivers for metabarcoding is a non-invasive biomonitoring tool that is highly sensitive to detect even elusive and rare species. However, the stochastic nature of eDNA and river systems can lead to spatial uncertainty.

Using transport models, we explored the effect of decay rate and species location on the eDNA concentration downstream and attempted to predict the signal origin upstream. We also took water samples from the River Severn to explore eDNA concentration in a model area related to species' behaviour, with a particular focus on the twaite shad (*Alosa fallax*). Here we present results modelled in an idealised system along with eDNA concentration related to predictions from species' behaviour.

A critical analysis of the ecological impacts and legal regulation of hydrogen extraction from the North Sea: a Bayesian Belief Network.

Miss Natalie R Harris[1], Professor Rick Stafford[1], Mr Tilak Ginige[1], Dr Iain Green[2], Dr Betty Queffelec[3]

[1]Bournemouth University. [2]Bournemouth Univeristy. [3]University of Western Brittany

Abstract

Hydrogen produced through wind powered water electrolysis will provide a reliable energy carrier. Saltwater electrolysis technology is still developing, meaning questions remain about the most ecologically safe way to conduct this on a commercial scale. Possibilities exist to achieve saltwater electrolysis through offshore co-location of electrolysers with wind turbines or transportation of offshore wind energy to onshore electrolysers. Holistic modelling will allow analysis of these two scenarios to compare their environmental impact. Possible negative consequences exist for benthic, demersal and pelagic species, meaning the implications could be detrimental to the functioning of the North Sea.

Subsequent analysis of current legislation regulating hydrogen will be vital to determine effectiveness at protecting the marine environment from overexploitation and will allow for necessary legal recommendations to be made to ensure ecologically safe technological advancements. Combining science and law disciplines allows for an evidenced based approach to the acceleration of the energy transition

Scoping indicators to assess the effectiveness and adequacy of climate change adaptation interventions for biodiversity

Blaise Martay[1], Diana E Bowler[2], Simon J Duffield[3], Richard D Gregory[4], Alun H Jones[5], Nathalie Pettorelli[6], James W Pearce-Higgins[1,7]

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Abstract

There is an urgent need for results-based indicators to evaluate actions taken to facilitate biodiversity's adaptation to climate change.

To identify potential indicators, and criteria with which to assess these, we carried out three stakeholder workshops. Initial discussions focused on indicator attributes and criteria for assessing potential indicators, which were categorized into three groups: Usability, Accuracy and Availability.

Seven potential indicators were identified in the workshops. Four directly examined climate change impacts on populations, and three indicated trends in ecological functions linked to ecosystem resilience to climate change. We used the created framework of criteria to carry out a preliminary qualitative assessment of the indicators.

Key discussion points included the importance of defining success, the difficulty in attributing changes to adaptation, and the challenge of defining adaptation actions. We recommend combining process-based adaptation monitoring, with a suite of indicators of adaptation effectiveness and adequacy to monitor climate change adaptation.

Predicting vertebrate population declines: The role of life history traits in mediating population sensitivity depends on threat type and intensity.

Sarah Bull[1], Dr Rikki Gumbs[2], Dr Simone Blomberg[3], Dr Katrina Davis[1], Dr Rob Salguero-Gómez[1]

[1]Department of Biology, University of Oxford. [2]Institute of Zoology, Zoological Society London. [3]School of Biological Sciences, The University of Queensland

Abstract

Effective conservation requires understanding how populations respond to threats. Progress has been made to identify traits that influence extinction risk; however, we know little about how the relationship between traits and extinction risk changes with threat type and intensity. To address this knowledge gap, we used data from the IUCN Red List on the severity of species response to distinct threats. We employed a phylogenetically corrected PCA to characterise the life history strategies of Tetrapoda, and GAMs to explore how population decline varies across the life history trait space, and how this relationship changes with threat type and intensity. We found that life history strategy predicts population response to distinct threats but only when less than 50% of the population are impacted. The shape of the relationship greatly depends on threat type. Our results emphasise the importance of considering threat type and intensity when predicting species response to threat regimes.

Accounting for uncertainty in aggregated abundance-based biodiversity indicators

Dr Shawn Dove

Justus Liebig University Giessen

Abstract

Multi-species biodiversity indicators are essential tools used to track biodiversity trends and guide conservation and policy decisions. Therefore, it is important that they include reliable measurements of uncertainty. Precise confidence intervals can be calculated for indicators that use systematic monitoring protocols, but for indicators that use aggregated data, such as the Living Planet Index and the Priority Species Indicator, existing methods fail to account for real-world uncertainties.

The GAM-resampled rank envelope method generates accurate and precise confidence intervals for aggregated abundace-based indicators across a wide range of parameters. It accounts for multiple levels of uncertainty while reducing the influence of outlier growth rates that lead to inappropriately wide confidence intervals when measurement or sampling error are high. It thus offers a significant advancement for indicators like the Living Planet Index, ensuring that trends and their potential implications are interpreted with the appropriate level of confidence.

Mixed provenance of organic carbon in temperate intertidal seagrass sediments

Dr Emma A Ward[1], Dr Sarah E Reynolds[1], Prof Melanie J Leng[2,3], Dr Jack H Lacey[2], Dr Marianna Cerasuolo[4], Bronwen Paxton[1], Dr Federica Ragazzola[5]

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Abstract

Blue carbon accreditation for climate mitigation services provided by coastal ecosystems, such as seagrass beds, currently includes only autochthonous organic carbon in their valuations. Here, a multi-proxy approach is used to determine the provenance of organic carbon in two intertidal temperate seagrass ecosystems in the Northeast Atlantic. The organic carbon to nitrogen ratio (C_{org}/N) and carbon isotope composition ($\delta^{13}C$) of seagrass tissues and sediments from an open coastal sandy site (Ryde, UK) and a muddy tidal inlet site (Farlington Marshes, UK) were measured. Sedimentary C_{org}/N was found to be higher at the muddy site than the sandy site, suggesting a greater contribution of marine algal organic matter in the latter. Isotopic mixing model analysis showed seagrass biomass contributes 12-16% to accumulated sedimentary C_{org}. These findings demonstrate that temperate Northeast Atlantic seagrass sediments are dominated by allochthonous C_{org} (84-88%) and that current blue carbon accreditation frameworks undervalue these ecosystems.

Mind the Gap: Are national plans ambitious enough to bend the curve of biodiversity?

Dr Nick Isaac[1], Prof Andy Purvis[2]

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Abstract

The Kunming-Montreal Global Biodiversity Framework (KM-GBF) set an ambitious goal to recover nature and achieve healthy wildlife populations by the year 2050, as well as targets for action by the year 2030. Two unresolved questions are 1) Whether actions laid out in the National Biodiversity Strategies and Action Plans would be ambitious enough to achieve the 2030 targets? and 2) If the 2030 targets are met, does this put the world on a pathway to meet the 2050 goal? The UNFCCC refers to the "implementation gap" and "ambition gap" to describe these issues. To date, such concepts have rarely featured in discussions about biodiversity targets. We present the case that biodiversity models can quantify the ambition gap and implementation gap with respect to the KM-GBF and the English Environment Act targets.

The role of Protected Areas in mitigating range loss and local extinctions of terrestrial mammals

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Abstract

Protected Areas (PAs) are a major tool in biodiversity conservation, but the extent to which they mitigate species declines is often unclear. Here we evaluate the effectiveness of PAs in preventing range contraction and local extinction for 483 species of terrestrial mammals. We compare expert-based species range maps from the 1970s with current distributions to estimate changes in range area and PA coverage over the last five decades. We use generalized boosted models and propensity score matching to assess the effectiveness of PAs in mitigating species declines within landscape units sharing environmental features but differing in their protection status. Local extinction rates were nearly half as low in areas protected continuously since the 1970s (11.2%) compared with matched landscape units that were never protected (20.4%). Reduced species extinction and range contraction rates were also directly correlated with increased area encompassed by PAs, and time since the establishment of PAs.

Future habitat suitability of key agroforestry multipurpose trees in Benin: A Biodiversity conservation perspective

Mme DOGBO SEDOAMI FLORA

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Abstract

This study investigated the future suitable habitat of twelve key multipurpose tree species (MPTS) in Benin under two climate scenarios (SSP245 and SSP585) for the 2070 horizon. Focusing on peri-urban and protected areas, the research projected habitat changes under future climate scenarios and identified suitable habitat hotspots in Benin. To achieve this, four algorithms (GAM, GLM, Maxent, and RF) were employed. The models performed well, with a mean AUC of 0.88 and a mean TSS of 0.64. The results indicated a decline in suitable habitats for 67% of MPTS species, minor changes for 8%, and an increase in suitable habitats for 25% of the species. Comparative analysis pointed out the mixed effectiveness of protected areas in conserving MPTS. Savalou and Abomey peri-urban areas are identified as key conservation hotspots, emphasizing the need to shift conservation focus to these areas.

Developing effective indicators of wild bee species richness across Europe

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Abstract

Pollinator monitoring is often constrained by the availability of trained taxonomists and/or by the costs related to species identification. Here, using 63 independent studies sampling wild bees across Europe, we showed that the total abundance of wild bees was a very strong predictor of wild bee species richness with an average correlation above 0.80. Observed abundance-richness correlations were consistent across different climates, habitats, and sampling methods suggesting that, after a simple training, counting all bee individuals in transect walks could provide a non-lethal, effective method to robustly estimate wild bee species richness. With the growing involvement of non-specialists in pollinator conservation, the use of our proxy could facilitate the expansion of pollinator monitoring initiatives across Europe, particularly to areas where the lack of funding or taxonomic expertise are a limiting factor.

Prioritizing Stepping Stone Reefs to Maintain Connected Reef Networks Worldwide

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Abstract

Conserving coral reef climate refugia is a conservation strategy promoted to address climate change, but the accelerating impacts of coral bleaching and other stressors are expected to jeopardize refugia persistence. Coral larval dispersal networks are expected to increase long-term reef persistence through meta-population dynamics, as connected reefs can share beneficial adaptations to bleaching and facilitate demographic recovery. Here, we use network modeling to identify present-day coral larval dispersal networks of refugia and determine which reefs (stepping stones) should be prioritized to ensure that refugia remain connected, pending future reef degradation. We identify 10 key stepping stones (none of which are currently protected) in Indonesia, Mozambique, Madagascar and Malaysia that ensure that 84,564 km^2 of refugia will remain connected even if all other reefs become degraded. Global coral reef conservation efforts should prioritize conserving these stepping stones so as to build more redundancy and resilience into future-proofing conservation strategies.

Conservation strategy: spatial prioritization approach using Orchids

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Abstract

The biodiversity crisis necessitates innovative conservation strategies. Italy's rich biodiversity presents a unique opportunity for such approaches. This study uses scenario analysis and predictive models to identify new protected areas (PAs), focusing on orchids as biodiversity indicators. By leveraging LifeWatch as a comprehensive database, we incorporated ecological, phylogenetic, and functional diversity metrics into a 2x2 km grid analysis of 12,567 cells. The analysis, conducted using LifeWatch's advanced tools like MATLAB, identified 25 cells (0.2%) as biodiversity hotspots with high orchid richness. Cells within buffer zones showed greater effectiveness in orchid conservation. These results highlight the importance of specialized databases in driving effective conservation programs. By focusing on the Orchidaceae family, our findings offer valuable insights for policymakers, guiding targeted actions towards a nature-positive future.

Macro- and micro-scale habitat requirements of three dispersal-limited calcicolous plants (*Carex humilis*, *Phyteuma orbiculare*, and *Thesium humifusum*) for informed facilitated range shifting

Hugh M Richards, Dr Sarah E Dalrymple, Dr Danielle L Hinchcliffe, Dr Robert N Fitt

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Abstract

Facilitated range shifts are poleward and elevational conservation translocations of dispersal-limited species threatened by climate change in their historic range. With risk of translocation failure high in out-of-range introductions, understanding macro- and micro-habitat requirements is critical. Here, we consider these requirements for three dispersal-limited calcicolous plants: *Carex humilis*, *Phyteuma orbiculare*, and *Thesium humifusum*.

At the macro-scale, species distribution modelling highlighted the strong role of climate in determining each species' range, with southern range edge contraction and northern range edge expansion projected at subsequent time steps.

At the micro-scale, botanical community composition was uniform between presence / absence quadrats, but species' abundances varied significantly. Significant within-site variation in sward and soil variables occurred, but patterns were rarely consistent across sites.

These results show how study species' microhabitat preferences hinge on community structure, with environmental factors important at the site-level. Such information is critical for guiding successful out-of-range introductions.

A resource-based habitat approach to describe the functional habitat of the Black-veined White butterfly (Aporia crataegi)

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Abstract

The Black-Veined White butterfly (*Aporia crataegi*, BVW) is a native UK butterfly, which became extinct in Britain in the 1920s. A reintroduction effort is ongoing to reinstate this iconic species to the UK. Reintroduction projects can be effective conservation strategies to mitigate Lepidoptera loss, but it is key for the species resource requirements - including consumables (e.g., hostplants, feeding resources, roosting and mating sites, refuges) and utilities (thermal regimes and specific climate) - to be known and maintained across landscapes. Here, we used a resource-based habitat approach to identify the relative importance of species-specific ecological resources on the BVW population size in Normandy. We found that a homogeneous distribution of host plants, a heterogeneous distribution of nectar plants and a greater overlap between the two resource, were positively associated with *A.crategi* population size. This approach can effectively contribute to conservation efforts by identifying sites with greater potential of reintroduction success.

Duck Tales: Spatio-temporal dynamics of habitat use and prey relationships of Common Eider and its implication for conservation management

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Abstract

Effective protection of endangered and vulnerable species requires an in-depth understanding of spatiotemporal patterns relating to resource use and human threats. This is extra challenging for mobile species, like the common eider (*Somateria mollisima*). The common eider is an important target species for the North Sea region, one of its major wintering sites. However, in many wintering sites, no area-specific measures are in place regarding this species. Here, we use long-term (1993-2023) monitoring data to identify temporally consistent hotspots of wintering common eiders. We find clear hotspots of wintering common eiders, corresponding to places with high abundances of their preferred prey. However, the current spatial layout of protection measures poorly overlaps with the preferred wintering locations of common eiders. This mismatch emphasizes the need to better align conservation goals and practices. Explicit knowledge of spatiotemporal resource use can aid in designing Marine Protected Areas with clear objectives and boundaries.

Losing the parachutes? How has tropical ecology changed over 60 years?

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Abstract

There has been widespread discussion about inequity in global ecological research, and the BES has embarked on a strategy to address this issue. Tropical ecology is at the forefront of such issues, as its focus of research is in the Global South, yet financial resources are still mainly in the Global North. We conducted an analysis of all tropical ecology publications on Web of Science since 1960 using ChatGPT to analyse where research was being done and who was doing it. We find major shifts over this time, away from domination by North institutions, with Brazil in particular leading this transition. Co-authorship patterns have changed: in the 1970s, only 20% of publications involved local co-authors, whereas since the 2000s around 80% of publications do. There is still more to do and understand, but we find substantial positive shifts away from "parachute science" to inclusive and global ecological practice.

Effects of Riparian Buffers on Pollinator Activity in Oil Palm Plantations

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Abstract

In Southeast Asia, insect declines have been linked to habitat degradation due to oil palm expansion, yet paradoxically, oil palm relies on insects for ecosystem services that support yield, such as pollination. More sustainable management is needed, such as restoring forested riparian buffers within oil palm.

I investigated the impact of riparian buffers on pollinators in Indonesian oil palm plantations as part of the Riparian Ecosystem Restoration in Tropical Agriculture (RERTA) Project, a large-scale, long-term Before-After-Control-Impact experiment. Using baited sticky traps and direct insect counts, I assessed the efficacy of three riparian buffer restoration strategies and a control. Although environmental conditions changed, there were no major differences in pollinator communities or fruit set between restored buffers and the control.

My results indicate that riparian buffers change environmental conditions, but more time is needed to see community-wide impacts. These findings have implications for the management of oil palm in Southeast Asia.

An analysis of the Statutory Biodiversity Net Gain Metric in the context of Rewilding Ecosystems in Northeast England

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Abstract

Rewilding has gained momentum in the last decade as an approach to reverse biodiversity loss and land degradation. Biodiversity Net Gain (BNG) has emerged as a policy to meet infrastructure demands and environmental targets, requiring all new developments in England to create a 10% "gain" of biodiversity. This research aims to determine the suitability of the BNG statutory metric to predict the conservation potential of rewilding projects in the Northeast of England. Results show a total projected biodiversity change of >10% for all sites, and thus met the minimum statutory target for BNG. The BNG metric can be determined as a suitable method for predicting conservation potential of rewilding projects, however it does not sufficiently consider sub-category habitat detail and biological balance indicators within ecosystems.

Benthic biodiversity and food web recovery post-decommissioning of oil and gas structures

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[1]University of Essex. [2]Centre for Environment, Fisheries and Aquaculture Science

Abstract

Offshore oil and gas structures (OGS) approaching to the end of economic purposes are required to be decommissioned in the North Sea. However, emerging evidence argued that these structures could provide beneficial ecological effects like de facto MPAs. Using a biological trait approach on an industry benthic monitoring database, this study analyzed the decommissioning effects and post–decommissioning recoveries on seabed benthic invertebrate communities. Communities near the platform showed signs of recovery after the decommissioning with a larger increase in total individuals and top predators, leading to more diverse taxa and complex food web structure. Communities near wells showed adversely impacted with fewer species richness and simplified but more connected food webs. The post–decommissioning communities showed initial recovery but slow for larger organisms and top predators. While ecological benefits cannot be generalized owing to limited survey data, the study advocates continuous long-term post-decommissioning monitoring to guide better management decisions.

Optimising Aquarium-Based Seedling Establishment and Assessing Seed Germination Regimes for Key Seagrass Species in the United Kingdom

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Abstract

Seagrass habitat restoration success rates remain low, indicating a requirement for improved strategies. An ongoing study investigates seed selection and germination by assessing seed viability under natural and synthetic conditions. The effects of seed colour and light on the germination of *Zostera marina* (Zma) and *Nanozostera noltii* (Zno) were examined through controlled trials. Germination success under artificial light (PAR 142 µmol/cm^2 s) averaged 4.2% for both species, compared to 5.0% for Zma and 5.1% for Zno under natural light, with no significant differences observed. Dark-coloured seeds of Zma showed a 2.2% germination rate versus 7.0% for light-coloured seeds ($p=0.063$). For Zno, dark-coloured seeds germinated at 3.7% compared to 5.7% for light-coloured seeds ($p=0.293$). Light-coloured seeds in Zma appear to have a marginal advantage while increasing sample sizes could yield more accurate results for Zno. Adopting a wider light spectrum could enhance germination success by boosting photosynthesis and overall plant health.

Balancing Conservation and Livelihoods: Understanding Positive Intentions Towards Wildlife Conservation Amidst Farmland Abandonment in the Uttarakhand Himalaya

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Abstract

Crop depredation by wildlife is perceived as the primary reason for increasing farmland abandonment among the subsistence agricultural communities of Garhwal, Uttarakhand Himalaya, India. The perceived negative role of wildlife in farmland abandonment can have repercussions for wildlife conservation in the region. We utilised the Theory of Planned Behaviour to analyse the role of attitudes, subjective norms, and perceived behaviour control in influencing people's (N=102) intention to participate in wildlife conservation. Results of multiple linear regression model (R^2 = .59, F(3, 98) = 48.81, p<.001) suggest that favourable attitudes toward wildlife (β=0.608, p < .001), reinforced by social norms (β=0.160, p=0.0520), and perceived control (β= 0.186, p=0.0118), collectively sustain positive conservation intentions despite a greater percentage of people citing wildlife as the primary reason for farmland abandonment (43%). A deeper understanding of why positive intentions persist despite negative perceptions is crucial to developing more effective and targeted conservation strategies.

Commodity traceability through chemical composition to reduce global deforestation

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Abstract

Export-driven agriculture is causing unprecedented forest loss worldwide despite international mitigation efforts. The production of soybean and oil palm alone accounts for nearly one fifth of all agricultural deforestation—topped only by the beef industry. Several importing economies are introducing legislation to regulate the trade in, and importation of, Forest Risk Commodities (FRCs). These laws require science-based traceability testing to determine the plausibility of point-of-origin claims made by FRC distributors. Here, we present a complete analytic pipeline for testing origin claims of FRCs, based on their elemental and isotopic composition, using a geolocated reference library of South American soybeans and a Gaussian Process regression model. Our method predicts soybeans origin to within 193 (±23.5) km from the true harvest location. This tool will promote supply-chain transparency and traceability where current efforts fall short, and facilitate timely and effective action to regulate global FRC supply chains.

A Global Audit of the Pollinator Citizen Science Landscape

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Abstract

Addressing the myriad threats that face pollinator populations worldwide requires coordinated, evidenced-based action and accurate monitoring. The task is great. However, people are increasingly aware of pollinator declines and want to help. Thus, citizen science projects that educate and engage in pollinator monitoring have proliferated. We carried out a global audit of pollinator citizen science. Using online searches and expert input we collected 141 projects focusing on pollinating species, interactions and pollination outcomes, from 6 continents. We assessed projects according to 40 attributes and used Multiple Factor Analysis to map the landscape of pollinator citizen science. We show how projects vary along axes of effort and accessibility and how different approaches impact outputs for monitoring, research and engagement. We also highlight key gaps and opportunities, demonstrating how a diverse landscape of pollinator citizen science can contribute to monitoring at the local and global scale to help meet conservation targets.

Urban habitats associate with a change in dietary niche and gut microbiota in the bank vole.

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Abstract

Urban development can have diverse impacts on wildlife physiology and health. In this study, we quantified bacterial and fungal gut microbiota (by amplicon sequencing) and diet (by stable isotope analysis) of bank voles inhabiting forests in national parks, managed forests, suburban forests, and forests in urban areas from sites across central Finland. Animals from urban environments had distinct bacterial and fungal gut microbiota compared with voles from other forest habitats (especially national parks). Moreover, the urban and non-urban bank voles differed in their dietary niches, with an apparent loss of lichens from the diets of urban voles. Animals in urban areas tended to have higher percentage body fat. Affecting the availability of dietary items is therefore a prominent route by which urban development can alter the composition of wildlife bacterial and fungal gut microbiota, and potentially the condition of the host.

Unifying Connectivity Science for A Well-connected Planet

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Abstract

New global biodiversity targets focus on ecological connectivity as a foundational component of biodiversity conservation, including establishing “well-connected” networks of protected areas around the world. A clear challenge is to transform the concept of “well-connected” from nebulous to a scientifically grounded and quantifiable concept that is applicable to conservation. We propose an operational definition of ‘well-connected’ and describe a unified, mathematical framework for connectivity that can be directly linked to diverse empirical data for interpreting the extent to which landscapes are ‘well-connected’ and provide guidance for conservation interventions. We apply this framework to the Florida Wildlife Corridor, where major investments are underway. Our assessment provides key information on where landscapes are well-connected for land mammals and strategies for improving connectivity through land acquisition and restoration. Our framework helps address the pressing need to protect and manage areas that support species’ movements and meet the diverse needs of nature and people.

Perceptions and use of evidence among farmers combatting disease

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Abstract

Bovine tuberculosis (bTB) is a bacterial disease prominently affecting cattle in England. Current policies to reduce disease spread have focused on cattle testing and badger culling, but recently the Government has shifted wildlife policy to focus instead on badger vaccination. There is however reported concern among farmers over the lack of evidence to support this. In a comparative study of three case studies of badger vaccination, we used key informant interviews with participating farmers to assess their attitudes towards evidence. Here, we present an analysis of how farmers in different case studies will judge the success of their vaccination schemes, and how they think they will use the evidence they have access to. We show differences in how farmers value different pieces of evidence, based on their circumstances and experience with the disease. This research has implications for current policy decisions by emphasising the role of evidence for key stakeholders.

From single to multi-species conservation: using camera trap data and multi-species occupancy modelling to understand space use in a Tibetan Plateau mammal community

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Abstract

Prioritizing conservation efforts towards single charismatic species to the presumed benefit of co-occurring species is common practice in conservation. However, the underlying assumption that the habitat needs of surrogate species are suitable indicators for other species is seldom tested with systematically collected data. We used snow leopards, *Panthera uncia*, a commonly used surrogate in the Himalayan-Tibetan ecosystem to test this assumption. We used camera trapping data to understand the reaction of individual mammal species and the overall community to both human land use and natural environmental features. The results showed that only one-third of co-occurring species shared habitat requirements with snow leopards and would thus benefit from its habitat protection. In contrast to a single-surrogate strategy focused on the snow leopard, we found that a multi-surrogate approach would provide a more balanced assessment to the conservation benefit of the entire community.

Ecological consequences of treescape expansion through planting and natural colonisation

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Abstract

Treescapes expansion is a priority to boost biodiversity and mitigate climate change. In the UK, this has been historically achieved primary through tree planting. But recently, there is growing interest in integrating 'natural colonisation'—allowing trees to naturally spread into new areas—as a complementary strategy for achieving large-scale woodland expansion. Proponents contend that woodlands formed through this process may exhibit greater structural diversity, ecological complexity, and resilience than planted woodlands. These approaches can also be combined, for example using low-density planting to kick-start natural processes. However, there is limited evidence of the ecological outcomes of these approaches. We systematically compared the biodiversity, structural characteristics, and ecological functions of 28 woodlands across England established through planting, natural colonisation, and hybrid approaches. Initial analyses indicate differences in structural characteristics and biodiversity (e.g. higher plant and moth diversity in hybrid woodlands) which highlight the benefits of expanding treescapes through diverse methods.

Quantifying the biodiversity co-benefits with the Wakehurst Ecosystem Observatory

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Abstract

The pressures of climate change, land-use practices and resulting decline in biodiversity are pushing UK habitats towards ecosystem collapse. Evidence is required to identify trends in ecosystem function, inform and test policies that are designed to reverse the trajectory of decline and inform people on the societal benefits of biodiverse habitats. The Royal Botanic Gardens Kew established Nature Unlocked to help build this science-based body of evidence as well as engage with and share the values of UK biodiversity. At RBG Kew Wakehurst, Nature Unlocked scientists have installed the Wakehurst Ecosystem Observatory, a living laboratory and Long-Term Experiment research facility to identify and monitor trends in function, diversity and structure of key UK habitats. This paper presents results from two years of carbon, pollination and nature-connectedness research, sharing insights into the co-benefits of biodiversity identified across habitats and the importance of collaborative partnerships to deliver high-impact science.

Functional equivalence hypothesis: pristine versus spontaneously recovered grasslands

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Abstract

We studied diversity and functional characteristics of pristine and recovered steppic grasslands using plots ranging from 0.01 to 100m^2. We found that there are remarkable differences in taxonomic diversity between pristine grasslands and spontaneously recovered ones from small to large scale. But we found no difference in functional diversity based on multi-trait indices between pristine and recovered grasslands. Patterns and physiognomic structure of spontaneously recovered grasslands became similar to those of pristine grasslands, but the species richness and diversity remained much lower. This suggest that there is a functional saturation of the species assembly; the frequent species recover but the high diversity of rare species characteristic to pristine grasslands is missing in the spontaneously recovered grasslands even 50 years after abandonment of agricultural use. Our findings suggest that pristine grasslands harbour high biodiversity and even small fragments of these grasslands act as important refuges for plant species.

Biodiversity conservation through local-scale interventions: a meta-analysis

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Natural History Museum, London

Abstract

Local-scale conservation interventions – such as planting flowers, trees or hedges, installing wildlife ponds and green roofs, reducing management intensity, or providing resources for nesting or shelter, etc. – aim to mitigate biodiversity loss in people's local environments and can also engender a sense of agency and nature-connectedness. These local-scale actions are proposed by the UK government as ways to improve biodiversity and improve children's access to nature across the entire education estate in England. However, there is lack of consensus about the effectiveness of many local-scale interventions as studies often find divergent effects on biodiversity. Furthermore, we do not know which conservation interventions are most effective in different contexts (spatial or taxonomic). We therefore use systematic review and dynamic meta-analysis to estimate the impact of different interventions on biodiversity, including any variation in effectiveness according to context. We present findings for the first intervention studied: local-scale increases in flowering plants.

The Ecological Feasibility of Trophic Rewilding in Britain

Miss Mia E Arundel, Dr Chris Clements, Dr Max T Stockdale, Professor Jane Memmott

University of Bristol

Abstract

Britain ranks as one of the most nature depleted countries on Earth, with biodiversity continuing to decline despite the implementation of traditional conservation efforts. Trophic rewilding presents a transformative solution by aiming to restore lost ecosystems through the reintroduction or reinforcement of extirpated or endangered species. This methodology relies on the reinstatement of trophic complexity to promote natural processes and restore healthy ecosystems. Despite promising early results from the few established rewilding projects, little research has been done to assess its large-scale feasibility in Britain. Our study uses ecological niche models (ENMs) to identify suitable locations for the reintroduction of ten key species and highlights several potential rewilding 'hotspots.' These findings, combined with social data, aim to guide future efforts to ensure that rewilding initiatives in Britain are both ecologically effective and socially supported.

Integrating anthropogenic impacts and climate change projections to identify conservation priorities for giraffe.

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[1]University of East Anglia. [2]Tyndall Centre for Climate Change Research

Abstract

Anthropogenic pressures and climate change pose significant threats to many species. Whilst identifying climate change refugia is a crucial step for successful long-term conservation, further integrating indirect climate impacts and human activities provides a more comprehensive approach. Giraffe, as charismatic species, contribute to African economies through tourism and play vital ecological roles. However, many populations are declining due to habitat loss, fragmentation, and poaching. Using species distribution models and zonation analyses, we have identified conservation priorities under various warming scenarios. We have incorporated factors such as agriculture, extreme climate events, shifts in the distribution of food species and predators, and human population growth, to determine the areas of refugia that are least exposed to negative pressures. Our findings offer a detailed guide for giraffe conservation under a changing climate, highlighting priority areas that minimise threats and maximise long-term viability.

Can environmental RNA characterise the physiological status of the European eel?

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Abstract

The European eel, *Anguilla anguilla*, is a critically endangered species which is hard to survey using standard methods.

This PhD project aims to build upon established environmental DNA (eDNA) work on European eels by identifying environmental RNA (eRNA) recovered from water samples and monitor the expression of genes related to ecologically relevant traits.

RNA is extracted from water samples collected from eel tanks. The RNA is amplified and analysed to assess if specific genes related to life stage and physiological stress are being expressed. So far it has been possible to extract RNA from water samples and look for housekeeping genes specific to *A. anguilla*.

If successful in a captive context, the method will be tested at rivers with known eel populations to assess whether species-specific eRNA detection is possible and what the eRNA can tell us about the physiological status of eels without the need for invasive handling.

The effect of abiotic urban stressors on pollinator-plant interactions

Miss Stephanie Glendinning[1], Dr Jill Edmondson[1], Dr Luke Tilley[2], Dr Stuart A Campbell[1]

[1]University of Sheffield. [2]Royal Entomological Society

Abstract

Urban environments present numerous challenges for pollinating insects. While the impacts of habitat availability have been well-studied, less attention has been given to how abiotic stressors, including pollution, drought, and the urban heat island effect, indirectly influence pollinators by affecting the availability and quality of floral resources (pollen and nectar). We are investigating the impact of road traffic pollution on pollinator diversity and abundance, and plant-pollinator interactions, using patches of wildflower turf established in pairs of high-pollution (main road) and low pollution (minor road) grass verge sites across Sheffield, UK. Pan traps were used to assess variation in pollinator diversity and abundances in relation to proportion of surrounding greenspace. Experimental plots will be used to harvest pollen and nectar and assess how urban stress affects reward quality (i.e., secondary metabolite, protein and lipid content). We discuss our findings in the context of effective conservation of pollinating insects in urban environments.

Exploring PFAS Concentrations, Exposure Routes, and Trophic Transfer in Wood Turtles (*Glyptemys insculpta*) in an Impacted Area of Maine

Dr Matthew W.H. Chatfield[1], Kara J. SantaLucia[1], Dr Jitka Becanova[2], Dr Dianne A.D. Kopec[1]

[1]University of Maine. [2]University of Rhode Island

Abstract

Per- and polyfluoroalkyl substances (PFAS) are a group of chemicals that pose significant risks to animals and humans. Of particular concern are sensitive species like the North American wood turtle (*Glyptemys insculpta*), which is declining throughout its range. Wood turtles exhibit a seasonal migration pattern and thus have different potential exposure pathways throughout the year. Focusing on a population involved in a long-term monitoring project, we collected water, sediment, diet, and nonlethal tissue samples to assess the severity of PFAS contamination, as well as to identify exposure routes and quantify trophic transfer. Fifteen PFAS compounds (out of 56 tested) were detected in the water samples, with sum concentrations reaching 125ng/L. PFAS concentrations in blood serum exceeded these by a hundredfold, indicating bioaccumulation. Our study adds to the growing body of knowledge regarding PFAS contamination in the environment and their concerning propensity for transfer and bioaccumulation in an imperiled species.

Enhancing accuracy in ecosystem services and biodiversity hotspot assessments

Dr. Paul M Evans[1], Prof. Simon Willcock[2,3], Dr. Rachel A Neugarten[4], Patrick R Roehrdanz[5], Prof. James M Bullock[1]

[1]UK Centre for Ecology and Hydrology. [2]Rothamsted Research. [3]Bangor University. [4]Wildlife Conservation Society. [5]Conservation International

Abstract

Environmental policies increasingly focus on maximising ecosystem services (ES) and biodiversity. To support these goals, areas of high ES and biodiversity, known as "hotspots", are often identified for protection or management. However, these hotspot assessments are typically based on a single model, which can result in inaccurate or unreliable outcomes due to inherent model uncertainties. Model ensembles, which combine multiple outputs into a single, weighted result, have been shown to improve accuracy when modelling individual metrics. This research explores whether using combined model ensembles for both biodiversity and ES can reduce uncertainty in hotspot assessment. By evaluating potential errors across different continents, we examine the limitations of single-model approaches in mapping biodiversity and ES hotspots, assessing whether combined ensembles provide more reliable results. The findings suggest that using an increasing number of model ensembles for both biodiversity and ES improves certainty, which could ultimately aid better-informed environmental policies and decision-making.

Semi-natural grasslands as Nature-based solutions for climate change mitigation

Dr Tamsin Lockwood, Dr Jessica Elias, Dr Melanie Stone, Mrs Melanie Spiers, Miss Rebecca Davess, Mr Nicholas Izard, Miss Hannah Kemp, Miss Emily Mason, Dr Jodie Hartill, Professor Mike Morecroft

Natural England

Abstract

Semi-natural grasslands have the potential to sequester carbon and enhance biodiversity, and therefore offer substantial opportunities as nature-based solutions for climate change mitigation. However, our understanding of how this potential for carbon storage might work alongside their diversity benefits is based on a small quantity of variable evidence. Here, we use a chronosequence approach to investigate soil carbon and plant diversity in semi-natural grasslands of a range of ages, from newly established to over 150 years old. Our results show that overall soil carbon stock increased with grassland age, by up to 106% when comparing grouped younger (<25 years) and older (26-100 years) fields. Environmental metrics specific to each site, in particular clay content and mean annual rainfall, were among the strongest predictors of soil carbon stock within linear mixed effects models. Plant diversity was not found to increase with habitat age but was strongly correlated with soil carbon stock.

Nature Returns: an assessment of the impact of semi-natural habitat creation for carbon and biodiversity

Dr Melanie Stone, Dr Tamsin Lockwood, Melanie Spiers, Becky Davess, Nick Izard, Hannah Kemp, Emily Mason, Dr Jessica Elias, Dr Jodie Hartill, Prof. Mike Morecroft

Natural England

Abstract

Nature-based solutions through the creation of semi-natural habitats offer a unique opportunity to tackle the twin crises of climate change and biodiversity decline. However there remains a lack of quantification of the potential of these habitats to store and sequester carbon, and how this can be considered alongside their ecological value to maximise societal gains.

Across six Local Partnership Projects, 628 ha of habitat and 9 km of hedgerow have been created for their potential as nature-based solutions for climate change. Soil carbon, vegetation composition, above-ground carbon, and carbon flux (CO2 and CH4) studies have been conducted across these sites in multiple habitats including grasslands, woodlands, floodplains, and hedgerows.

The initial results of this extensive project are presented, which not only enables the establishment of a baseline to assess resultant changes from habitat interventions, but also allows for the comparison of current habitats within and across project sites.

Nature-based solutions for climate change at the Landscape Scale: initial results from the Nature Returns programme

Prof Mike D Morecroft

Natural England. Nature Returns Programme

Abstract

Nature Returns is a £17.5m programme, with a wide range of local and national partners, that brings together research, habitat creation, community engagement and green finance. It is building the evidence base on how to best deliver benefits for biodiversity, climate change mitigation and people within 6 mixed landscapes across England. I will present an overview of the programme and headline results from the first 3 years of the programme, with a focus on which habitats provide most benefit for carbon and biodiversity, whilst at the same time being practical for local land managers to deliver and fund going into the future. The implications for progressing net zero and nature recovery will be considered.

Hedgerows as a nature-based solution for climate change mitigation

Miss Becky Davess[1], Dr Mandy Cooper[2], Dr Tamsin Lockwood[1], Miss Melanie Spiers[1], Dr Melanie Stone[1], Dr Jessica Elias[1], Mr Nicholas Izard[1], Professor Mike Morecroft[1], Miss Hannah Kemp[1], Dr Justin Moat[2]

[1]Natural England. [2]Royal Botanic Gardens Kew

Abstract

Semi-natural and natural habitats offer numerous ecosystem services, which are being increasingly explored as nature-based solutions. Hedgerows are widespread in the UK, but their contribution to climate change mitigation through carbon sequestration and storage is unclear and reliant on a few datasets. This study aims to expand current understanding, through the development of a non-destructive method for hedgerow carbon estimation. Lidar-based estimation of hedge volume was compared with hedge biomass samples of varying sizes to determine if a consistent relationship can be observed. Estimation of hedge volume and measures of hedge biomass were compared with carbon stocks in adjacent soil to determine if hedge biomass and volume can estimate soil carbon levels. This project aims to extend sampling to explore variation in hedgerow management practices, to determine how these affect carbon sequestration and guide on optimal practice for long-term carbon storage.

Airborne eDNA to Aid Bat Conservation

Iseult Merlin[1], Dr Paul Lintott[1], Dr Jon Flanders[2], Dr Ben Williams[1], Dr Mark Steer[1]

[1]University of the West of England, Bristol. [2]Bat Conservation International

Abstract

Documenting the biodiversity, abundance and distribution of bat species are critical steps towards implementing conservation strategies in the face of increased anthropogenic pressures. While initially, eDNA work focused on monitoring biodiversity within aquatic environments, recent work shows that eDNA can be recovered directly from air samples. Airborne eDNA could therefore be effective in detecting bat populations aggregating in large numbers in enclosed roosting spaces.

This poster will discuss our research assessing the potential for airborne eDNA to be used as a rapid, non-invasive survey method for bat populations in both small, UK populations and large (~2 million) bat populations in Jamaican cave. We outline the use of both DNA metabarcoding and qPCR to investigate the capacity for airborne eDNA to provide reliable species inventories, facilitate data collection, allow for enhanced surveys of low-abundance species and limit disturbance to bat populations when compared to traditional surveying techniques.

Co-benefits of tidal power barrages – protection of vulnerable ecosystems, populations and infrastructure.

Miss Sylvia E Ascher[1], Miss Iris M Gray[1], Dr Caroline Howe[2], Dr CM (Tilly) Collins[2]

[1]Dyson School of Design Engineering, Imperial College London. [2]Centre for Environmental Policy, Imperial College London

Abstract

Development of tidal range energy has been hindered by negative perception of the ecological impacts of tidal barrages. These impacts, however, are less severe than believed, and there is little evidence to substantiate historic concerns. With rising sea levels and increasing extreme weather event frequency through climate change, many ecologically valuable coastal and estuarine ecosystems as well as human communities and infrastructure face heightened risk of flooding and habitat loss.

As knowledge and data have grown, implementation of specific operational strategies for tidal barrages can protect key ecosystems by maintaining sea levels and natural tidal cycles within the basin, and upstream populations and infrastructure by reducing risk of storm surges travelling up the estuary.

Viewed through a systems lens, tidal barrages now present promise to balance renewable energy generation with coastal ecosystem conservation and flood risk reduction, making them a valuable tool in mitigating some climate change impacts.

Linking Landscape Features and Insect Abundance to Bird Productivity Across Europe

Miss Sarah E Binnie[1], Professor Jennifer A Gill[1], Dr Catriona A Morrison[1], Dr Robert A Robinson[2], Dr Simon J Butler[1]

[1]University of East Anglia. [2]British Trust for Ornithology

Abstract

Since the 1980s severe declines have occurred in many Afro-Palaearctic migratory bird species. Previous work has demonstrated considerable spatial variation in population trends and productivity across European breeding grounds, with sites that are better for migrants also better for residents. Understanding the mechanisms driving this variation and co-variation can inform how the local environment could be manipulated to improve poor breeding sites and boost productivity. A pilot study at 12 central-England Constant Effort Scheme (CES) ringing sites demonstrated that those with above-average productivity rates had significantly greater insect abundance than below-average sites. In 2024, we expanded this sampling to over 250 sites across 11 European countries, with volunteer ringers deploying sticky traps during CES sessions to monitor flying insects. We use this novel, continental-scale dataset to examine relationships between site-level bird productivity, insect numbers and features of the surrounding landscape, with the aim to identify targets for conservation action.

A comprehensive tool for prioritising ecologically sensitive locations and driving nature-positive actions

Dr Benjamin Howes

Natcap

Abstract

There exists an urgent need to address the ongoing nature crisis, and businesses must play a pivotal role in fostering positive change. As a result, there has been a significant increase in corporate attention on biodiversity. In response to this attention, several frameworks for companies to report their impacts on nature have emerged. These frameworks set out steps for companies wanting to make a positive impact and include nature in business, particularly through determining their proximity to ecologically sensitive locations.

Our advanced prioritisation tool enables screening of any site in the world (both terrestrial and marine assets) for proximity to ecologically sensitive locations. Our tool aligns with best practices and with reporting guidance and standards (TNFD and CSRD). By leveraging our screening tool, businesses can turn data-driven insights into responsible nature-positive actions.

Prioritising conservation actions for nature recovery

Dr David J Baker, Dr Siddharth U Kumar, Professor Ilya MD Maclean, Professor Kevin J Gaston

University of Exeter

Abstract

The focus of nature conservation has shifted from protection to recovery, recognising the urgency of *bending the biodiversity curve*. Decades of conservation theory and practice have shown that the strategic targeting of conservation actions is important for maximizing biodiversity benefits given limited resources. In many locations, landscapes have been cleared of natural vegetation and reversion to historical states is not necessarily achievable or optimal given existing or emerging threats (i.e., climate change). Here, strategic decisions are required about not only where to focus conservation efforts but what specific actions to take where and when. As such, there are important differences in the concepts, values and techniques used for prioritising nature recovery actions compared to prioritising the protection of existing habitat. Here, we introduce a novel spatial prioritisation method for targeting nature recovery actions and illustrate the approach with a case study on the Lizard peninsula in Cornwall, UK.

Rewilding: An approach for increasing the microclimate diversity of landscapes?

Mr Cameron J Goodhead, Professor Philip A Stevens, Professor Steve G Willis, Dr Rebecca A Senior

Durham University

Abstract

Microclimates that substantially deviate from the broader macroclimate may enable species to persist locally in otherwise inhospitable areas. Heterogeneous landscapes with greater diversity of microclimates available can increase provisioning of these 'microrefugia' for species. Understanding how different land management approaches affect microclimate diversity is of key importance for ensuring the future resilience of ecosystems to climate change. One such approach, rewilding, is becoming increasingly prominent for tackling the global biodiversity crisis. The typical increase in ecological complexity associated with rewilding is suggested to increase the heterogeneity of landscapes. As a result, rewilding could present an effective approach for increasing the microclimate diversity of large areas and thereby potentially buffer organisms against the effects of climate change. In this research, we combine drone-based photogrammetry methods with microclimate measurements and modelling to assess changes in microclimate diversity across the Knepp Estate, Sussex, a site that has been rewilding for over two decades.

Systematic conservation planning for nature recovery: a Cornish case study

Dr Marcus W Rhodes, Dr David J Baker, Professor Ilya M D Maclean

University of Exeter

Abstract

Across England, Local Authorities are currently developing their Local Nature Recovery Strategies (LNRS). Mandated under the Environment Act 2021, these are a set of statutory spatial strategies that must agree local priorities for nature's recovery, map the most important existing areas for nature, and map specific proposals for creating or improving habitat. Our team at the University of Exeter has been commissioned by Cornwall Council to undertake mapping of the LNRS for Cornwall and the Isles of Scilly. This talk will showcase the novel approach that we have developed to prioritise opportunities for nature recovery, using systematic conservation planning (SCP) to target habitat creation/restoration according to the needs of multiple individual species.

High wetland habitat quality amid emerging stressors: Insights from the wetlands of Oba Water Reservoir, Nigeria.

Oluwatobi E Olaniyi[1 2 3], Taiwo O Soliu[1], Ajoke F I Akindele[4], Troy M Farmer[3], Akshit R Suthar[2 3], James T Anderson[2 3]

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Abstract

Wetlands around water reservoirs face increased threats from stressors, underscoring the necessity for comprehensive ecological risk assessments to inform management decisions. We evaluated the habitat quality and risk factors of wetlands at Oba Water Reservoir, Nigeria, employing an integrated valuation approach. Landsat 8 satellite imagery was analyzed to derive wetland habitat stressors' related to land use/cover. Wetlands occupied the largest area among the land use categories. The habitat degradation index varied between 0.00027 and 0.00028, with habitat quality scores ranging from 0.8 to 1.0, reflecting high habitat quality. Despite this, the major wetland habitat stressors identified were domestic water supply, firewood harvesting, farming, fishing, and overgrazing. To mitigate these risks, we propose implementing urban rewilding, ecological revetment, and vegetation recovery strategies. These recommendations aim to enhance habitat quality, reduce degradation, and bolster ecological resilience and biodiversity in the Oba Water Reservoir wetlands.

Introducing PaRaVis as a powerful graphical Python tool for seamless plant diversity analysis from spaceborne data

Prof. Hooman Latifi[1,2], Mr. Mohammadreza Fathi[1], Prof. Hamed Gholizadeh[3], Prof. Siddhartha Khare[4]

[1]K. N. Toosi University of Technology. [2]University of Würzburg. [3]Oklahoma State University. [4]Indian Institute of Technology Roorkee

Abstract

Anthropogenic and climatic changes are causing significant loss of plant diversity, especially in regions with inadequate regulations. Effective geospatial approaches are essential for conservation and monitoring efforts. While most remote sensing studies focus on alpha-diversity, beta-diversity offers a more comprehensive view of biodiversity patterns. Rao's Q index is a reliable metric for quantifying beta-diversity using multispectral remote sensing data. However, current methods lack comprehensive and efficient analytical, graphical and diagnostic tools. To address this, we developed PaRaVis, an open-source Python package for deriving spectral diversity from multispectral datasets using Rao's Q index. PaRaVis facilitates parallel computation, visualization, and analysis of 75 multispectral vegetation indices, and calculates Rao's Q both unidimensionally and multidimensionally. This aids those with limited programming skills in monitoring plant diversity. Demonstrations in test sites located in the temperate zone showed that multidimensional Rao's Q using EVI, SR3, and TCI indices outperforms unidimensional methods, enhancing plant diversity monitoring.

Insights from the German long-term research program Biodiversity Exploratories on causes and consequences of biodiversity change

Dr. Victoria Grießmeier[1], Prof. Markus Fischer[2,1]

[1]Senckenberg - Leibniz Institution for Biodiversity and Climate Research Centre. [2]Institute of Plant Sciences, University of Bern

Abstract

The *Biodiversity Exploratories* (BE; www.biodiversity-exploratories.de) are a research program focusing on long-term, large-scale investigations of the relations between land-use, biodiversity, and ecosystem processes and services since 2006. In three study regions situated in the NE, center and SW of Germany, the so-called "Exploratories" (Schorfheide-Chorin, Hainich-Dün, and Schwäbische Alb), 150 grassland and 150 forest sites serve for comparative research, which is complemented by multi-site experiments in grassland and forest. The program is also addressing indirect societal drivers of land-use change and the consequences of changes in ecosystem service supply for various stakeholders. In the current funding phase (2023-2026), 41 interdisciplinary research projects are involved.

This talk will present key results from 18 years of research on land-use - biodiversity - ecosystem process/ecosystem service relations.

Riparian stream mesocosms for the experimental linkage of aquatic and terrestrial ecosystems

Franziska Fiolka, Franziska Middendorf, Stephane Mutel, Collins Ogbeide, Alessandro Manfrin, Ralf Schulz

RPTU Kaiserslautern-Landau

Abstract

Riparian ecosystems experience dynamic changes including flooding, with increasing intensity in the future due to climate change. As surface waters are polluted, flooding may become a stressor, since flood water is expected to act as a mediator of pollutants from the aquatic to the terrestrial ecosystem. We investigated this flood-mediated pollutant pathway in a unique riparian-stream-mesocosm facility at the iES Landau, Germany consisting of 16 natural fed 1 m x 15 m stream channels with an adjacent 4 m terrestrial area. We tested the effect of increasing flood durations & frequency on the contamination transfer from the aquatic to the terrestrial soil, and through bioaccumulation in riparian plants and terrestrial arthropods. UHPLC-MS/MS analysis reveals a positive trend between flood and pesticide concentration in soil, translating into the riparian food web. This research contributes to further establishing the link between aquatic and terrestrial ecosystems and highlights an increasingly recognized pollutant pathway.

Rethinking the role of mesopredatory reef fishes in structuring herbivory in nutrient-limited marine ecosystems

Anish Paul[1], Harshul Thareja[1], Rohan Arthur[2,3], Teresa Alcoverro[2,3], Sandeep Pulla[1], Rucha Karkarey[4]

[1]National Centre for Biological Sciences, Bengaluru, India. [2]Nature Conservation Foundation, Mysore, India. [3]Centre d'Estudis Avançats de Blanes (CSIC), Girona, Spain. [4]Lancaster University, Lancaster, United Kingdom

Abstract

Apex predators shape ecosystem functions by altering trophic interactions and prey demography through predation. However, non-consumptive effects of predation in marine ecosystems remain ambiguous and context-dependent. Predators can substantially contribute to nutrient supply in nutrient-limited ecosystems, like coral reefs, but their contribution to bottom-up processes remains underappreciated. Commercial fisheries worldwide target predatory fishes. However, its consequences on essential ecosystem processes, like herbivory, especially in post-disturbance reefs, remain largely unknown. Through field experiments and observations, we examined how predatory fishes influence herbivory through indirect top-down and bottom-up mechanisms along a predatory fish biomass gradient in the Lakshadweep Archipelago, India. Our findings suggest predatory fishes enhance primary productivity and reef-scale herbivory. Our findings reveal that Ctenochaetus striatus, a key herbivorous fish, reduced its feeding in areas with high predator biomass, likely due to higher nutritional gains per effort. Our study underlines the significance of predators in conferring reef resilience amid global change.

Multi-taxa habitat suitability and connectivity maps to raise awareness towards the biodiversity-wind energy-land use nexus

Vishesh Leon Diengdoh, Florian Kunz, Ursula Nopp-Mayr, Eva M Schöll

University of Natural Resources and Life Sciences, Vienna; Department of Integrative Biology and Biodiversity Research; Institute of Wildlife Biology and Game Management; Gregor-Mendel-Strasse 33, 1180 Vienna, Austria

Abstract

While a rapid development of renewable energy sources is necessary to reach climate goals, the deployment of wind farms faces significant challenges due to low acceptance amongst societal actors. Ecosystems and biodiversity are also threatened by climate change and its consequences, however, taking people´s concerns seriously by providing comprehensive information on various aspects is a first step in raising acceptance and increasing societal engagement. High-resolution, spatially explicit ecological niche models for a selection of threatened wildlife species were developed for the pilot region Austria. Ecological niche models showed that habitats suitable for species can overlap, thereby, careful siting of wind farms and the protection of areas of high sensitivity can minimize impacts of wind farms on these species. The maps prepared for the pilot region can provide valuable information for societal actors and can be used to raise awareness towards the multiple land demands that exist.

The contribution of urban trees to biodiversity in Coventry

Megan Bedford[1], Katharina Dehnen-Schmutz[1], Liz Trenchard[1], Simon Newell[2]

[1]Coventry University. [2]Coventry City Council

Abstract

iTree Eco is used to make an ecosystem service assessment of trees in a given area. Using field data from surveyed trees, along with local climate and pollution data, it values carbon storage and sequestration, reduced run-off and pollution removal by trees. However, iTree Eco does not assess biodiversity, despite the vital role that trees play in enhancing and sustaining biodiversity, particularly in urban areas. This research uses the iTree Eco survey conducted in Coventry and aims to develop the ecosystem service assessment by incorporating data on birds, invertebrates and vegetation. To assess avian diversity, Audiomoth devices were deployed at selected iTree plots, using bioacoustics to measure species diversity. Invertebrates were investigated through beat sampling of a subset of trees and ground vegetation surveys were undertaken within the circumference of the tree canopy. Combined, these will be incorporated into a biodiversity survey design that can be used alongside iTree Eco.

Ecosystem size tunes the effects of the spatial feedback between autotrophic and heterotrophic ecosystems on ecosystem function.

Emanuele Giacomuzzo[1,2], Dr Tianna Peller[1,2], Dr Isabelle Gounand[3], Prof Florian Altermatt[1,2]

[1]Eawag (Swiss Federal Institute of Aquatic Science and Technology). [2]University of Zurich. [3]iEES Paris

Abstract

The connection between autotrophic and heterotrophic ecosystems can impact their ecosystem function. However, it is uncertain how the size of the ecosystems influences the effect of the connection. Here, we used a protist experiment to examine how differences in ecosystem size affected the impact of non-living resource flows on the functioning of two-patch, autotrophic-heterotrophic meta-ecosystems. We found that when the autotrophic patch was larger, the connection between the patches led to an increase in the total biomass of the meta-ecosystem. Conversely, when the heterotrophic patch was larger, the connection resulted in a decrease in the total biomass of the meta-ecosystem. We also observed that ecosystem size played a critical role in determining the effects of the connection at a local (ecosystem) level. Our findings reveal that differences in patch sizes can significantly influence function in cross-ecosystem dynamics among ecosystems of different types.

Using marine sound to restore lost oyster reefs

Dr Dominic McAfee

The University of Adelaide

Abstract

Marine soundscapes provide important navigational cues to dispersing larvae in search of suitable habitat. To accelerate the restoration of an ecological significant, but functional extinct oyster - Australian Flat oysters - we combine laboratory and field experiments to identify the most attractive sounds for increasing larval recruitment to newly constructed boulder reefs. In the laboratory, more complex marine sounds (recorded from kelp forests) induced greater directional swimming and settlement behavior than more simplistic soundscapes (from sedimentary and seagrass habitats). Across two of Australia's largest reef restorations, speaker playback of these attractive soundscapes significantly increased oyster recruitment at 8 of 10 sites by on average 5 times (5,281 ± 1,384 more larvae m2). And after 5 months, reef boulders had 4.3 times more three-dimensional habitat growth than nonspeaker controls. Results suggest that early application of speakers on new reef restorations may help steer the ecological succession on a trajectory of rapid habitat recovery.

Stable isotopes as a tool for understanding the impact of the rupture of a huge ore tailings dam on fish assemblages of a tropical river basin.

Dr. Paulo S Pompeu[1], Dr. Débora R Carvalho[1,2], Dr. Patrícia S Fráguas[1]

[1]Federal University of Lavras. [2]Lancaster University

Abstract

We utilized δ13C and δ15N stable isotopes to gain a better understanding of the effects of the Fundão dam rupture on the fish fauna of the Rio Doce basin, Brazil. We assessed aspects of the trophic structure across ten sites (seven impacted and three control) in 2020 and 2022. Currently, non-native species exhibit a broader isotopic niche than the native assembly in the Doce River basin, occupying all trophic levels. The site closest to the dam rupture exhibited a more simplified trophic structure compared to all other sampled sites, with most fish species occupying similar trophic positions. The isotopic niche of sites affected by the rupture has also been shown to be more temporally unstable than that of control sites. These data are important for future assessments of ore tailings dam failure disasters and for evaluating the effectiveness of mitigation measures for the recovery of the Doce River basin.

Should I grow faster or slower before drought? Pre-drought growth, live crown ratio, age and height drive tree-level resilience to drought across European forests

Diego Rodríguez-Hernández[1], Tommaso Jucker[1], Fabian Fischer[1], Duncan O'brien[1], Bo Wang[2], Martin De Kauwe[1]

[1]University of Bristol. [2]Lanzhou University

Abstract

Global change is making extreme conditions more frequent, enduring and severe. Consequently, forest ecosystems worldwide face increasing drought-induced tree mortality risks. Therefore, understanding the drivers that govern the variability in drought responses among individuals from different species, provenances and forest types will be critical to predicting ecosystem resilience to climate change. Here we present a more comprehensive latitudinal study encompassing six different forest types and sixteen major European tree species to (i) evaluate what are the primary biotic drivers controlling tree-level resilience to drought; and (ii) determine whether this resiliency depends on the species, provenance or forest type. We found tree-level resilience to drought was mainly driven by predrought growth, with a secondary impact of live crown ratio, age and height, but with no influence of species richness or competition. Furthermore, drought resiliency did not depend on species identity but rather on provenance and forest type where trees were growing.

Hydraulic and Economic Trait Dimensionality in Wine Grapes

Kale Vicario[1], Adam Martin[1], Emily Young[1], Guangrui Li[1], Rachel O Mariani[1], Kimberly A Cathline[2], Gavin Robertson[2]

[1]Department of Physical and Environmental Sciences, University of Toronto Scarborough, Canada. [2]Horticultural & Environmental Sciences Innovation Centre, Niagara College, Canada

Abstract

Understanding how key functional traits covary with one another across spectra that reflect common trade-offs (e.g., the leaf and root economics spectra (LES and RES)), is a primary theme in plant ecology. However, in the plant trait literature there remains debate about whether functional trait spectra vary independently of one another. Relationships among trait spectra—referred to as "trait dimensionality"—have been tested in multiple studies, investigating the dimensionality among the most common trait spectra (such as the LES and RES). However, less is understood about the dimensionality of plant hydraulic traits. Using 12 varieties of grapevine (*Vitis vinifera*), we evaluated trait dimensionality among 11 LES and eight hydraulic traits derived from pressure-volume curves. Multiple factor analysis revealed moderate relationships between hydraulic traits, and a LES in wine grapes. Understanding hydraulic trait variation is increasingly important in economically significant crops such as *V. vinifera*, as drought becomes more prevalent.

The trajectory of change in greenhouse gas emissions following peatland restoration.

Dr Naomi Gatis[1], Dr Pia Benaud[1], Lou Goodger[1], Professor Karen Anderson[2], Professor Richard E Brazier[1]

[1]Centre for Resilience in Environment, Water and Waste, University of Exeter.
[2]Environment and Sustainability Institute, University of Exeter

Abstract

Peatland restoration can rapidly raise water tables, but significant change in vegetation and greenhouse gas emissions often takes longer and can be harder to detect. Using an innovative space-for-time experimental approach, we have been monitoring the effect of restoration on four distinct vegetation communities on Dartmoor's blanket bog. These communities, identified via earth observation data collected in 2010, have since experienced varied conditions - remaining unrestored, restored for >4 years, restored for >10 years and a "pristine" area. Herein we present initial results from monthly CO_2 and CH_4 monitoring, water table depth and vegetation survey. This project aims to gain a realistic understanding of the timing and magnitude of changes to ecohydrological function on the moor in response to peatland restoration.

Land use effects on soil organic matter carbon quality are consistent across European and Permafrost regions

Dr Sabine Reinsch, Dr Inma Lebron, Dr Laura Bentley, Prof Bridget A Emmett, Prof Bernhard J Cosby, Mr Michele Brentegani, Dr Susan Tandy, Dr Amy Thomas, Prof David A Robinson

UK Centre for Ecology & Hydrology

Abstract

Soil organic matter (SOM) is a recognized soil health indicator. Its fractions of particulate organic matter (POM) and mineral-associated organic matter (MAOM) are recognized for their potential importance for soil organic carbon (SOC) sequestration. Here we examined the SOC-to-SOM relationship across land uses, using datasets from European and Permafrost regions. SOM fractionation was performed on 100 samples to investigate the impact of SOC-to-SOM ratios on POM-C and MAOM-C. We found that datasets have unique SOC-to-SOM ratios falling between 0.38 and 0.58 based on the SOM carbon quality captured in the datasets. Additionally, land use systematically affects the SOC-to-SOM relationship across regions. Looking at associated SOM fractions, SOC-to-SOM ratios grouped by land use may provide a cost-effective upper estimate for carbon stored in SOM fractions. Overall, the SOC-to-SOM ratio is an underused indicator of soil health, and for large datasets can be used to explore SOC dynamics, especially at national scale.

The reassembly of seed dispersal interactions across a recovery gradient in the Chocó Rainforest of Northwest Ecuador

Nicole Lussier[1], Gregory Paladines[2], Jordan Karubian[3,2], John L Reid[4,2], Charlie Kwit[1,5]

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Abstract

Understanding the reassembly of animal-mediated seed dispersal interactions is crucial for successful tropical forest restoration, yet this critical process remains understudied. This research investigates the recovery of seed dispersal interactions along a chronosequential forest recovery gradient in the Chocó Rainforest, Northwest Ecuador. Using interaction data collected from camera traps and mist-netting surveys, we constructed and analyzed seed dispersal networks across four stages of forest regeneration: 2, 10, 25, and 50 years post-agricultural abandonment. Our findings reveal that birds quickly colonize and introduce a high diversity of seeds into pasture-like habitats that retain some vegetation structure. Intermediate stages of forest recovery foster highly connected, generalized networks, whereas more complex patterns of interactions (modularity and specialization) develop in later stages of forest recovery. This work underscores the importance of restoration strategies that consider the recovery of mutualistic interactions, ultimately aiming to help guide effective conservation strategies in tropical forests.

Drivers of ecological complexity in recovering ecosystems

Dr Emily H Waddell[1], Professor Kirsty J Park[1], Dr Elisa Fuentes-Montemayor[1], Professor Kevin Watts[2], Dr Ben A Woodcock[3], Professor James M Bullock[3], Dr Matt Guy[2], Dr Samuel Hibdige[4], Dr Alexey Larionov[4], Dr Mark Pawlett[4], Professor Jim Harris[4]

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Abstract

Enhancing complexity may be a more realistic goal for ecosystem restoration than the traditional approach of re-assembling historic communities. However, ecological complexity is rarely studied in real-world scenarios, so its development, especially in the context of restoration, is poorly understood. In the Restoring Resilient Ecosystems (RestREco) project we examined ecological complexity within two contrasting ecosystems, calcareous grasslands and broadleaved woodlands. Data collected on soil microbes, plants, invertebrates, species networks and habitat structure were used to calculate 'ecological complexity' metrics, which we then analysed using Structural Equation Models to investigate the relative influence of key drivers (time since restoration, initial state, restoration method, proximity to other habitat) on 'ecological complexity'. Whilst the drivers we explored influenced elements of complexity, namely soil microbes and habitat structure, there were relatively few linkages between the different complexity metrics. Therefore, they tell us slightly different things about how complexity develops in restored ecosystems.

The resilience of biodiversity's benefits for smallholder farmers in South Africa

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Abstract

Anthropogenic pressures are leading to ecological community shifts, impacting ecosystem functioning and the benefits nature provides for people. The resilience of ecosystem services to community shifts remains a major question. We used species distribution models and novel risk-assessment frameworks to assess the impacts of climate and land-use changes in South Africa on two key ecosystem services – animal-mediated pollination and natural pest control. Then, focusing on the province of KwaZulu-Natal, we investigated risks for smallholder farmers in more biologically realistic detail by introducing biotic interactions as additional determinants of community composition. Despite species turnover and local extirpations, we find potential for these ecosystem services to be resilient to future environmental changes across 50-70% of South African ecological communities. In KwaZulu-Natal, we find the spatial distribution of resilience is highly heterogeneous, with benefits in some localities expected to improve under higher emissions scenarios, suggesting potential for both 'winners' and 'losers' among farmers.

Framing Multifunctional Ecological Networks across scales

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Abstract

The way natural and semi-natural environments are interconnected within a landscape and their multiple ecological functions and services is critical to how ecosystems work and interact. Yet, the underlying concepts of ecological connectivity (EC) and ecosystem multifunctionality (EM) are rarely integrated quantitatively to inform sustainable landscape management, mainly due to scale constraints. We build on the notion of Multifunctional Ecological Networks to extend existing multifunctionality approaches and operationalize EM and EC across spatial scales. At the ecosystem scale, we introduce intra-ecosystem multifunctionality to capture the EM variability within ecosystems, as opposed to interecosystem multifunctionality, describing its variability across landscape types. We pair these two metrics with EC analysis based on ecosystem fragmentation and landscape heterogeneity and demonstrate the approach in a case study in the Alps. Our framework enables land managers to fully grasp the multiscale interactions between ecological structures and multiple ecosystem services and to manage for sustainable landscapes.

Evaluating the Impacts of Beavers on UK Biodiversity Using Environmental DNA

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Abstract

UK reintroductions of the Eurasian beaver, *Castor fiber*, provide a key opportunity to research their impacts on biodiversity across entire ecological communities, different landscapes and spatiotemporal scales using modern and powerful monitoring tools like environmental DNA. Sampling from enclosed and wild reintroduction projects, we are investigating 1) how beavers impact the local distribution of conservation priority vertebrates and invertebrates, 2) how the composition of invertebrate and vertebrate communities shifts as beavers alter habitats, 3) how these impacts vary across space and time. Water samples have been collected from a number of locations across England and Wales with different environmental characteristics. Beaver sites are paired with a local control site which has not been influenced by beaver activity and will be sampled across several years to show change across temporal scales. Here we present an initial analysis of our biodiversity data collected from enclosed reintroduction projects and catchments supporting free-living beavers.

Hot plants doing cardio: Using a global network of temperature gradients to assess for non-linear productivity responses in mountain vegetation

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Abstract

A major uncertainty of ecosystems responding to global warming is the shape of change over time. There are some systems, such as coral reefs, that seem to have catastrophic tipping points, while other systems appear to be changing more gradually. Here, we used natural temperature gradients in mountain ranges globally (Australia, Sweden, USA, Argentina, France) to predict how vegetation productivity is likely to respond to future warming. We found that, more often than not, groundstorey vegetation showed no change in productivity with increasing temperature, implying that potential increases in carbon fixation were counterbalanced by other factors such as competition with trees. Yet when we included trees in our productivity estimates, there was a clear threshold at the treeline, beyond which carbon cycling increased markedly. These findings suggest that, as trees shift their ranges in a warming world, the amount of carbon entering mountain ecosystems is likely to dramatically increase.

Complex temporal trends in biomass and abundance of Diptera communities driven by the impact of agricultural intensity

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Abstract

Insect declines have been reported widely and are expected to alter ecosystem functions and processes. However, variation in local environmental drivers and the scale of available monitoring data have left large knowledge gaps in where and which taxa are declining and how this will impact ecosystems. We used 11 years of monitoring data on 40 farms in southern Québec, Canada, to quantify the impact of agricultural intensity on temporal trends in abundance and biomass of Diptera (true flies). Contrary to expectation, Diptera abundance increased over time in areas with higher agricultural intensity, which contrasted with biomass trends. We found steeper declines in biomass per total number of Diptera with increasing agricultural land cover. Using a combination of macroecological theory, we show intensive agriculture in Canada is likely resulting in booming populations of smaller flies with lower individual mass, altering the distribution of key functional traits within communities.

Seasonal response of emerging aquatic insects to temporal flooding intensity: a mesocosm study.

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Abstract

As global climate change affects water levels in freshwater ecosystems, riparian zones face heightened flooding risks, potentially altering aquatic insect dynamics. Our study assessed the response of emerging aquatic insects to varying flooding duration (3, 7, and 14-day periods) over four cycles (May to September 2023). The study was conducted using the Riparian Stream Mesocosm facility, with 16 independent replicated stream channels (15 m x 1 m) and adjacent riparian zones (15 m x 4 m). Flooding regimes were applied, and emerging insects were sampled every 3-4 days using floating emergence traps at multiple stream sections. Our results showed significant temporal and spatial variation in insect abundance and aquatic-terrestrial biomass flux, particularly in the 14-day flooding period. These findings suggest that prolonged flooding duration could disrupt insect life cycles, with cascading effects on riparian spiders and ecosystem interactions. Furthermore, flooding disturbance may affect insect dynamics in linked aquatic-terrestrial ecosystems.

Terricolous alpine lichens decline under recurrent summer drought

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Abstract

In alpine ecosystems, terricolous lichens contribute to the vegetation biomass, the overall species richness and sustain important ecosystem functions (e.g., water retention, biogeochemical cycling, fodder source). The direct uptake of compounds from the atmosphere renders lichens potentially useful as bioindicators for deposition of pollutants (SO_2, NO_x, NH_3, etc.).

In a longer-term, manipulative experiment at 2500 m a.s.l. in the Swiss Alps, the mass of terricolous, fruticose lichens declined by 36-55% under recurrent summer drought after 6 yrs, while shifted snowmelt timing (through experimental snow addition/removal) had no effect. In the most abundant lichen, *Cetraria islandica*, an unexpected, significant increase in the thallus N concentration was observed under drought, questioning the use of this species as an indicator species for atmospheric nitrogen deposition. Shifts in thallus N concentration in this species are most likely due to impaired glucan synthesis under drought, altering the C : N ratio of the thallus.

Modelling CO_2 dynamics in the UK: Evaluating the effect of land use change and management on the path to Net Zero emissions

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UK Centre for Ecology & Hydrology

Abstract

The UK emits around 400 Tg of CO_2 annually and has a legally binding commitment to reach Net Zero emissions by 2050. Net CO_2 emissions result from a balance between CO_2 uptake by photosynthesis and emissions from respiration (plants, microbes, animals, including humans and livestock) and fossil fuel burning (for transport, energy, heating, etc.). In managed ecosystems, land use change and management contribute to both uptake and loss of CO_2 (e.g. via afforestation) which can be used to offset fossil fuel emissions. We developed a model that incorporates all these processes and their dynamic variation on daily and seasonal cycles. This model helps predict the contribution of each process to atmospheric CO_2 levels. By comparing model predictions with atmospheric CO_2 observations, we can constrain this model, and infer the magnitude of different anthropogenic and biogenic processes, which enables us to attempt to monitor progress toward Net Zero.

Island area, seasonality and social caste, not habitat type, influence the thermal tolerance of ants on fragmented habitat islands

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Abstract

Habitat fragmentation alters thermal conditions within remnant patches. However, few studies have explored variation in thermal tolerance of species that occur in fragmented habitats. To address this gap, we investigated the critical thermal maximum (CTmax), minimum (CTmin), and range (CTrange) of a dimorphic ant *Pheidole nodus* within a fragmented island system in southeastern China. We further tested the effect of island area, habitat types, seasons, and social castes on thermal tolerances. By measuring over 2,300 individuals from 117 colonies, we found that edge populations of *P. nodus* did not exhibit higher CTmax despite experiencing higher temperatures. Instead, interior populations on larger islands exhibiting higher CTmax and CTrange. Moreover, *P. nodus* possesses higher CTmax in summer and lower CTmin in autumn. Workers generally exhibit stronger thermal tolerance than soldiers. These findings challenge the edge effect hypothesis, emphasizing the importance of island area, seasonality, and social caste in shaping ants' thermal tolerance.

Nutcracker behavioral variation shapes patterns of seed dispersal

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Abstract

Seed dispersal is key in a plant's life cycle. For animal-dispersed plants, the behavior of seed-dispersing animals has direct consequences for seed fate. We investigated how individual behavior of spotted nutcrackers (*Nucifraga caryocatactes*) affects seed dispersal of Swiss stone pine (*Pinus cembra*). We compared movement data of juvenile and adult birds during seed harvest and caching. Among adults, we identified two behaviors: short-distance and long-distance seed dispersal. Short-distance dispersers cached seeds at high elevations with high regeneration potential within the pine's habitat. Long-distance dispersers cached seeds at low elevations with low regeneration potential outside the pine's habitat. Juveniles had larger movement ranges and dwelled at higher elevations than adults, and may be especially important for the effective dispersal of Swiss stone pine. These behaviors were not associated with bird body mass, wing length, or sex. Our findings highlight that intraspecific behavioral differences in seed-dispersing animals can significantly impact ecosystem functions.

Canopy cover instigating faeces deposition on paved roads in urban ecosystems

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Abstract

Urbanisation, including paved roads, is impacting seed dispersal by making faeces deposition sites a detrimental factor for successful seed establishment. Therefore, understanding the influence of canopy cover and distance from the forest patch on paved road faeces deposition becomes important for seed dispersal (dis)service. We examined faeces deposition on paved roads in urban forest fragments of Yokohama, Japan. Out of 1971 recorded faeces, a large number were present on roads near the forest patch (n = 1668) compared to roads away from the forest patch (n = 303). The canopy cover had a significant effect on the faeces deposition on paved roads. 35% of the dispersed seeds were possibly wasted on the paved roads. With 30% seed loss, birds majorly contributed to seed dispersal disservice on paved roads. Paved roads were found to be a critical factor in seed dispersal disservice and weakening of ecosystem function in urban ecosystems.

Tropical forest restoration affects soil carbon negatively through links with mycorrhizal fungi

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Abstract

Tropical rainforests are the focus of active restoration efforts globally, but how this management strategy, which involves tree planting, liana cutting, etc., affects ecosystem functioning in the long term is still poorly understood. At our study site in Sabah, Malaysian Borneo, we observed a change in the microbial diversity and community composition, with potentially unprecedented consequences for belowground carbon. Active forest restoration affects the abundance of certain microbes as the predominately planted tree family (Dipterocarpaceae) is associated with ectomycorrhizae, but tropical forests are generally dominated by arbuscular mycorrhizae, with both of these two mycorrhizal types affecting the biogeochemical cycling differently.

Indeed, we found a negative correlation between Dipterocarpacea density and soil carbon, suggesting a loss of soil carbon under active restoration. This so far largely ignored downside of this restoration strategy needs to be integrated into future management to achieve restoration goals in the most efficient way.

Declining fish stocks in a temperate estuarine system reveals the importance of long-term data sets in setting seascape restoration baselines.

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Abstract

Estuarine environments are dynamic systems influenced by ecological processes l and anthropogenic pressures, making long-term fish population trends difficult to detect. This study utilized decadal spatiotemporal data to assess juvenile fish populations in the Solent, a semi-enclosed estuarine system in southern England. Data from 390 seine net hauls across 14 sites during 2007–2018 revealed shifts in species abundance and composition. A decline in fish abundance ($\tau = -0.0498$, $p = 0.001$) has occurred across the Solent, particularly in disturbed areas. Spatial analysis revealed patterns in fish community composition across catchments and sites, whilst temporal trends were primarily driven by changes in species richness. European bass (*Dicentrarchus labrax*) and Sand smelt (*Atherina presbyter*) comprised over 50% of the total catch. These findings underscore the importance of long-term monitoring to guide habitat restoration and assess its success beyond natural variability, ensuring the resilience of fish populations.

Land conversion generates cascading effects on direct and indirect ecosystem services provision

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Abstract

Feeding an increasing human population while preventing biodiversity loss is a major challenge, yet the effects of land conversion on communities and ecosystem services (ESs) are poorly understood. We used data from a farm containing diverse habitats to simulate the effect of a gradual conversion from extensive organic to intensive non-organic crop production on multiple ES. Land conversion significantly reduced the proportion of some ES by up to 96% (e.g., pollination), while others remained unaffected (e.g., bird watching). However, indirect effects on species providing ES, quantified by the number of paths connecting ES providers to other species, linearly declined, indicating latent effects of gradual habitat conversion. Comparison to a null model that controlled for the number of species lost indicated that species identity either mitigates or increases land conversion's effects, depending on the type of ES. Our results provide insights into the mechanisms underlying multiple ES loss in modified habitats.

Climate, vegetation and disturbance predict green leaf phenology across temperate, boreal and arctic peatlands

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Abstract

Peatlands store one-third of the world's soil carbon, and these dynamics are partly driven by understory vegetation such as sedges, mosses, and shrubs. The green leaf phenology of these small-statured plants is difficult to capture with remote sensing. We developed smartphone-based methods to initiate a community-based project called PeatPic. PeatPic provides a platform for images to calculate leaf greenness indices. Submissions from 25 sites (10 countries) across different biomes were made every 1-2 weeks. We found that leaf greenness indices like day of year at peak greenness varied across biomes. Using a random forest model, we also found climate and vegetation-related variables best predicted peatland green leaf phenology. Notably, our model had lower predictability at disturbed sites, suggesting disturbances such as drainage or resource exploration may increase variability in peatland phenology. We hope to maintain PeatPic as a long-term, open-source community database to improve understanding of peatland carbon cycling.

Declining growth in European beech associated with temperature-driven increase in reproductive allocation

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Abstract

Climate change effects on forest growth and reproduction are widely reported, but indirect effects resulting from their interactions have rarely been demonstrated. We tested for these predicted effects using four decades of growth and annual seed production data from individually monitored trees. We show how altered allocation to seed production, a consequence of warming summer temperatures, has resulted in declining tree radial growth. Allocation to reproduction was the key driver of a 28% decline in tree growth, which occurred despite no local change in summer drought. This is a previously unidentified indirect mechanism for climate change-driven growth decline. Our analysis highlights the importance of considering interactions between demographic processes when assessing species sensitivity to climate change.

Combining data loggers and remote-sensed data to explore microclimates: a year-round assessment in boreal caribou (Rangifer tarandus caribou) habitat

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Abstract

The thermal niche of cold-adapted animals could contract following global increases in temperature, potentially triggering changes in space use for thermoregulation. Remote sensing tools are widely used to estimate variations in air temperature, but their coarse resolution hinders our capacity to measure temperature at the scale of microclimates. We aimed to measure local temperatures in the habitat of boreal caribou, a species at risk in Canada. We measured local temperatures using data loggers deployed in 250 sites over 2 years, and integrated ERA5-Land data into our predictions. We found that models combining remote-sensed and local temperatures provided the best fit. We confirmed that temperatures in open habitats were more variable than in closed-canopy forests, reaching higher temperatures during the day and lower temperatures at night. We discuss environmental attributes that, if promoted by land managers, could maintain climate refugia suitable to wildlife in the face of climate change.

The Role of Area and Beta Diversity in Scaling Diversity-Stability Relationships in a Grassland Biodiversity Experiment

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Abstract

Managing biodiversity for ecosystem stability amid environmental change is crucial, but local scale knowledge often fails to align with regional management needs. The variation in species composition among communities (beta diversity), plays a key role in stabilizing functions at the larger spatial scale by enhancing spatial asynchrony—where different communities respond differently to environmental fluctuations. Importantly, both beta diversity and spatial asynchrony are inherently scale dependent, but the role of spatial extent in this relationship, and consequently, in large scale stability remains unquantified. Using simulated landscapes from a highly replicated grassland biodiversity experiment, we find that the contribution of beta diversity and spatial asynchrony to the temporal stability of biomass production at the larger spatial scale depend on both local diversity and spatial extent. Our results underscore the need for multi-scale conservation strategies to ensure ecosystem stability.

Impacts of an omnivorous ungulate on plant communities and soil organic carbon

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Abstract

Ungulates are proposed to impact belowground carbon both directly and indirectly by altering plant diversity and plant functional traits. To date, the relative importance of these routes has been poorly researched. In this study, we investigated both direct and indirect links between wild boar and soil organic carbon (SOC). We estimated boar visit frequencies to survey plots using camera traps, from which we recorded plants and SOC. Average structural equation models suggested boar were associated with resource-acquisitive plants, which corresponded to lower SOC. However, no relationships between boar and plant species diversity were detected. This work provides, for the first time, evidence on the indirect routes through which an omnivorous ungulate influences SOC. Resource-acquisitive plants are more able to exploit boar rooting, leading to decreases in SOC. As an individual species does not systematically improve all ecosystem functions, ecological restoration efforts should thus aim at introducing functionally diverse ungulate communities.

Environmental drivers of taxonomic, phylogenetic, and functional diversity in forest ecosystems: a multi-taxon approach.

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Abstract

The accelerated global biodiversity loss also threatens forest ecosystems, crucial for maintaining terrestrial biodiversity and multifunctionality. Consequently, understanding biodiversity drivers is essential for developing effective conservation strategies. This study integrates different attributes of biodiversity (taxonomic (TD), functional (FD), and phylogenetic (PD)), across five ecologically distinct taxa and along the Hill series. As predictors we used high-resolution remote sensing data on climatic, soil, topographic, and structural properties of forest stands across Switzerland. TD, FD, and PD showed positive correlations across most taxonomic groups and Hill numbers, but biodiversity drivers varied among taxa and diversity attributes. Structural stand characteristics (e.g. canopy height heterogeneity) positively influenced most diversity attributes, supporting the hypothesis that environmental heterogeneity enhances diversity through increased niche availability. Diversity of low mobility taxa was further influenced by soil and topographic properties. Our findings reveal complex interrelationships between different attributes of forest biodiversity, with notable variations across taxa and diversity metrics.

From Past to Present: How Extinction and Introduction is Reshaping Avian Diversity in Hawaii

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Abstract

Islands comprise only a small percentage of global terrestrial area but contain a substantial proportion of the world's biodiversity. Unfortunately, islands have suffered disproportionately in the global biodiversity crisis and have witnessed unprecedented rates of extinctions and introduction of non-native species. In this study, we explore the avian communities of six Hawaiian Islands and how biodiversity has changed with species extinctions and introductions. Using morphological and ecological traits, we investigate changes in both taxonomic and functional diversity and the potential impacts on ecosystem function. Surprisingly, we found that alien species restored multiple functional diversity indices to values similar to pre-extinction levels. However, the limited trait overlap between extinct and alien species suggests that alien species will not fulfil the functional role of the extinct community. These results emphasise the importance of conserving native species and demonstrates how understanding the past is an important tool in preserving ecosystem function.

Landscape and soil management intensification impact multiple ecosystem services in Mediterranean olive groves

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Univesity of Bari

Abstract

Agricultural intensification and expansion have been identified as key drivers of biodiversity loss worldwide, with negative repercussions for the provision of the associated ecosystem services. Here, we investigated the effects of ground cover management and landscape simplification on the provision of multiple ecosystem services (pollination, pest control, soil services) in 60 olive groves in southern Italy. We assessed trap nest colonization, pollinator abundance, predation (dummy caterpillars and seeds cards), occurrence of olive pests, soil biological quality and soil fertility in 2024. Preliminary results show negative effects of tillage on pollinators, seed predation and soil services. Landscape simplification negatively impacted pollinators and dummy predation. However, local and landscape intensification enhanced the control of *Xylella fastidiosa* vectors, suggesting potential tradeoffs between ecological intensification and pest control. These results have important implication for the sustainable management of olive groves, especially considering the threat of *X. fastidiosa* in the Mediterranean area.

Optimizing conservation translocations: the role of landscape connectivity and global changes in dispersal success

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Abstract

Conservation translocations are complex, locally tailored actions involving diverse stakeholders, constraints, and motivations. These interventions typically occur in landscapes heavily impacted by human activities and threatened by climate change, leading to spatial limitations on suitable release sites. The selection of release locations is critical, as it profoundly influences the long-term viability of translocated populations, especially under future climate and land-use scenarios. In this study, we evaluated how current and projected landscape connectivity may facilitate or hinder the dispersal of a diverse group of mammal species, considering factors such as land-use conversion, climate change, and anthropogenic barriers like roads and railways. Our findings indicate that changes in landscape connectivity are species-specific, strongly influenced by traits related to habitat specialization and dispersal capacity. We highlight the importance of incorporating global change considerations into translocation strategies to enhance the effectiveness and long-term success of conservation efforts.

Humidity and soil moisture affect nitrogen pools in California grasslands.

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Abstract

Drought can reduce soil moisture and affect nitrogen cycling (e.g., via decreased plant uptake). Rain-exclusion experiments that simulate soil drought may overlook the role of atmospheric moisture for driving nitrogen cycling in drought adapted ecosystems. Non-rainfall water inputs such as water vapor adsorption by litter and soil can be sufficient for stimulating microbial activity in drylands. Here we explored how soil moisture and atmospheric relative humidity affected nitrogen pools and plant productivity in native perennial grasslands during drought. We found that nitrate increased in drought soils in drier air (with lower plant biomass), but this reversed as atmospheric humidity increased (even when soil moisture remained the same). Conversely, ammonium concentrations decreased in drier air, but only when soil moisture was high. We show that increasingly dry soils may absorb water vapor sufficiently to promote nitrogen cycling processes and keep up with plant uptake.

The effect of fire on the carbon fluxes and productivity of Brazilian woodland savannas.

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Abstract

Improving fire management is a key strategy for conserving fire-dependent ecoregions such as the Cerrado, yet the effects of controlled fires on carbon cycling are still poorly understood. Thus, in this study, we investigate the effect of fire regimes of different frequencies on the net primary productivity, respiration and carbon budget of woodland savannas, making use of an experimental fire and carbon monitoring research project at the Estação Ecológica da Serra das Araras, Brazil. After six years of periodical burning, total woody productivity decreased by 40% in the burnt plots, which supported around three times more herbaceous productivity than unburnt areas. Fire regime properties distinctively affected carbon fluxes depending on their vegetation components, where fire intensity and severity appear to be more strongly linked with patterns in woody stems and the herbaceous layer. Burning is ultimately revealed as a strategy that can successfully limit woody encroachment in the Cerrado.

Unraveling Temporal Fungal Diversity in Forest Ecosystems Through Environmental DNA

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Abstract

Fungi are essential to the functioning of forest ecosystems, playing critical roles in nutrient cycling and ecological stability. Understanding the full scope of fungal diversity, including changes over time, remains challenging due to the limitations of traditional methods. This study explores fungal diversity within the leaf litter of three dominant tree species in a Japanese deciduous forest, using a combination of environmental DNA (eDNA) analysis and culture-based techniques. By leveraging eDNA, we were able to investigate not only current fungal communities but also uncover those from 30 years ago. Our findings reveal that eDNA methods uncovered a broader spectrum of species, offering insights into both contemporary and temporal ecological dynamics. While culture-based methods yielded less diversity, they provided crucial information on the functional roles of culturable fungi. Integrating these approaches allows us to develop a more comprehensive understanding of fungal contributions to forest ecosystem health and their evolution over time.

Phytochemical diversity of naturally regenerated trees in an enriched oil palm plantation

Vannesa Montoya-Sánchez, Delphine Clara Zemp

Université de Neuchâtel

Abstract

Tropical forests are among the most biodiverse ecosystems on Earth, harbouring high taxonomic and chemical diversity, i.e., the diversity of chemical compounds. Phytochemical diversity plays a crucial role in plant survival, ecological interactions, and ecosystem stability, yet remains understudied in restoration contexts. We investigated the phytochemical diversity of 76 naturally regenerating tree species across 34 families within a large-scale restoration experiment in an oil palm plantation 12 years post-establishment. Using an untargeted metabolomic approach, we characterized the entire chemical profiles of these species and the local phytochemical diversity cross plots varying in size and initial planting diversity. Our results reveal interspecific variations in phytochemical composition. Additionally, plots with higher initial planting diversity and larger sizes exhibited increased phytochemical diversity, indicating enhanced chemical niche complementarity. These findings underscore the potential of biodiversity enrichment strategies to foster complex chemical interactions, highlighting the lasting impacts of initial planting diversity on ecosystem recovery.

Coordination of wood anatomical traits to regulate hydraulic functions and stem biomass growth of Tectona grandis L.f. in a moist tropical forest of Bangladesh

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Abstract

Xylem anatomical traits drive the hydraulic strategies in trees particularly when trees are in environmental stress. The present study aimed at understanding the relationships of wood anatomical traits and their functional role in determining stem biomass production of *Tectona grandis* L.f. in a moist tropical forest of Bangladesh. In total 25 wood anatomical traits were measured using a measurement protocol. Principal component analysis (PCA) revealed that the first axis mainly represented by the vessel traits related to vessel size explaining 32% of the total variance. The second axis was mainly represented by the ring width traits and vessel variables associated with wood and vessel density. The anatomical traits associated with vessel size positively affect stem growth by increasing efficiency in water conduction, whereas traits associated with vessel density halt carbon fixation in stem growth and thus reduce stem growth but ensure adequate safety against hydraulic failure.

Pyrogenic carbon contribution to soil organic carbon stocks in a tropical savanna

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Abstract

Savannas cover 25% of Earth's land surface, account for 70% of the global burned area, and potentially contribute up to 80% of fire-produced pyrogenic carbon (PyC). Understanding the role of PyC in the savanna carbon cycle is crucial for assessing savannas' contribution to the global carbon cycle and incorporating fire into Earth system models. However, PyC measurements across tropical savannas, where fires are frequent, are currently lacking. In this study, 250 sites across a tropical savanna in Kruger National Park, South Africa, were sampled, and PyC content in the soils was estimated using a peroxide/weak nitric acid digestion method. We predict that PyC contributes more to soil organic carbon stocks in savannas with intermediate fire frequency, higher rainfall, and clayey soils. These findings offer important insights into fire's impact on soil carbon cycling and can guide fire management strategies to enhance soil carbon sequestration in savannas.

Is natural reef recovery from blast-fishing a fairy tale? Insights from Indonesia's Bunaken National Park

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Abstract

Blast fishing has severely degraded over 50% of Indonesian coral reefs, transforming them into rubble fields that can hinder coral recruitment and recovery. Unconsolidated and unstable rubble is easily moved by currents, smothering coral recruits. While rubble can stabilise through binding processes, no studies have examined this in Indonesia. We characterised four blast fishing-generated rubble beds, including one restored site, by assessing rubble characteristics, stability, binding likelihood, binding community composition, and coral recruitment. Across sites, rubble stability was low (<10%), with binding likelihood ranging from 7% to 25%. Restored and sheltered sites showed higher binding but not enhanced coral recruits, indicating ongoing recruitment limitations. Smaller rubble pieces were found to be less stable, less bound, and had less coral recruits. Our findings highlight limited natural recovery decades after blast fishing, likely due to small rubble size, emphasizing the need for targeted and well-maintained stabilisation projects to promote coral recovery.

Enhancing arthropod diversity on Green Roofs: how ecosystems developed on newly constructed green roofs over time.

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Wageningen University

Abstract

Green roofs can offer a valuable habitat for urban biodiversity. As cities face increasing space constraints, green roofs are becoming a popular solution for incorporating undisturbed green infrastructure to metropolitan areas. However, the potential of green roofs to enhance biodiversity remains uncertain, particularly due to the predominance of low-diversity *Sedum* roofs and challenges in finding comparable sites for study. This research addresses these gaps by examining arthropod and nematode communities on newly constructed green roofs in Amsterdam, ranging from 500 to 1800 m^2 in size and sown with native plant species. By studying the development of soil fauna, plants, and above-ground arthropods over time, we aimed to quantify biodiversity and understand how soil-plant-insect interaction networks are established on green roofs. The results from the first three years of this study provide insights into the formation of these communities.

Post-fire regeneration of a non-serotinous Mediterranean pine: influence of fire refugia

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Abstract

We assessed the main biophysical drivers of post-fire regeneration of a non-serotinous pine (*Pinus nigra)* in NE Spain, focusing on the role of unburned forest patches – fire refugia. We used aerial orthoimages, SVM classification and airborne LiDAR to identify fire refugia over 67,000 hectares affected by wildfires between 1994 and 2003. We sampled the abundance of pine regeneration on 270 five-meter-radius-plots located inside and outside refugia. We used zero-inflated negative binomial models to assess the role of seed availability (calculated using a two-dimensional distance to seed source; DWD), plant community composition, and water/nutritional constraints (heat load index) on regeneration inside and outside refugia. DWD and the presence of *Rubus sp.* benefit the abundance of regeneration, while shrub cover exerts a facilitative to competitive effect depending on the heat load index. Fire refugia has a sheltering effect over post-fire regeneration, reducing the negative effects of heat load and shrub cover.

Investigating the accuracy of stem CO_2 efflux methodologies: A case study from Sabah, Malaysian Borneo

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Abstract

Respiration from tree stems contributes a significant proportion of ecosystem respiration and subsequently the tropical forest carbon balance. However, current methods of estimating stem CO_2 efflux (EA) allow for a large potential for error and uncertainty due to the logistical constraints involved in measuring EA. These methods typically measure EA at one time-stamp and at one height on the stem, assuming no vertical or diurnal variation in EA. Additionally, they employ allometric equations to estimate stem surface area to scale EA to ecosystem level, which ignores potential biogeographic differences in stem allometry. This research, therefore, uses an old-growth forest in Malaysian Borneo to investigate what is the most accurate time of day to measure EA, whether measuring EA at one height on the stem is representative of the trees vertical profile, and if estimates of stem surface area from allometric equations are comparable to estimates derived from terrestrial laser scanning.

Functional Robustness of Reef Fish Networks to Simulated Coral Extinction: A Novel Analytical Approach

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Abstract

As we face an unprecedented biodiversity crisis, with species disappearing at alarming rates, understanding co-extinction cascades is crucial for conservation scientists. Species loss affects not only taxonomic diversity but also functional diversity, significantly impacting ecosystem functioning and services. In this study, we developed a novel method to assess network functional robustness in the context of cascading extinctions, focusing on coral-fish networks from the Southwestern Atlantic. We evaluated how different coral loss scenarios—degree centrality, bleaching vulnerability, and random removal—affect both taxonomic and functional diversity. Degree centrality caused the greatest losses. While functional diversity showed higher robustness to the direct loss of coral-associated fish, taxonomic diversity was more significantly impacted. Both taxonomic and functional diversity exhibited lower robustness to losing indirect interactions than to direct interactions. Our results reveal that coral loss has extensive impacts beyond direct coral-fish associations, highlighting the broader consequences of human-induced changes on coral reef ecosystems.

Terrain characteristics structure the spatial distribution of reindeer carrion on a High-Arctic tundra ecosystem

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Abstract

The study of vertebrate carrion and their effects on ecosystems is difficult due to their ephemeral nature and patchy distribution. High-Arctic tundra areas such as Svalbard are characterized as nutrient- and species-poor systems, and effects of carrion in such systems are expected to be both more pronounced and persist longer as compared to warmer ecosystems. The Svalbard reindeer is the only large herbivore on the archipelago and represents the greatest proportion of large vertebrate carrion. They mostly die from starvation during winter. Field and drone surveys results showed that carcasses can alter vegetation composition and 'greenness' for several years. Spatial distribution modelling showed that carcasses occurred at lower altitude areas with moderate south-facing slopes and relatively high NDVI values. Given this structured distribution and long-lasting vegetation effect, our results suggest that carrion can contribute to maintaining or shaping landscape-level heterogeneity in the Arctic tundra.

Identification and use of bespoke plant functional types as to investigate the ecological implications of agricultural technologies

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Abstract

Extreme climactic events such as drought are becoming increasingly common. Drought threatens farmers by placing pressure on food production. Various water binding technologies have been designed to mitigate drought by increasing the water holding potential of soils. Agricultural alterations to soils often leach into the adjacent landscape which is problematic as agricultural land can be surrounded by wild spaces. Researching agricultural technologies in an ecological setting generates data which enables farmers to make environmentally mindful management choices. This work aims to understand how water retention technologies may impact ecosystem function in landscapes adjacent to farms. It is predicted that the use of cluster and multivariate analysis on relevant plant traits is able to identify unique plant functional types within pre-existing communities which better describe ecosystem function than traditional forb:legume classifications. Said functional types can then be used in pot experiments to investigate the ecological implications of drought mitigating technologies

Maximising understorey diversity through the synergistic effects of canopy opening and litter removal

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Abstract

In Europe's lowland forests, there has been a long-term trend towards shady and nutrient-rich habitats, resulting in a gradual loss of biodiversity due to the abandonment of traditional management practices and increased atmospheric deposition. At the same time, natural openings are occurring due to forest dieback from droughts linked to climate change, often resulting in the spread of nutrient-demanding species that hinder biodiversity recovery. In a four-year field experiment, we investigated the effects of canopy opening and litter removal to determine whether regular litter removal can mitigate eutrophication and promote plant diversity. In the first two years, canopy opening significantly increased diversity, while the effect of litter removal became apparent in the third year. The highest species richness was found in plots with both canopy opening and regular litter removal, mainly supporting thermophilous oak woodland species. Our study shows that this combination can successfully restore biodiversity in European lowland forests.

Air pollution clouds pollinators' scents

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Abstract

Air pollutants like ozone (O_3) and nitrogen oxides (NO_x) can detrimentally affect economically-beneficial insects, such as pollinators, by disrupting the volatile organic compounds (VOCs) they use to locate flowers and other food sources. However, interactions between O_3 and NO_x in the troposphere may mitigate their individual harmful effects on these insects. Our recent meta-analysis, which synthesises data from 23 studies on the effects of O_3 and/or NO_x on pollinator performance—including metrics such as foraging efficiency, abundance and oviposition—shows that elevated O_3 and NO_x reduce pollinator performance by 40% and 39%, respectively. Their combined effect is detrimental but not additive. We highlight the urgent need for field studies that incorporate realistic and varied concentrations of multiple pollutants and their interactions to better predict long-term impacts on insect-mediated ecosystem services, especially as we transition away from fossil fuels and face evolving air quality challenges.

Birds, Bats, Beavers, and Bioacoustics: Listening in to the biodiversity of beaver-engineered wetlands

Alexander Adams

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Abstract

Eurasian beavers (*Castor fiber*) returned to Scotland over 20 years ago, and have been exerting their "ecosystem engineering" influence ever since. Many taxa can benefit from habitat modification by beavers, including birds, bats, and invertebrates. The aim of this study is to use acoustic techniques to investigate the effects of beaver engineering on freshwater ecosystems and surrounding terrestrial habitat. Autonomous recording units have been deployed terrestrially and aquatically at 5 beaver ponds and 5 non-beaver ponds in eastern Scotland since February 2024. The audio recordings are analysed with acoustic indices, and bird and bat species identified using automatic classifiers. Early results suggest that although there is considerable overlap between the community composition of the two pond types, each also supports a few unique species. The acoustic indices also show clear temporal trends, which differ between the two pond types. This difference is most pronounced in recordings of the aquatic environment.

Evaluating ecosystem recovery: planktonic community and biodiversity assessment on a recently restored native oyster *(Ostrea edulis)* reef in the Solent, UK

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Abstract

Reef restoration initiatives aimed at reviving depleted oyster populations require monitoring to assess progress against restoration goals. In the Solent (South Coast, UK), European oyster *(Ostrea edulis)* restoration has been ongoing for the past decade, culminating in the creation of a new reef in Langstone Harbour in 2021.

This study used ecological indicators to evaluate the reproduction and recruitment status of the restored native oyster reef. Spatiotemporal monitoring of zooplankton diversity, abundance, and community composition has been used to determine oyster spawning frequency, duration and behaviour and characterise the planktonic community in the harbour, post-restoration activity.

This data also allows calculation of the temperature sum in degree days for peak spawning for *Ostrea edulis*. This study emphasises the importance of integrating biological indicators to optimize the timing of restoration strategies and to ensure the long-term recovery of *Ostrea edulis*' population.

Breakdown of the growth–mortality trade-off along a soil phosphorus gradient in a diverse tropical forest

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Abstract

An ecological paradigm predicts that plant species adapted to low resource availability grow slower and live longer than those adapted to high resource availability when growing together. We tested this by using hierarchical Bayesian analysis to quantify variations in growth and mortality of ~ 40,000 individual trees from > 400 species in response to limiting resources in the tropical forests of Panama. In contrast to theoretical expectations of the growth–mortality paradigm, we find that tropical tree species restricted to low-phosphorus soils simultaneously achieve faster growth rates and lower mortality rates than species restricted to high-phosphorus soils. This result demonstrates that adaptation to phosphorus limitation in diverse plant communities modifies the growth–mortality trade-off, with important implications for understanding long-term ecosystem dynamics. We will also introduce an ongoing project to examine growth and mortality responses to resource limitations in Bornean tropical forests.

Functional responses of Mediterranean flora to fire: a community-scale perspective

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Abstract

Fire regime is predicted to change, particularly in Mediterranean regions, towards more severe and frequent fire events. Trait-based ecology offers a comprehensive framework to characterize vegetation responses to fire. Since fires induce erosion and decrease soil nutrients, species' functional traits and their distribution should reflect these changes. We here analyzed the relationships among fire, vegetation and functional traits, at both species and community levels. Altogether, there are highly significant direct relationships between the number of fires and leaf area as well as seed mass. For woody communities, wood density is also highly significantly related to the number of fires. Overall, these findings suggest that fire may have an important impact on the functional response of plant communities, while not apparent when looking at individual species. Further, this research paves new ground to better understand the mechanisms behind trait convergence and the way plant communities respond to different environmental pressures.

The Best Trees for BeesGriffiths-Lee, J. & Stevenson, P.C.

Dr Janine Griffiths- Lee, Professor Phil Stevenson

Wakehurst Kew

Abstract

Trees are often overlooked in habitat management strategies for pollinators, although they can provide vast sources of pollen and nectar for pollinators. The 'Best Trees for Bees' project is being conducted at RBG Kew, Wakehurst. This wild botanic garden covers 217 hectares of diverse landscapes and has over 1,500 species of tree and woody plant species. Therefore, bees have an extensive choice of diverse tree pollen.

The project focuses on pollen collection from a diverse range of bees using non-destructive collection methods, targeting bees returning to their nests. The project also involves citizen science by recruiting Wakehurst visitors to aid in recording pollinator visits to trees of interest in the landscape. With this data, we hope to inform urban planners and landscape architects on which trees to plant to best support pollinators, with diversity that cover multiple seasons, while selecting trees that are most resilient to a changing climate.

Global variation in seed covering structure hardness of woody species is related to seed morphology, dispersal traits and dormancy, but physical dormancy does not equal hardseededness

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Abstract

Seed covering structure hardness could play a role in defence/predation, physical dormancy and *in situ* longevity/persistence. However, research to date has been limited regarding quantification methods, plant diversity and geographic distribution. In this study, we determined global variation in seed covering structure hardness of 476 woody species with desiccation tolerant seeds using puncture force and analysed its relationships with relevant seed traits, ecological processes and climatic variables using phylogenetic-informed regressions and pairwise comparisons.

Our results suggest roles for morphology (size, roundness), dormancy (vs non-dormancy), dispersal unit (fruit vs seed) and mechanism and precipitation (of the driest quarter) in explaining part of the global variation in seed covering structure hardness of woody species with orthodox seeds. However, we showed that physical dormancy does not always imply having a harder covering structure and therefore terms like "hardseeded" or "hard coat" should no longer be used as synonyms.

Forest management impact on sexual versus vegetative regeneration in Mediterranean oak forest

Mrs Solène Brasseur[1], Dr Mathieu Santonja[1], Mrs Sylvie Dupouyet[1], Mrs Alexia Pavard[1], Mrs Faustine Guyot[1], Dr Bernard Prévosto[2], Pr Anne Bousquet-Mélou[1]

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Abstract

Sustainable forest management is essential to cope with the ongoing climate change, especially for Mediterranean oak forests whose aging stands regenerate slowly. To promote regeneration, forest managers use methods such as regeneration cutting to provide light to young seedlings and partitioning to reduce soil compaction by machinery. However, these methods may favor both sexual and vegetative reproduction, resulting from seed germination and resprouting/suckering, respectively. In this context, we studied the effect of thinning intensity and forest partitioning on a *Quercus pubescens* forest regeneration in southern France. Although seed germination was higher in unthinned plots, the canopy opening favored seedling growth and survival. Forest partitioning reduced seedling growth and favored seedling emergence by suckering. Finally, stump sprout number increased according to thinning intensity and sprout growth according to stump size. Thus, our study highlights that the impact of management on forest regeneration is far from trivial and advocates for caution.

Exploring deep-sea benthos in the Greenland and Norwegian Seas: what may be affected by deep-sea mining?

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Norwegian University of Science and Technology NTNU

Abstract

Impacts of deep-sea mining include loss of substrate and biodiversity, which may affect the community structure, function, health status and biomass in the marine ecosystem. Within estimators of structure, can be found measures of biodiversity (*e.g.* species richness) and as indication of function, functional groups (*e.g.* herbivorous guilds). Species pool effects on local communities (*i.e.* availability of species in a regional area influencing the local community assembly) might be higher as rarer species are present, thus the description of specific species within those guilds is relevant. Here, we explore geographical patterns of deep-sea benthic taxa, searching for ecological functions in the ecosystem, especially related with non-widely described species. We take as source information for species richness in the extended Norwegian continental shelf, derivate from open-source data. This works aims to align to the recommendation of 3D-assessments by several authors, as deep-sea areas are scarcely explored when compared to shallow areas.

Biodiversity shifts mediate global change effects on trophic pyramids

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Abstract

Classic models suggest that ecosystem size and resource availability impact trophic biomass pyramids but often overlook species richness and composition. Our simulations show that considering a community perspective provides different predictions. We then conducted a field study on invertebrate communities across 186 lake ecosystems, indicating that, in low-nutrient and large systems, ecosystem size and resource availability have less effect on biomass pyramids. Conversely, in high-nutrient and small systems, their impact is stronger. Both simulations and field data suggest that changes in species richness drive these effects: positive impacts of ecosystem size and enrichment on richness weaken pyramid effects, while negative impacts strengthen them. These findings highlight the importance of adopting a community perspective to better understand and manage ecosystem functioning in response to global change.

Using Odonata Diversity to Evaluate the Potential of Artificial Water Body Networks in Supporting Freshwater Biodiversity in Arid Regions

Dr Zohreh Eslami Barzoki, Dr Jonathan Chase

German Centre for Integrative Biodiversity Research

Abstract

In the extremely arid regions of the Middle East, agriculture has led to the creation of a network of artificial water bodies (NAW). NAW could serve as crucial habitats for freshwater species, especially given the scarcity of natural water bodies in the region. The present study evaluates the potential of NAW to support freshwater biodiversity, using Odonata as indicators of freshwater biodiversity. The results showed that agricultural land use, serving as an indicator of NAW presence, positively impacts taxonomic diversity but not functional diversity. This suggests that while NAW may support a higher number of species, these species tend to have overlapping ecological roles. In contrast, Urban land use was found to positively influence functional diversity, indicating altered habitats may provide unique niches for specialist species. These findings emphasize the importance of NAW in regional biodiversity of the Middle east, but their ecological functions require further investigation.

Examining the impact of heathland restoration via felling on Coleoptera diversity in the Purbecks

Jenny Manley, Professor Anita Diaz, Dr Matthew Hill, Dr Phillipa Gillingham

Bournemouth University

Abstract

Over recent decades, heathland decline has caused the loss of habitat quality and quantity across the UK, impacting thousands of rare and threatened species. There has been a recent drive to restore heathlands, which often involves the felling of conifer plantations. Carabids were sampled from 35 sites across the Purbeck Heaths National Nature Reserve following tree removal. The sites were equally split across seven categories; forested, wet and dry heath, and restored wet and dry heath whether the restoration was either new (< 12 years) or old (> 17 years). Environmental variables measured include ground temperature; soil moisture; humidity; and vegetation structure. 354 carabid species were identified, including the globally rare *Anisodactylus nemorivagus* and nationally scarce *Carabus nitens*. The most beetle-diverse habitat was newly restored wet heathland, which supported 23 species from 119 total carabids. Old dry restored heathland was the least beetle-diverse habitat, recording six species from 23 total carabids.

Vulnerability of European forests to future bark beetles climatic suitability

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Abstract

Bark beetle disturbance is a major cause of tree mortality that may be critical for forest dynamics under future climates with increasing warming and drought. Previous studies have revealed that the vulnerability of forests to this disturbance can be determined by the location of tree populations in the species' climatic niche. Furthermore, a high overlap between tree and bark beetle climatic niches may increase this vulnerability. We focused on assessing changes in the climatic niche overlap of tree and bark beetle species among historical, current and future conditions at European scale. We found that changes between periods were related to the variation effect of precipitation on trees, and temperature for bark beetles. The interaction between tree and beetle species revealed increased niche overlap under future climates leading to a convergence of tree-beetle niche optima. These results indicate a future increase in the vulnerability of European forests to bark beetle disturbance.

How does peatland restoration alter hydrological function and fluvial carbon exports?

Dr Pia Benaud, Dr Naomi Gatis, Lou Goodger, Prof. Karen Anderson, Prof. Richard E Brazier

University of Exeter

Abstract

Globally, significant resources are being targeted towards the restoration of degraded peatlands to help recover ecohydrological conditions and promote the delivery of ecosystem services, such as flood management, water storage, and carbon sequestration. However, though crucial for net-zero plans and climate change adaptation strategies, the ecohydrological response to restoration efforts is not yet fully understood. Using a before-after-control-impact experimental design and monitoring data collected every 15 minutes from a degraded peatland on Dartmoor, this project aims to build a detailed, high-temporal understanding of peatland ecohydrological function and response to restoration works. We quantify restoration impacts on water table depth in an erosional pan/hagg complex and related alterations to flow regimes in a downslope erosional gully within paired sub-catchments. Water quality is monitored in each gully, with a particular focus on DOC and colour, capturing the impact of any changes in peatland function on fluvial carbon.

Identifying facilitative grassland communities using plant functional traits.

Mink R Verschoor, Dr. Kathryn E Barry

Utrecht University

Abstract

Biodiversity loss is challenging the maintenance and stability of ecosystem functions under climate change. Abiotic facilitation, in particular, microclimate amelioration is an important pathway for biodiversity to maintain ecosystem functioning under climate change, as species alter the microclimate to make it less stressful for other species. These effects are often identified where a single individual provides this service to others. In grasslands, however, this process may be harder to identify but equally important as it may emerge from the community rather than from any individual species. We investigated whether facilitative communities can be identified using plant functional traits. We found that the community-weighted mean (CWM) plant traits can moderate soil moisture and temperature, thereby influencing the microclimate. Our results shed light on the driving forces behind microclimate amelioration in temperate grasslands, suggesting that facilitation in these systems arises from the community rather then from single facilitators,

Anthropogenic impacts lead to intricate dynamics of ecological communities, revealing the existence of distinct spatial clusters characterized by minimal species turnover

Dr Emmanuel Chibuike Nwankwo, Dr Axel Rossberg

Queen Mary University of London

Abstract

Results from numerical studies of metacommunity dynamics and analyses of long-time series of community composition suggest that the intrinsic species turnover of ecological communities tends to slow down as the environment degrades, becomes too heterogeneous or regional species pools decline, up to a transition point where intrinsic species turnover comes to a halt. Mathematical arguments suggest that beyond this point, local species richness (alpha diversity) and productivity become dependent upon regional richness (gamma diversity). Here, we show that for some ecological communities recorded in the BioTIME database, their Sorenson similarity between distant time points does not decline beyond 0.9, suggesting that this transition point has been reached or surpassed. In agreement with theoretical expectations, these communities are clustered in space, and clusters are either isolated or in areas with high anthropogenic impacts (suggesting high environmental degradation).

Impact of Plant Life Forms on Hydrological Fluxes in Venezuelan Andean Paramos

Mayanin Rodriguez-Morales

Instituto de Ciencias Ambientales y Ecológicas. Universidad de Los Andes

Abstract

Paramos are the Andean ecosystem, essential water supplier. Climate change threatens it. Plants could have a role reducing its impact. Little is known about the paramos' vegetation effect on the water cycle. To assess it, TDR sensors were installed beneath rosette, shrub and bare soils from March-2012 to November-2013 and through an ecosystem approach, soil water content (SWC), evapotranspiration and other hydrological fluxes were evaluated in a Venezuelan paramo. Evapotranspiration was estimated through the daily SWC variation in days without rain when fluxes get cero, except it. Bare soils lost water two times faster than soils under plants. Shrub retained 120% more water than bare soil, and rosette maintained 50% more in the driest period. Plants reduced the EVT by half in the dry season. These findings showed the critical role of plants keeping water in the ecosystem and the natural infrastructure as a water supplier solution facing climate change.

Assessing the importance of trees outside of woodlands in connecting wooded landscapes

Ms Madeline A Richards[1], Dr Elisa Fuentes-Montemayor[1], Professor Kirsty Park[1], Dr Kevin Watts[2], Dr Matt Guy[2]

[1]University of Stirling. [2]Forest Research

Abstract

Woodland in the UK has experienced a recent period of increase in area, while woodland specialist species have been declining since at least the 1970s. Woodland creation sites are typically small and isolated, making it difficult for woodland species to colonise them and take advantage of this new habitat. Trees outside of Woodland (ToW; e.g. lone trees, hedgerows and groups of trees) can potentially act as connecting features. This poster describes a robust study design investigating how ToW features influence the movement of species across agricultural landscapes, potentially aiding colonisation of new woodlands. Using historic maps and newly developed ToW maps, we identified pairs of woodlands (older source and woodland creation sites), with different degrees of connectedness. These sites will be assessed for the similarity of species assemblages between pairs of woodlands. Future work will focus on identifying species groups most likely to benefit from increasing woodland connectivity with ToWs.

Assessing the performance of automatic tree segmentation algorithms from 3D point clouds of highly liana-dense tropical forests

Joshua Darné[1], Dr Sruthi M. Krishna Moorthy[1], Xingyan Cao[2], Kasper Coppieters[2], Barbara D'hont[2], Dr Félicien Meunier[2], Professor Hans Verbeeck[2], Dr Roberto Salguero-Gómez[1]

[1]University of Oxford. [2]Ghent University, Belgium

Abstract

Tropical forests store the most carbon among all terrestrial biomes, making accurate tree biomass measurements critical for understanding climate change impacts on carbon storage. Terrestrial laser scanning and automatic tree segmentation from 3D point clouds offer promising non-destructive methods for aboveground tree biomass measurement. While automatic segmentation algorithms have shown encouraging results across different forest types, their performance in structurally complex, liana-dense secondary forests remains underexplored. This study evaluates an automatic tree segmentation algorithm on 40 manually segmented trees - 20 from liana-dense and 20 from liana-free forest stands. Using the Jaccard index weighted by voxel-level point cloud density (0: poor; 1: perfect match), the algorithm's performance averaged 0.24 in liana-dense and 0.33 in liana-free stands. Our results highlight the algorithm's lower performance across both forest types, with significantly poorer results in liana-dense stands ($p < 0.05$), emphasizing the need for further research to enhance accuracy in these complex environments.

Moving slopes shape alpine plant traits

Jana Eichel[1], Florine Kooij[1,2], Philipp Gewalt[3], Emma Lok[1], Kees van der Meulen[1]

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Abstract

Elevation and climate are key factors recognized to shape alpine plant traits. Yet, high mountain environments are also characterized by widespread slope movements. How alpine plant species deal with slope movements has been described early on, but barely quantified. We sampled above- and below ground traits of 23 alpine plant species on four active landforms with known slope movement rates in the Swiss Alps. First analyses show that intense sediment erosion or deposition favor high specific leaf areas, root length densities and elastic roots or rhizomes. With less intense but more frequent movements, high leaf dry matter contents and leaf densities prevail, while large leaves and high root mass densities characterize stable slopes. Our quantified linkages between plant traits and slope movement intensities help to understand geomorphic limitations for shifting plants and support trait-based nature-based solutions for slope stabilization.

Utilizing belowground plant strategies to predict ecosystem productivity across environmental gradients

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Abstract

Plant functional strategies are often seen as the 'holy grail' for predicting ecosystem functions like aboveground productivity in open ecosystems, a key indicator of carbon storage. However, past assessments have had mixed success, likely due to the omission of belowground traits in predictive frameworks. Belowground plant strategies are considered critical drivers of ecosystem productivity, particularly in the context of global change. However, comprehensive studies assessing how these trait-ecosystem functioning relationships vary across environmental gradients are still lacking. Here, we leverage a new database on belowground traits—including fine roots, clonal organs, bud banks, and rooting depth—integrated with global aboveground productivity data. We demonstrate that belowground traits are important predictors of ecosystem productivity, although their predictive ability varies across climatic regions, which represent different environmental constraints. Our findings underscore the importance of belowground strategies in driving ecosystem functioning, offering new insights for predicting ecosystem dynamics in response to climate change.

Tree diversity increases carbon stocks and fluxes above- but not belowground in a tropical forest experiment

Florian Schnabel[1], Joannès Guillemot[2], Kathryn E. Barry[3], Melanie Brunn[4], Simone Cesarz[5], Nico Eisenhauer[5], Tobias Gebauer[1], Nathaly R. Guerrero-Ramirez[6], I. Tanya Handa[6], Chris Madsen[7], Lady Mancilla[8], Tim Moore[7], Yvonne Oelmann[9], Michael Scherer-Lorenzen[1], Luitgard Schwendenmann[10], Audrey Wagner[7], Christian Wirth[5], Catherine Potvin[7]

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Abstract

Mixed planted forests are promoted as a nature-based solution to climate change mitigation. However, experimental studies comprehensively examining the control of tree diversity on carbon stocks and fluxes above- and belowground are lacking. We compared multiple above- and belowground carbon stocks and fluxes in the oldest tropical tree diversity experiment, the Sardinilla experiment in Panama. We show that tree diversity significantly increased aboveground carbon stocks and fluxes, with a 57±8% higher gain in aboveground tree carbon in five-species mixtures compared to monocultures. Positive tree diversity effects persisted despite repeated climate extremes. Higher tree growth in mixtures enhanced leaf litter and coarse woody debris carbon fluxes to the soil. However, belowground, we observed a net reduction in soil organic carbon (SOC) and no significant difference in SOC stocks between mixtures and monocultures. Our study elucidates the mechanisms through which higher tree diversity bolsters the climate mitigation potential of forest restoration.

An investigation into the impact of wildfire on ground flora diversity and species composition in the United Kingdom.

Miss Teanne Kesi Kigonya[1], Lily Harpley[2], Adele Julier[2]

[1]University of Portsmouth, 3rd Year Biology student (Undergraduate). [2]University of Portsmouth

Abstract

This study investigates the change in biodiversity and species composition of ground flora post-wildfire. A comparison will be made between approximately 1 year and 2 years after the fire disturbance in Coldharbour, Surrey which was previously a plantation site. Indicator species found on the site (*Calluna vulgaris*, Ulex europaeus and Pteridium aquilinum) classify it as heathland, a priority habitat in the UK under the Biodiversity Action Plan and NERC.

Species composition was found by using quadrats to estimate percentage cover at identical GPS points from secondary year 1 data to make a paired dataset. The Shannon's diversity index for 1 year post-wildfire was 1.101 and 2.081 for year 2, showing an increase in diversity when natural regeneration is allowed. Understanding succession and habitat response after disturbance is key to maintaining heathland as the threat of wildfires increases due to global warming.

Variation in Aquatic Subsidies Induce Indirect Effects in Terrestrial Food Webs

Alanah Kripp, Victoria S. Stoll, Agnes Schöndorfer, Prof. Dr. Mirco Bundschuh, Prof. Dr. Klaus Schwenk, Prof. Dr. Martin H. Entling

RPTU Kaiserlautern-Landau

Abstract

Emerging aquatic insects are an important prey for riparian predators. Variation in the availability can have contrasting effects on terrestrial food webs: if predators accumulate in areas of high aquatic insect densities, this can increase predation pressure on terrestrial herbivores and enhance plant growth. Conversely, if predators switch from terrestrial to aquatic prey, this can relax predation pressure on terrestrial herbivores, thus increasing herbivory and reducing plant growth. This study examines the impact of aquatic insect emergence on spider predators and their subsequent impact on herbivores and *Urtica dioica*. Nettle plants were placed in gauze tents covering both water and terrestrial vegetation across twelve floodplain mesocosms. Preliminary results suggest no clear effects on predator densities but higher aphid infestation and reduced nettle growth with high insect emergence. These observations suggest prey switching and indirect negative effects of enhanced aquatic emergence on terrestrial plants.

Can shade tree diversity predict caterpillar prey-predator interaction in coffee agro-forests of the Western Ghats biodiversity hotspot, India

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Central University of Kerala

Abstract

Agricultural intensification can decrease biodiversity. Coffee agro-forests worldwide experience it. In south India, native trees have been replaced by silver oak trees. Native trees-shaded coffee is floristically complex and diverse than oak-shaded coffee. We hypothesize that natural prey removal is higher in native than oak tree shaded coffee. We used artificial caterpillar models to test this. Arthropods are the predominant predator followed by lizard, birds, and mammals. Overall, predation rates did not differ with the shade tree diversity, but lizard predation rates were higher in diverse trees-shaded coffee than in oak-shaded coffee. Predation rates of predator taxa were higher for the caterpillars placed on stems and branches than on leaves. The study does not support the hypothesis that the overall natural predation rates is driven by the shade tree diversity. But it is worthy to note that the bio-control potential of lizards is higher in diverse tree shaded coffee.

Studying the relationship between protected areas and recreation demand across the UK

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Abstract

Protected areas are important for conserving biodiversity and delivering a range of ecosystem services, including recreation. In the UK, Sites and Areas of Scientific Interest (SSSI/ASSIs) are the basic unit of protection, designated for their special flora, fauna, and geology. Despite these sites being widely used and appreciated by people, our existing understanding of the relationship between recreation demand and protected areas nationally is limited.

In this study, we develop a spatial workflow which investigates the level of recreation demand across all SSSIs and ASSIs in the UK. We find that recreation demand is high for protected sites located closer to urban areas and for sites which contain woodland and grassland. The results of this study are important for identifying recreational hotspots and supporting the management of the UK's SSSIs and ASSIs.

Synthesis of animal trait data across the Tree of Life with ShareTrait: problems, pitfalls and possibilities.

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Abstract

Here we present ShareTrait, a user-friendly platform that makes animal trait data not only Findable and Accessible, but also Interoperable and Reusable, thus embracing FAIR principles. To date, the ShareTrait database holds over 30,000 records on three traits universal to animal life: metabolic rate, development time and fecundity. A key feature is the wealth of metadata that is included in a standardized manner, which we demonstrate greatly enhances data interoperability and reusability. For instance, after accounting for differences in common covariates such as size and temperature, intraspecific trait variation was similar to variation in traits across species for both fecundity and metabolic rate, while variation in development rates was ~3 fold smaller within species, compared to across species. This makes ShareTrait a valuable resource for researchers collaborating in large-scale syntheses projects, which are urgently needed to address the complex, global environmental challenges of our time.

Investigating the relationship between biodiversity and ecosystem function in agricultural systems

Dr Olivia F Morris, Dr Will Pearse

Imperial College London

Abstract

We examine the relationship between biodiversity and ecosystem functions in agricultural systems, considering the ongoing biodiversity losses and the rising demand for food production. Using a meta-analytical approach, we find that increasing biodiversity generally enhances ecosystem functions, but the strength of this relationship varies significantly depending on the sustainable agricultural practice used. Crop diversification is particularly effective, enhancing food production, biomass turnover, and habitat creation, likely due to factors such as improved soil quality. Non-crop diversification, such as flower strips or tree islands, benefit ecosystem functions irrespective of biodiversity levels, indicating the need for diverse approaches to achieve multiple ecosystem service benefits. We also find that factors such as study duration and spatial scale have limited impact on these relationships, suggesting robust patterns across contexts. Overall, our findings highlight the complexity of biodiversity-ecosystem interactions and advocate for a combination of sustainable practices to support both ecosystem health and food security.

Revealing the compositional and functional responses of mycorrhizal fungi to rewilding at the Knepp Wildland

Jed M Soleiman[1,2], Dr Laura M. Suz[3], Dr Jesús Aguirre Gutiérrez[1,2], Dr Cecilia Dahlsjö[1,2], Professor Yadvinder Malhi[1,2]

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Abstract

Mycorrhizal fungi build symbiotic relationships with plant roots, can form common mycorrhizal networks, and forage for soil nutrients otherwise inaccessible to plants. This movement of resources is essential to the sustained health and growth of above-ground vegetation, ultimately helping determine overall ecosystem structure. This becomes particularly pertinent for nature recovery strategies such as rewilding, which prioritises functionalism and ecosystem autonomy, using low-impact interventions that aim to create resilient, self-regulating ecosystems. However, little attention has been paid to rewilding's impacts below-ground, and specifically on 'keystone' mycorrhizal fungi. Employing novel survey techniques, we collected soil eDNA from the Knepp Wildland and compared them to local analogous sites that are chemically farmed. We present differences in the diversity and abundances of mycorrhizal fungi, transitions in community structure, and attempted to map their impact in soil functions. Overall, we intend to help normalise and integrate mycorrhizal monitoring for nature recovery.

Species richness is increased by weedy plant species at higher intensities of sheep grazing in acidic sand pastures

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Abstract

Effect of sheep grazing was studied in acidic sand grasslands. The study sites are in a dense network of municipalities in North East Hungary. In total, 15 sites were classified into five grazing intensity categories. We tested the effect of sheep grazing on the biomass of vascular plant species. Their biomass was the basis for determining species richness, the proportion of life form groups and the CSR-based social behaviour types.

Species richness and total biomass displayed a unimodal relationship. Higher grazing intensity decreased perennial graminoid biomass but increased that of short-lived forbs and species richness. Proportion of weedy species of the studied grasslands were also increased by higher grazing intensity. We found that high grazing intensity increases species richness but decreases the proportion of species of high conservation interest. Our results are instructive for conservationists managing grasslands in densely populated regions.

Flexible or Fortified? How Lichens May Balance Defense Strategies Across Extreme Environments

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[1]Vrije Universiteit Amsterdam. [2]British Antarctic Survey

Abstract

Lichens, symbiotic units of fungi and photobionts, are crucial for habitat formation in polar and alpine ecosystems, yet the ecological roles of their traits remain poorly understood. We propose a trait trade-off for managing UV exposure based on climatic harshness. In the harshest environments, lichens should depend on photostable, hydrophobic compounds, offering durable protection without the need for continual synthesis. Conversely, in milder conditions where biotic interactions become increasingly pronounced, lichens should retain flexibility, producing relatively soluble secondary compounds that can leach out to influence their direct environment. Such compounds allow lichens to modulate chemical protection in response to fluctuating moisture and temperature, not only serving as UV protectants, but potentially also as anti-microbials and allelopathic agents. Preliminary findings for the Antarctic support this hypothesized trade-off. As climate change progresses, the range of lichens producing leachable compounds may expand, with cascading effects on rock weathering, nutrient cycling, and ecosystem dynamics.

Interactive effects of urbanness and land use type on soil carbon and nitrogen pools in green space

Mr Peng Huang, Dr Yue Sun, Dr Kirsty Watkinson, Miss Abigail Coole, Professor David Johnson, Professor Richard Bardgett

The University of Manchester

Abstract

Increasing the proportion of green spaces in urban areas is a key strategy to maximize ecosystem services. Here, we investigated the associations among urbanisation and land use type with carbon and nitrogen pools in bulk soil and organic matter fractions. We found that soil carbon and nitrogen content in urban green space generally increased from rural to urban areas and from woodland to grassland. Plant species richness had a negative relationship with soil carbon and nitrogen content, and we observed a significant interaction between land use type and urbanisation which can promote soil carbon and nitrogen sequestration. Moreover, green space in the most urbanised areas contained significantly more carbon in particulated organic matter fraction compared to rural areas. This findings demonstrate that urbanisation and land use type has significant effects on key pools of soil carbon and nitrogen and emphasise the importance of considering these pools for future urban planning.

Tree growth responses to varying intensities of liana removal in a partially logged tropical forest

Miss Rosemary Wool[1], Dr. Patrick Cannon[2], Dr. Catherine Finlayson[3], Mr. William George[1], Miss. Alice Jackson[1], Mr. Mick Turner McKinnel[1], Prof. David Edwards[4], Prof. Robert Freckleton[1]

[1]University of Sheffield. [2]University of Reading. [3]Center for Natural Climate Solutions. [4]University of Cambridge

Abstract

Commercial selective logging in tropical forests leads to canopy disturbance and the subsequent rapid growth of ruderal, photophilic lianas. Lianas are known to negatively impact tree performance but can be beneficial to fauna for forage, nests and connectivity. Climber removal is a widely employed form of tropical forest restoration, however previous studies have only explored the effect of complete liana removal on trees. Using a 320-ha liana removal experiment in Sabah, Malaysian Borneo, we explored the impact of a range of liana removal intensities on liana regrowth, tree growth and carbon storage. We find that removal intensity significantly increases overall and species-specific adult tree growth. However, overall juvenile tree growth, tree and plot biomass, and carbon were unaffected four years post-treatment. Our findings suggest that partial removal can cause intermediary responses in tree growth but is dependent on factors such as tree age and species identity.

Impacts of ash dieback on mycorrhizal hyphal production and respiration in Wytham Wood, Oxford

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Abstract

A severe dieback of ash (*Fraxinus excelsior*) caused by the fungal pathogen *Hymenoscyphus fraxineus* has spread across Europe. Ash is an arbuscular mycorrhizal (AM) species, whereas the other dominant tree species, such as beech and oak, are ectomycorrhizal (ECM) species. As ECM trees often allocate more carbon to their fungal partner than AM trees, ash dieback and the resulting increase in ECM trees may increase mycorrhizal hyphal production and/or metabolic activity, but this remains unclear. Here we compared mycorrhizal hyphal production and respiration rates using the hyphal ingrowth cores between ash-dominated, ring-barked ash-dominated (a treatment mimicking severe ash dieback), and beech- and oak-dominated forests every 50 days from March to September 2023 in Wytham Woods, outside Oxford, UK. Both hyphal production and respiration were generally higher in beech- and oak-dominated forests than in the two ash-dominated forests. This suggests that ash dieback may increase carbon allocation to mycorrhizal fungi.

How sustainable are urban trees?: a comparative trait-based analysis of urban tree

Dr Jayanti Ray Mukherjee[1], Dr. Satyajit Oraon[1], Dr. Kishore Rajput[2]

[1]Azim Premji University. [2]he Maharaja Sayajirao University of Baroda,

Abstract

Plant functional traits are often used as indicators of plants' resilience capabilities. In plant trait-based ecology, plants' resilience properties are frequently examined from the lens of their leaf, stomatal, or wood traits, where the associations of these trait realms are often ignored. In this study, in the landscape of urban Bengaluru, India, we examined the leaf, stomatal, and wood functional traits and their correlations across 23 urban tree species. We found that the higher the specific leaf area (or thinner the leaves), the smaller the stomatal pores, suggesting a strategy for optimizing water loss in these species. Our comparison also showed that trees with greater vessel diameter had less wood density and were more vulnerable, indicating that these species might be prone to xylem embolism under water-limited conditions. Understanding such trait comparisons may significantly improve urban planning in the face of climate change and increased heat and drought stress.

Plant silicification by biome

Dr Julia Cooke[1], Dr Ofir Katz[2], Dr Ryosuke Nakamura[3], Dr Jonas Schoelynck[4], Dr Felix de Tombeur[5]

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Abstract

All plants accumulate silicon and there are strong phylogenetic patterns in accumulation, across multiple plant parts. Previous studies and reviews have largely focused on the role of Si accumulation in plant functional types, the functions of silicon in plants or Si cycling in specific ecosystems. Here the role of plant silicon, in terms of functions, dynamics, and quantity, is considered from a biome perspective, with a focus on terrestrial systems, but also including marine and freshwater biomes. Which biomes are best studied, how do they differ and where are the biggest gaps in our knowledge?

Toward a global relationship between net primary production and biodiversity in marine ecosystems

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Abstract

The oceans are critical to sustaining life on Earth, acting as major carbon sinks, regulating climate and providing essential ecosystem services. Net primary production (NPP), the rate at which phytoplankton convert inorganic carbon into organic matter through photosynthesis, is critical to the flow of energy in ecosystems. This study examines the global relationship between NPP and marine biodiversity using satellite data and in situ measurements. The results show a strong relationship between NPP and biodiversity, suggesting that higher productivity supports greater species richness and ecosystem resilience. However, this relationship is complex, as some diverse ecosystems may experience large declines in NPP due to resource competition. The study notes that while global trends show a climate-induced decline in NPP, local variations and other environmental factors add uncertainty and require different conservation approaches, highlighting the importance of understanding NPP-biodiversity dynamics for effective conservation strategies.

Assessment of first trophic level functional traits using molecular ratios in coastal ecosystem

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Abstract

In marine ecosystems, traditional biomass indicators as cell abundance and chlorophyll *a* are able to measure population size without reflecting phytoplankton functional activity. Molecular traits, such as DNA, RNA, and 18S rDNA, are more closely linked to metabolic dynamics in pelagic ecosystems. By focusing on two diatom species *Chaetoceros socialis* and *Skeletonema marinoi*, commonly found in the northwestern Adriatic Sea, Mediterranean Sea, this study evaluates RNA/DNA and 18S rRNA/rDNA ratios as indicators of changes in phytoplankton functional activity. Significant correlations were observed between abundance, chlorophyll *a*, carbon content, and proteins. During early growth phases, both species showed peaks in RNA/DNA and 18S rRNA/rDNA ratios followed by a sharp decline. In co-culture systems, maximum molecular ratios occurred during the exponential phase. Significant correlations were found between molecular ratios and biomass indicators, suggesting that these ratios may serve as predictive tools to monitor phytoplankton dynamics and ecosystem productivity.

Tree Growth Responses to the Central European 2018-2020 Drought: Roles of Diversity, Drought-Tolerance Traits, and Mycorrhizal Types

Lena Sachsenmaier[1,2], Florian Schnabel[3], Pablo Castro Sánchez-Bermejo[4,1], Nico Eisenhauer[1,5], Olga Ferlian[1,5], Sylvia Haider[6,4,1], Bernhard Schuldt[7], Fon Robinson Tezeh[7], Christian Wirth[2,1,8]

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Abstract

Climate change is projected to increase the frequency of consecutive drought years, threatening the productivity of Central European forests. While mixed-species forests often promote growth stability, their performance during extreme droughts is still debated. This study investigates tree diversity's effect on growth in experimental tree communities before, during, and after the 2018-2020 Central European drought, focusing on mycorrhizal associations and functional traits. We analyzed annual growth data from 5,120 trees in the MyDiv experiment (Germany), measured drought tolerance traits, and modeled diversity-productivity relationships and their interaction with functional traits. Results show that trait syndromes related to embolism resistance and stomatal control are key drivers of diversity–productivity relationships in drought and non-drought years. Analyses including the functional diversity of the tree neighborhood and its mycorrhizal associations are ongoing. This study provides a functional approach to understanding diversity-productivity relationships under drought and contributes knowledge to the drought-resistance of tree mixtures.

Agate.jl - a new digital infrastructure for probabilistic aquatic ecosystem models in Julia

Dr Joost de Vries[1,2], Dr. Levi Wolf[1,2], Dr. Radka Jersakova[2], Dr. Chris Follett[3,2], Dr. Fanny Monteiro[1,2], Dr. Stephanie Dutkiewicz[4]

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Abstract

Process-based models are widely used to infer ecological and biogeochemical processes in planktonic ecosystems, and their response to environmental change. However, many of the parameters (e.g. mortality) needed for such models are impossible to infer from laboratory data, due to difficulties culturing many groups of marine microbes and significant challenges running competitions and predation experiments. Inverse modelling approaches (i.e. parameter estimation based on observational data) offer an exciting avenue to determine traditionally difficult to infer parameter values based on widely available observational data. However, the uncertain nature of observational data, and difficulty applying inverse modelling approaches to high complexity models means applications of these approaches remain limited. Here, we present a new digital infrastructure under active development in programming language, Julia (Agate.jl), which will empower researchers with the tools to deploy inverse and probabilistic process-based aquatic ecosystem models more rapidly.

Machine learning usage for detecting forest fires from satellite images in the Rif area (Chefchaouen and Tetouan provinces), Morocco.

Pr. Fouad MOUNIR, Mss Youssra GAMOUSSI

National Forestry School of Engineers, Salé Morocco

Abstract

Forest fires represent disturbance. We used remote sensing and machine learning techniques to detect burned areas in Rif region.

Using Sentinel-2 imagery, we mapped burned areas for five years (2018-2022). For each year, we obtained one scene of images before the fire's year, and one for the following fire's year.

Various spectral indices were computed and incorporated within the Random Forest algorithm. The results demonstrated RF's high accuracy in delineating fire-affected areas.

Feature importance analysis identified RdNBR and dGNDVI as critical variables for detecting burn scars.

Subsequently, fire trends analysis revealed fluctuating trends across the study timeframe, with a peak in wildfire occurrences in 2022 and heterogeneous burnt area distribution.

Estimated burnt areas validation, using reference data, showed varying levels of accuracy. In Chefchaouen, the algorithm demonstrated strong performance in 2019-2020 with an R2 over 0.8. In Tetouan, the model exhibited satisfactory results with high R2 across all years (0.66-0.94).

Drought stress and flammability are linked in species across Southern California, USA

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Abstract

Relationships between plant hydration, drought- and fire-adapted plant traits may explain landscape-scale wildfire dynamics, especially in semi-arid regions where drought and wildfire often co-occur. To inform predictions of wildfire dynamics and risk, we linked plant hydration to tissue-level flammability via synchronous measurements of drought stress (xylem water potential), fire risk indicators (live fuel moisture), and flammability (burning characteristics) in eight species common to fire-prone regions across Southern California, USA.

In chapparal species, live fuel moisture showed a threshold-type relationship with tissue flammability that aligned with drought-response traits and fire behavior identified at the landscape scale, while water potential proved to be a better predictor of flammability than LFM in linear models. Threshold relationships were not observed in species found in mixed-conifer forests, where different species had unique drought~flammability relationships. Our results highlight the complex nature of drought-flammability linkages, and the importance of species-specific empirical grounding for predictions and models.

Nanotechnology in agriculture: evaluating impacts of a copper-based nano-fungicide on fungi-mediated processes

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Abstract

The intensification of agriculture has led to an unsustainable dependence of chemical substances. Nano-pesticides, a new generation of agrochemicals, promise enhanced efficiency in precision agriculture and reduced environmental impact. However, these statements need confirmation. Using bi-trophic models as experimental systems, we investigated the impacts of a nano-fungicide (copper oxide nanoparticles, Cu-NP) on aquatic fungi and the processes where they intervene. Here, we present our findings on a host-parasite model (the crustacean *Daphnia sp.* and the microparasitic yeast *Metschnikowia bicuspidata*) and a detrital food web model (decomposer fungi and detritivorous insect larvae). In both cases, a concentration-dependent pattern was observed, but relevant ecological effects on disease spread or decomposition were only detected at high Cu-NP concentrations. Antifungal effects on parasitic or decomposer fungi were observed from 301 μg L^{-1} onwards. Our research provides valuable insights into the potential ecological consequences of nano-fungicide use in aquatic environments.

Investigation of species-specific size-to-mass scaling dynamics for common European broadleaf tree species using terrestrial laser scanning

Tom E. Verhelst, Louise Terryn, Hans Verbeeck, Kim Calders

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Abstract

Allometric aboveground biomass (AGB) models are conventionally constructed using linear regression, which assumes a constant size-to-mass scaling across the tree size range. However, recent findings suggest this assumption does not hold and that size-to-mass scaling likely changes throughout a tree's lifespan. Failing to account for such dynamic scaling could bias AGB estimates, specifically for trees outside of the calibrated size range. A better understanding of possible dynamics in the size-to-mass scaling of specific tree species could improve further AGB modelling and provide insights into the interplay between growth and AGB dynamics. We use a TLS dataset containing detailed structural data of several European tree species (*Fagus sylvatica, Quercus sp., Acer pseudoplatanus and Betula sp.*) from the UK and Western Europe. Full 3D tree reconstructions are used to investigate differences in size-to-mass allometric scaling among the tree species. We then explore how those differences might relate to the species' growth strategies.

The structural and functional responses of Amazon forests to seasonality and drought across soil water availability gradients

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Abstract

Much of our knowledge of tropical forest drought responses comes from deep water table depth regions (deep WTD, with limited soil water) while shallow WTD forests (where soil water is normally plentiful) are severely under-researched, despite occupying ~50% of the Amazon basin and recent work indicating that shallow WTD forests may be more resilient to drought.

We present preliminary results showing the effects of soil water availability on seasonal and drought responses of leaf flush (from RGB drone images), woody stem growth (via automatic dendrometers), vertical leaf area distributions (from ground-based lidar), root growth, and hydraulic function (sapflow sensors). We also present fine-scale 3D structural characterisations of deep and shallow WTD sites from mobile laser scanning.

Understanding the influence of soil water availability on forest seasonal and drought responses will help improve ecosystem models projections of climate change impacts, including the potential for a tipping point in Amazon forest function.

Conversion of natural vegetation to agricultural land use alters ecosystem multifunctionality through contrasting ecological mechanisms

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Abstract

Land use/cover (LULC) changes have affected biodiversity and multiple ecosystem functions (multifunctionality) worldwide. However, the biodiversity-related mechanisms underlying the effect of LULC change on ecosystem multifunctionality (EMF) remain unclear. Therefore, we conducted a real-world experiment across forests, savannas and agroforestry parklands to assess the drivers of the response of woody species diversity and EMF to land conversion in the dryland landscapes of Benin. We found that the conversion of forests and savannas to agroforestry parklands decreased EMF both directly and indirectly via biodiversity attributes. Indirect land conversion effects were mediated by two contrasting mechanisms including a loss of species diversity and a shift in functional composition towards the dominance of wood species with acquisitive traits. Our findings demonstrate that land conversion from natural vegetation to agricultural land use weakened EMF through biotic homogenization.

Variability in aboveground biomass resistance to extreme drought in successional old-field mesic grasslands tied to belowground processes

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Abstract

A range of belowground ecosystem factors, including soil organic carbon, and plant traits such as root turnover and allocation, are predicted to contribute to drought resistance for grassland productivity. Following agricultural abandonment, successional development provides variation in these factors at a local scale. We examined soil factors along a chronosequence of old-field grasslands that were abandoned between 6 and 94 years from agricultural use. Our experimental extreme drought was applied via precipitation reduction (-43%) over two growing seasons. We found that aboveground growth was significantly reduced under drought in both years, however no effect of succession. Instead, the field with the lowest drought resistance had significantly lower belowground biomass than predicted based on the age of that field. Belowground community traits play an important role in assessing potential impacts from disturbance, and management actions that promote this component of recovery may be needed for reducing impacts from increased drought risk.

Co-flowering species in a glasshouse boost stingless bee health and strawberry pollination services

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Abstract

Pollination is essential for producing most fruits and vegetables, but must be managed alongside biodiversity, pest control, plant growth and bee health. In protected cropping systems like glasshouses, conditions optimise plant growth and pest control but exclude essential pollinators, leading to reduced biodiversity. Introducing managed bees lead to their poor health due to limited plant food diversity. Growing co-flowering plants is an option, but they may compete with the main crop for pollinators. To address these interactions, we studied strawberry pollination by Australian stingless bees (*Tetragonula carbonaria*) in a glasshouse environment with (treatment) and without (control) four co-flowering plant species (basil, marigold, lavender, Cape daisy). Bee activity (~227 hours), hive weight (proxy for hive health) and strawberry fruit quality were assessed. Results showed improved bee visits, hive weight, and better fruit quality when co-flowering plants were present. Thus, co-flowering plants synergistically lead to a "win-win" outcome in protected cropping systems.

In-situ measurements of feeding and burrow removal rates of fallen leaves of a mangrove species, *Bruguiera gymnorrhiza*, by three species of detrivorous crabs.

Kyosuke Kojima, Ko Hinokidani, Ryosuke Tadokoro, Ko Tanabe, Hikaru Shionoya, Yasuhiro Nakanishi

Tokyo University of Agriculture

Abstract

We have shown that mangrove ecosystem function as a source of dissolved iron supply to coastal waters, that the iron supplied is an organic iron complex of phenolic substances in mangrove leaf-litter with iron in the forest floor soil. In this case, the formation of the iron complex can be related to the removal of fallen leaves by detritivorous crabs. To demonstrate the hypothesis, we examined the amount and rate of feeding and taking to their burrows by three species of detritivorous crabs, *Neosarmatium smithi, Episesarma lafondi*, and *Parasesarmas bidens*, and compare to the amount of dissolved iron in the habitat soils. These experiments were conducted on Iriomote Island (sub-tropical climate), Japan, from July 2023 to August 2024. As the result, the differences of feeding amounts and removal rates by the crab were observed in summer and winter seasons, and this trend can be attributed annual range of temperature.

Highly variable ecosystem-wide responses of tropical forest to disturbance: logging alters forest structure and environment, while conversion to agriculture affects biodiversity and functioning.

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Abstract

The impacts of degradation and deforestation on tropical forests are poorly understood, particularly at landscape scales. We present an extensive ecosystem analysis of the impacts of logging and conversion of tropical forest to oil palm from a large-scale study in Borneo, synthesizing responses from 82 variables categorized into four ecological levels spanning a broad suite of ecosystem properties: 1) structure and environment, 2) species traits, 3) biodiversity, and 4) ecosystem functions. Responses were highly heterogeneous and often complex and non-linear. Variables that were directly impacted by the physical process of timber extraction, such as soil structure, were sensitive to even moderate amounts of logging. By contrast, measures of biodiversity and ecosystem functioning were generally resilient to even heavy logging but more affected by conversion to oil palm plantation.

A global assessment of the interoperability of tree crown allometries derived from field and airborne remote sensing data

Miss Mathilda A Digby[1,2], Mr Tommaso Jucker[1], Mr Fabian J Fischer[1]

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Abstract

Advancements in airborne imagery allow detailed measurements of global tree height and crown size, revolutionising forest monitoring. This has enabled large-scale estimates of tree counts, size classes, and biomass. However, these estimates assume that measurements from field and airborne data are directly comparable, an assumption that may not hold due to differences in crown observation from the ground versus the air. These discrepancies could lead to significant biases in tree size and biomass estimates. But to date no one has assessed this in a systematic way. To address this, we manually delineated over 30,000 trees using airborne LiDAR and RGB data from 30 global sites, spanning diverse climates and forest structures. By combining these data with field measurements from TALLO database, we assessed the agreement between crown area and height allometries at global, biome, and site levels. This study provides crucial insights for improving the accuracy of large-scale forest monitoring.

Forest Management and Microclimate: The Impact of Stand Structural Complexity on Temperature Buffering within a Temperate Mixed Forest

Stephanie P Koolen[1,2], Dr. Kerstin Pierick[2], Prof. Dr. Dominik Seidel[2]

[1]University of Oxford. [2]Georg August University of Göttingen

Abstract

Forests act as buffers against macroclimatic warming, but the role of forest management and structure on this buffering capacity remains underexplored. Management can alter stand structural complexity, potentially allowing us to regulate the microclimate and create microclimate refugia. However, efficiently and objectively measuring this complexity has been challenging until recent developments in laser-derived structural indices. Here, I investigated how management interventions in a mixed forest in Bavaria, Germany, impacted above- and below-canopy temperature during the summer of 2023, five years post-intervention, and how these temperatures correlated with structural indices derived from terrestrial laser scanning. While structural indices showed ambiguous relationships with management interventions, below-canopy temperature variables were significantly affected, indicating a reduced buffering capacity. Canopy openness proved to be the best predictor of below-canopy temperatures, with increased openness leading to more extreme conditions. These findings highlights the importance of maintaining continuous canopy coverage to preserve the buffering capacity of forests.

The soil microbiome in restoration programmes is shaped by antecedent land use.

Dr Samuel GS Hibdige, Prof Jim a Harris, Dr Alexey Larionov, Dr Mark Pawlett

Cranfield University

Abstract

The RestREco project explores the relationship between complexity and resilience in restoration of habitats. Whilst the project overall examines many multidisciplinary factors, one key aspects it explores is how the soil microbiome is shaped by the past using metagenomics.

One Hundred and Twenty restored woodland and grassland sites across the UK were sampled. Amplicon sequencing was used to determine the composition of both bacterial and fungal communities and compared to chemical properties of the soil. By examining changes in relative abundance and inferred functional capacity between sites, we were able to see how restoration trajectories of the microbiome are limited by their past.

Stark differences in the microbiome were detected in restored woodlands even after 70 years that correlate with former land use. Not only were the bacterial and fungal communities different between former land use practices, but also demonstrate different trajectories entirely without converging to a single "restored" point.

The Impact of Natural Hazards on Species Distribution, Ecological Interactions, and Ecosystem Services

Dr Fernando Gonçalves

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Abstract

Natural hazards such as earthquakes, hurricanes, tsunamis, and volcanoes pose significant extinction risks, especially to species with narrow distributions or small populations. These risks are particularly high in the tropical islands, where species are more susceptible. This study examines how these events affect amphibians, birds, mammals, and reptiles, and their impact on ecosystem processes and services from a multiscale landscape and biogeography perspective. Evidence from the Caribbean, following Hurricane Maria, reveals how extreme events disrupt specialised mutualisms, like those between pollinators and plants. While such disruptions can harm specialised species, they may also provide opportunities for generalists, promoting ecosystem resilience. These disturbances reshape species interactions and influence ecological and evolutionary processes, vital for biodiversity. Given the increasing frequency and intensity of natural hazards due to global warming, conservation strategies like intensive population management and establishing insurance populations will be crucial for species survival in the coming decades.

Investigating the resilience of North-East Atlantic intertidal forests to disturbance over a latitudinal gradient

Ruby George[1], Tom Fairchild[1], Francisco Arenas[2], Fraser Brough[3], Thomas Burel[4], Michael Burrows[5], Amelia Curd[6], Dominique Davoult[7], Marina Dolbeth[2], Gabin Droual[6], Aline Migne[7], Pippa Moore[8], Joanne Porter[9], Daniel Smale[3], John Griffin[1]

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Abstract

As climate change intensifies storms and heatwaves, understanding the resilience of ecological communities is crucial. Yet how the resilience of foundational species in marine ecosystems varies across different climatic conditions is poorly understood. To explore the variation and drivers of resilience in marine ecosystems, we are undertaking a large-scale experiment across seven regions spanning from Portugal to Orkney. In Spring 2023, we simultaneously disturbed experimental plots on intertidal shores by removing canopy-forming algae at three treatment levels and are monitoring the fucoid and community responses. Additionally, we are undertaking coordinated measurements of morphological traits and growth of macroalgae to further understand the biological processes underlying resilience. After 18 months, the results are supporting our hypothesis that recovery from disturbances is hindered under stressful climatic conditions. Overall, this collaborative experiment is advancing our understanding of large-scale drivers of resilience in marine systems increasingly impacted by extreme climate-related disturbances.

Revisiting The Effects of Climate and Land Use on The Biological Composition of South African Streams.

Mr Buntu Fanteso[1], Dr Michelle Jackson[1], Dr Tatenda Dalu[2], Dr Ryan Wasserman[3], Dr Wilbert Kadye[3]

[1]University of Oxford. [2]University of Mpumalanga. [3]Rhodes University

Abstract

Climate change and land use are two critical global stressors that are significantly impacting freshwater biodiversity. Our limited understanding of how these two stressors interact and shape the biological composition of freshwater ecosystems makes it challenging to disentangle their individual from their combined effects, therefore, making prioritising management responses difficult. In this study, we analysed climate data (temperature and rainfall) and macroinvertebrate communities from 30 streams across a latitudinal gradient in South Africa, sampled in August 2023 and April 2024, to study their response to the two key stressors. We used Detrended Correspondence Analysis (DCA) and General Linear Models (GLM) for analysis and the preliminary findings indicate macroinvertebrate response is shaped by climate-related changes in temperature and agriculture. The study demonstrates the need to consider multiple stressors for more sustainable management of freshwater ecosystems.

Methods to quantify the connectivity value of newly planted woodlands

Dr Fiona Plenderleith[1], Ms Nicola Rae[1], Dr Alice Broome[1], Dr Sam Hughes[1], Dr Matt Wainhouse[2], Prof Luca Börger[3], Dr Ruby Bye[4], Prof Kevin Watts[1,5]

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Abstract

In their early stages, planted woodlands support a proportion of the biodiversity found in mature woodlands, making their ecological value seem irrelevant. However, young woodlands may play a crucial role in promoting species movement and enhancing biodiversity due to their structural similarities. We conducted a natural experiment, using woodlands planted in the 1990s. We selected new woodlands which 'connect' two mature woodlands and compared these with woodlands separated by agricultural land. Here we outline several methods we developed to quantify connectivity across different taxa (plants, fungi, animals) and present preliminary results. For plants, we focused on modelling seed dispersal and survival, recording established plants as movement indicators. Ground-dwelling beetles were studied using a novel RFID tagging method to assess propensity to emigrate. Fungal movement was assessed using eDNA from soil sampling and spore movement through air sampling. For small mammals we developed an automated RFID feeding station to monitor movement.

Combining Forest Structure and Microclimate Measurements: A Study Conducted in the Australian Tropical Rainforest.

Ir. Luna Soenens[1], Pr. Kim Calders[1], Dr. Louise Terryn[1], Zane Cooper[1], Geike De Sloover[1], Andrew J. Ford[2]

[1]Q-ForestLab – Laboratory of Quantitative Forest Ecosystem Science, Department of Environment, Ghent University, Ghent, Belgium.. [2]Independent Researcher, Australian Wet Tropics, QLD, Australia.

Abstract

Forests can buffer the effects of climate extremes with microclimate regulation being crucial for forest functioning. However, both forests and the ecosystem services they provide are globally under increasing pressure from climate change. Our study focuses on 15 permanent plots established in the Australian tropical rainforest during the 1970s-2000s, spanning a rainfall and altitudinal gradient. By combining microclimate measurements and terrestrial laser scanning (TLS) data, we aim to improve our understanding of how forest dynamics and disturbances are impacted by rainfall and altitude, and how this subsequently affects the forest's microclimate buffering capacity. In this presentation, I will focus on how 3D forest structure (through TLS) relates to microclimate. Data were obtained during a field campaign conducted in the wet tropics of North Queensland from June to August 2024. These data consist of 60 microclimate loggers and 726 TLS scans collected over a three-hectare area at Robson Creek.

Studying a century of body size change in two pollinator groups reveals divergent responses

Miss Mahika K Dixit, Dr Andres N Arce, Dr Richard J Gill, Dr William D Pearse

Georgina Mace Centre for The Living Planet, Department of Life Sciences, Silwood Park, Imperial College London, Ascot, UK

Abstract

Understanding morphological change in ecologically important taxa is critical for safeguarding ecosystem functions under environmental change; body size change in insect pollinators can significantly impact the health of flowering communities. Museum collections remain underused despite their unique suitability for studying morphological change through time. We used images of UK museum specimens to investigate how body size in bumblebees (six species) and butterflies (nine species) has changed over the last century and with temperature. We found that the direction of temporal bumblebee body size trends matched trends with temperature within castes, but trends consistently differed between bumblebee castes. Consequently, increasing ambient temperatures will likely impact bumblebee castes differently. Contrastingly, butterfly body size trends over time and with temperature remained relatively constant across species and generations. This study demonstrates that different taxa, species, and life-history groups may respond distinctly to climate change, and highlights the importance of studies using deep-time baselines.

Tracking ecosystem resilience by satellite in the cloudy UK

Dr Will Rust, Prof Ron Corstanje, Prof Jim Harris, Dr Daniel Simms

Cranfield University

Abstract

Advanced warning of catastrophic ecosystem change is crucial for managing biodiversity loss and mitigating the impacts of climate change. In dynamic systems, such shifts are often preceded by critical slowing down (CSD), where reduced resilience slows the system's recovery from disturbances. Previous studies have proposed early warning systems (EWS) for ecological tipping points using satellite data to model system autocorrelation as a resilience measure. However, this depends on extracting high-quality phenology data. Here, we introduce a new method, Selective Wavelet Extraction for Estimating Phenology (SWEEP), which extracts up to 16 times more phenology information from satellite data and improves CSD modelling across 15 UK COSMOS sites, showing notably improved performance ($r^2 \approx 0.75$ compared to $r^2 \approx 0.3$ with previous methods). This step-up in resolution allows us to track of ecosystem resilience in far greater detail, even in cloudy climates such as the UK.

Assessing Road Crossings Effects on Amazonian Stream Connectivity

Gabriel O. Ferraz[1,2], Cecília G. Leal[2], Jos Barlow[2], Thiago B. A. Couto[2], Karlmer A. B. Corrêa[1], Gabriel L. Brejão[3], Débora R. Carvalho[2], Alice Whittle[1], Guilherme C. Berger[4], Marcos Â. Alves Filho[5], Leonardo T. Y. Maeoka[1], Silvio F. B. Ferraz[1]

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Abstract

Road construction threatens the Amazon by driving deforestation and disrupting ecosystems. While there is strong evidence of road effects on terrestrial ecosystems, the impacts of road-stream crossings on aquatic ecosystems are largely underlooked. We aimed to measure this impact by mapping crossings on 13,000km² of an Amazon region, where 6,500km of dirt roads were driven to validate and characterize the type of each crossing. Next, we evaluated its impacts on the eco-hydrological connectivity of streams over a 34-year period. We found that highly deforested catchments lost 57% of eco-hydrological connectivity, and even catchments with high forest cover lost 30% over the study period. Roads directly affect the eco-hydrological connectivity, a critical element to ecological integrity of freshwater ecosystems. We provide new evidence on the scale and extent of this threat in the Amazon, the world's largest river basin, highlighting the need to consider road-stream interactions to ensure its sustainable future.

Greenhouse gas fluxes in eucalyptus plantations: biotic and abiotic controls and response to climate change

Dr. Alexandra Rodríguez, Dr. Margarita Lema, Dr. Jorge Durán

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Abstract

Eucalyptus plantations are among the main drivers of land-use change in Europe. In the Iberian Peninsula, E. globulus plays a key role in the pulp industry while raising environmental concerns. Our project explores the effects of land-use changes on soil microbial diversity, composition and functioning with a particular interest in soil-atmosphere greenhouse gas (GHG) fluxes (i.e. CO_2, CH_4, and N_2O), and their interactions with climate change. To do so, we compare three forest types—native forests, Eucalyptus monocultures, and mixed Eucalyptus plantations—across various climatic regions. Regular soil samplings and experiments simulating future climate conditions (temperature and moisture changes) are conducted to assess potential N-cycling rates and GHG fluxes. Additionally, the project will identify the key biotic (e.g. plant composition, soil microbial composition) and abiotic (e.g. soil pH, soil organic carbon) drivers of GHG fluxes and the role of soil microbial populations in determining ecosystem responses to climate change.

Changes in climate and management practices influence soil functioning n urban greenspaces

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Abstract

Urban greenspaces play a vital role in mitigating biodiversity loss, regulating urban microclimates, and assuring human well-being. However, there is limited understanding of how different management practices influence soil functioning, or how these soils will respond to climate change. Our study aims to help addressing this gap by investigating the effects of various types of urbangreenspaces, different management intensities, and climate change scenarios on soil functioning across up to 50 cities in Spain and Portugal.

Results show that both climate change and management practices are key determinants of potential soil respiration and nutrient production and availability. Additionally, we identified significant interactions between these factors, suggesting that climate change impacts in urban areas can be modulated by targeted management interventions. These findings highlight the need for informed urban greenspace planing and management to mitigate the adverse effects of climate change and ensure the ecological sustainability of cities.

Contrasting responses of size spectra and energy flux to heatwave and nutrient enrichment: a freshwater mesocosm experiment

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Abstract

Size spectra and energy flux in food webs are key tools for linking community structure to ecosystem functioning and detecting global change impacts on biodiversity. These concepts are related, with size spectra slopes often serving as proxies for energy flux. We examined how heatwaves and nutrient enrichment (N-P) affected size spectra and energy flux in freshwater mesocosms containing phytoplankton, zooplankton, and macroinvertebrates. Heatwaves and nutrient enrichment did not alter the size spectra slopes, indicating no changes in community size structure. However, heatwaves reduced energy flow in zooplankton, potentially limiting energy availability for top predators and simplifying energy flow in freshwater ecosystems. The differing effects of global change drivers on size structure and energy flow highlight that relying solely on size spectra slopes to infer energy flux may be inaccurate. Thus, combining both size spectra and energy flux approaches offers a more comprehensive detection of global change impacts.
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Ecological Restoration of Exploited Peatlands: Impacts on Greenhouse Gas Fluxes and Biodiversity

Juliet Everson

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Abstract

Peatlands are important habitats, both for their ecosystem functions and their role in supporting unique and specialised species. Degradation of UK peatlands has led to rewetting and restoration in the last two decades, but these efforts are rarely monitored long-term, and as such the lasting effects of rewetting are unclear. This project looks at a 10-year chronosequence of restoration across two degraded peatlands in Northern Ireland, investigating the impact of restoration on plant, invertebrate, and microbial communities, as well as greenhouse gas fluxes. Bryophyte recovery was investigated using quadrat sampling, and invertebrates were sampled from soil and sphagnum moss using tullgren funnels. Carbon dioxide and methane fluxes were sampled using dynamic chamber measurements with a LiCor, and paired with soil samples for microbial extraction and qPCR.

Function and diversity of montane heath lichens under environmental change

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Abstract

Lichens are globally widespread composite organisms consisting of a fungal partner, a photosynthetic partner (either Chlorophyta or Cyanobacteria), and an associated microbiome. They play a role in global biogeochemical cycles, with the photosynthetic partner fixing C and/or N that is assimilated and sequestered by the fungal partner. Lichens exhibit high environmental sensitivity, and are important indicators of environmental change. In high latitude and altitude ecosystems, land cover by lichens can become comparable to that of vascular plants. These are also some of the fastest changing environments on Earth and represent focal points for the study of organisms at the forefront of global change. Significant knowledge gaps surround our understanding lichen functional ecology in arctic-alpine habitats, limiting our ecological understanding of these important environments. Here we discuss the diversity and functional significance of major players in the lichen community of montane heath and highlight key questions for future research.

Understory plant diversity and carbon storage along an overstory density gradient in wooded pastures

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Abstract

Silvopastoral systems are increasingly recognized as land-use systems with potential to sustain both biodiversity, climate mitigation and food production. Here we investigate the effects of overstory density on understory plant diversity and total carbon storage, measured as the sum of C in soil and overstory biomass. Soil samples and vegetation data were collected in 38 plots along an overstory density gradient in traditionally managed wooded pastures in Sweden. To enable upscaling, we, related in-situ measurements to remote sensing proxies for predictors. Results show that understory taxonomic diversity (species richness and Simpson diversity) had a slight negative relationship with overstory density, while the functional diversity response varied depending on community trait composition. Carbon storage in soil was unaffected by overstory density, but increased in overstory biomass, making total carbon storage positively related to overstory density. Our results strengthen the notion of a multifunctionality potential in wooded pastures.

Plant-herbivore feedback in West Greenland: a conceptual modelling framework

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Abstract

Large herbivores shape ecosystems through grazing, trampling, and fertilizing with their waste, thus influencing the composition and productivity of plant communities. These vegetation changes, in turn, affect herbivore distribution and population, creating a feedback loop. Understanding this loop is crucial, especially in the Arctic, where climate change and human activities are rapidly altering these systems. In this project, we are building and parameterizing a conceptual modelling framework of the feedback loop between herbivores (i.e., non-migratory caribou and introduced muskoxen) and plant communities in West Greenland, considering both spatial and demographic parameters. By studying how these interactions may be modified by climate change and anthropogenic activities, we identify sensitive parameters in Arctic landscapes. The resulting model can thus enhance our understanding of Arctic plant-herbivore dynamics, support better decision-making in West Greenland, and could be adapted for use in other Arctic regions.

Tropical tree photosynthesis is more sensitive to temperature than to vapor pressure deficit: in-situ leaf-scale measurement contradicts ecosystem-scale inference.

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Abstract

Recent studies suggest that the high-temperature sensitivity of tropical forest photosynthesis is due to stomatal sensitivity to vapor pressure deficit (VPD). However, these ecosystem-scale studies may be confounding the effects of VPD with periods of concomitantly low (more negative) stem water potential (SWP).

We decoupled temperature and VPD sensitivity of photosynthesis and stomatal conductance with in-situ, leaf-scale measurements of tropical canopy trees in the Eastern Brazilian Amazon. We performed temperature response curves with constant VPDleaf, and VPDleaf response curves with constant temperature during morning hours of low expected variation in SWP. Normalized curves with a shared reference point were overlaid to compare sensitivities. Eight dominant canopy species showed either similar or stronger sensitivity of both photosynthesis and stomatal conductance to temperature than to VPD, contradicting previous ecosystem-scale studies. We suggest further study into the role of stem water potential to resolve mechanisms of high-temperature photosynthetic declines in tropical forests.

Axial variation in xylem anatomy of the tallest tropical tree family

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Abstract

The study explores vessel widening in tropical trees, a mechanism that has evolved to optimise water transport efficiency while balancing safety from hydraulic dysfunction. Examining 38 trees (height range: 7.7-71 m) across five dipterocarp species in a Bornean rainforest, we investigated how vessel diameter scales with distance from branch tips and varies across species, individuals, and heights. Results showed that vessel diameter widens towards the tree base, with no constraints on scaling in taller trees. Across all tree sizes, scaling exponents fully compensated for the resistance along the hydraulic path length. Within the canopy, sun-exposed branches had wider vessels than shaded branches, whereas the size of the apical vessel diameter was not driven by height-related gravitational constraints. These findings suggest that vertical adjustments in xylem anatomy enable tall dipterocarp trees to achieve effective hydraulic architectures, facilitating water transport to record heights while maintaining photosynthesis and carbon sequestration.

Why treelines are rarely in equilibrium with 'their' isotherm

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Abstract

Testable hypotheses for mountain treelines rest on the fundamental niche concept. Different from climate controlled treelines, those realized limits set by disturbance regimes (including land use), are hardly predictable. Once defined, climatic limits of tree occurrence permit quantifying the distance between elevations where trees could grow and where they are actually growing. New data from the Eastern Alps illustrate a several hundred meters distance, causing these lagging tree frontiers under non-limiting temperatures to exhibit exceptional vigor. It will take several decades for these current tree limits to reach a new steady state. Should isotherms continue to advance and mountains be not high enough, no such equilibrium will be achieved. The gap is explained by the time it takes for a seedling to become a tree, and in the case of *Pinus cembra*, the nutcracker's seed spreading and seed predation by mice. Suggested reading: Regional Env. Change 2024, https://doi.org/10.1007/s10113-024-02259-8

SCanning Ancient Trees with TERrestrial lidar (SCATTER) to characterise and compare UK ancient oak tree architecture

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Abstract

An ancient oak's ontogeny manifests the situational, environmental and management history through which it has lived; from suppressed individuals in temperate rainforest to open-grown colossi in royal parks. The SCanning Ancient Trees with TERrestrial lidar (SCATTER) project captured a 3D digital inventory of 40+ ancient and veteran oaks from across the UK. Using Quantitative Structure Modelling techniques, a unique database of structural traits was created that has allowed measurement of the exact shape, size and form of a tree, from the ground to branch tips. We will present an intercomparison of ancient oak tree architecture that identifies significantly different forms dependent on life history, as well as a structural divergence from younger oaks. Processes such as retrenchment and microhabitat creation are also revealed. Project outputs also include an open-access digital archive and discussion on the use of 3D scanning by arboricultural professionals.

Trait covariations in 100 *Olea europaea* L. varieties: insights into intraspecific coordination among plant organs

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Abstract

General relationships among functional traits have been identified across species, but whether these relationships remain valid within species is largely unknown. We tested trait covariations for several axes of variation within *Olea europaea* L., a Mediterranean sclerophyllous woody species showing large genetic and phenotypic diversities. Traits were measured on 100 olive varieties growing in the world olive germplasm bank of Marrakech, Morocco. Eleven traits related to water use and resource strategies, were assessed. Bi- and multivariate statistical analyses were conducted. Preliminary results show a positive correlation between wood density and leaf dry matter content, indicative of a coordination between leaf and branch structures, while negative relationships were found between stem specific length and conservation traits such as leaf and wood densities. Multivariate analysis showed no genetic segregation for the traits measured. Further analyses will explore which traits/combinations of traits are related to the climatic origins of the different varieties

Cryptogam functional ecology; overlooked and underestimated?

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Abstract

Mosses and lichens are frequently absent or poorly considered in studies of functional ecology, and most notably in biogeochemical models. Despite this, cryptogams are conspicuous in many ecosystems, and can become locally dominant, especially in alpine, arctic and sub-arctic environments. Their role in biogeochemical cycling, as a reservoir of biodiversity, and as a persistent growth form in the face of change is emerging, and necessitates much deeper study. Here I will present novel findings from our research group on cryptogam functional ecology in alpine environments, in particular highlighting the potential for energy and nutrient cycling on cryptogam surfaces that questions our assumptions in terrestrial biogeochemical modelling. I will also discuss evidence for a needed shift in our approach to microclimate and microhabitats, and present pertinent routes to study these emerging pathways by re-thinking our current take on biogeochemical models.

The initial spatial organization of dune grass patches shapes future coastal dune buildup

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Abstract

Vegetated dune systems provide natural protection against coastal erosion and buffer against storm surges and sea-level rise. Vegetation patches play a crucial role in dune formation by trapping sediment. However, it remains unclear how the spatial organization of these patches affects the buildup of coastal dunes. In this study, we coupled dune grass patch development with dune formation on an expanding beach in the Netherlands, using a ten-year time series of high-resolution aerial imagery and elevation models. Our results indicate that the spatial organization of dune grass patches at an early stage can dictate future dune development. We found a strong positive relationship between patch density and local dune buildup across multiple scales. This relationship follows an s-shaped curve and amplifies over time. The insights from this study are of great importance for efforts to create and restore dune systems as effective coastal protection.

Marcescence: A Survival Strategy in High-Himalayan Resource-Limited Environments

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Abstract

Plants often retain dead stems and leaves beyond their usual shedding time which is a special phenomenon known as marcescence. This has multiple ecological benefits, including acting as a prolonged nutrient source, grazers repellent, protecting fragile meristems, and providing insulation from heat and cold. Despite its significance, marcescence is not commonly studied in plant ecology, particularly its occurrence in different taxa across diverse habitats, seasonal patterns, and relationship to plant traits. The study was conducted on 600 individuals across 40 high Himalayan plant species found in desert, steppe, alpine, and subnival habitats, ranging from 3000-5400 meters in the Ladakh range, India. We found that the plants from moist high elevations retained more dead leaves while at dry low elevations retained more dead stems and more dead biomass at the beginning and end of the growing season. The study highlights that marcescence is prevalent in resource-conservative species in resource-limited environments.

The effect of plant responses on drought lengths

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Abstract

Soil moisture droughts can have severe impacts on forests, and drought length and frequency are expected to increase under climate change. To understand how this affects forest ecosystems, accurate predictions of the expected length of soil moisture droughts are needed. Such predictions are challenging due to the feedbacks between soil moisture and vegetation. Though current approaches to estimate soil moisture consider the impact of vegetation on the water balance, they typically regard forests as constant, neglecting trees' responses to drought. This could bias drought length predictions. Here, we address this issues by coupling the mesoscale hydrological model mHM with the forest model FORMIND and assess how the effects of droughts on plants alter drought lengths. Our results highlight the importance of including a dynamic vegetation component when modelling soil moisture drought and constitute a next step towards an integrated understanding of the complex interplay between soil moisture and vegetation.

Towards automated biodiversity monitoring -a set-up of Biodiversity Observatory Automation (Thematic Topic under LifeWatch-ERIC)

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Abstract

The ongoing biodiversity extinction crisis is forcing researchers to develop sophisticated and automated monitoring methods based on advances in the automation of big data collection, enhancing computing power and the use of artificial intelligence (AI). To address challenges in data integration, access to cyber infrastructure, and to promote standardization and reproducibility in data workflows a series of a Thematic Topics were launched under LifeWatch-ERIC. An international workshop on “Biodiversity Observatory Automation” was held in Slovenia (April 2024) organized by the LifeWatch Slovenia distributed node. The workshop explored various modern approaches to monitor and detect biodiversity, including aerial observations, eDNA), data collection design, curation and exploration, including use of AI to data FAIRfication and digital twins. The workshop outcomes highlighted the current challenges on data collection, curation, standardization and their effective use, emphasizing the need for further development and multidisciplinary collaborations in these areas.

Potential woodland proximity effects on wader nest predation

Miss Charlotte Le Marquand[1], Dr Karl L. Evans[2], Dr David J. T. Douglas[3], Dr Scott Newey[4], Professor Colin M Beale[1]

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Abstract

As policies worldwide set targets for increasing woodland cover to mitigate effects of climate change, it is important to understand the impacts on existing ecosystems. Waders, many of conservation concern, nest in open habitats and woodland creation may impact breeding success if it provides habitat for nest predators like foxes, badgers and corvids. We collected over 2,000 wader nest records from 23 sites across England, Scotland, and Wales containing data on nest exposure, outcome, and location. Woodland covariates were obtained from UKCEH Land Cover datasets including: distance of each nest to nearest woodland, proportion of woodland surrounding each nest, and woodland type. We used generalised linear models to investigate association between different aspects of woodland cover and nest predation using the Mayfield method. We found weak but variable correlations between woodland covariates and nest predation suggesting other factors, such as topography and predator density, may also influence predation risk.

Moose Trampling Alters Soil Environment, Microbial Properties, and Drivers of Nitrogen Cycling Across Ecosystems

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Memorial University of Newfoundland

Abstract

Physical trampling by terrestrial megafauna is a ubiquitous but poorly understood mechanism impacting biogeochemical cycles. Better understanding this process will improve our ability to predict ecosystem-level consequences of ongoing population changes in large animals. We conducted a field study of moose trampling effects on soil properties and nitrogen cycling in boreal forest and heath barren ecosystems on the island of Newfoundland, Canada. Using structural equation models, we found trampling effects on soil microbial abundance and community composition were driven by effects on soil organic matter content, not by simultaneous effects on bulk density, soil temperature, or moss cover. We also report between-ecosystem heterogeneity in trampling effects on soil microbial properties, despite qualitatively similar effects on bulk density, soil temperature, and moss cover. Finally, relationships between soil temperature, microbial physiology, moss cover and N-mineralization were altered by trampling. Overall, our results disentangle complex abiotic-biotic interactions underlying megafauna effects on ecosystem functioning.

Diversity of leaf flushing patterns in a moist tropical forest driven by insolation but constrained by water availability

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Abstract

Leaf phenology plays a key role in carbon and water cycling, yet uncertainties persist regarding the timing and drivers of leaf cycles in tropical trees. Using UAV-mounted lidar and cameras, we tracked the leaf phenology of 3,000 tree crowns a tropical forest of French Guiana over 3 years. We monitored changes in Plant Area Density (PAD) and Green Leaf Index (GLI) to assess leaf quantity and quality. Analysis of 100 dominant species revealed distinct phenology patterns, with most trees showing an annual leaf cycle that established fresh leaves in preparation for the dry season. Phenology was influenced by local environmental factors, including topographic position and tree height, with taller trees flushing earlier in the dry season, especially in moist gully habitats. Interspecific variation was linked to resource acquisition strategies. This study highlights the complex interactions between environmental heterogeneity and tree phenology, providing insights into how leaf dynamics affect forest productivity.

Reconecta: Restoration of hydrological connectivity of Amazonian streams

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Abstract

Road-stream crossings disrupt hydrological connectivity and fragment headwater streams worldwide, disconnecting movement of water, sediment, nutrients, and species. In the Amazon we estimate at least 100.000 road-stream crossings, mostly associated with poorly planned and undersized culverts. Despite their ubiquity, culvert impacts on Amazonian streams are poorly understood. Reconecta is the first field experiment of fragmentation impacts in tropical headwater streams. We are adopting a before-after-control-impact (BACI) design to assess the scale and speed of recovery of Amazonian streams following the removal of culverts. We are assessing biodiversity, water quality, physical habitat, and ecosystem processes in 15 streams divided into three treatments: control with no road-crossing, culvert removal, culvert maintenance. We will share preliminary findings from the pre-removal monitoring and discuss the challenges and learnings so far. Restoring hydrological connectivity is key to the ecological integrity of freshwater ecosystems in the Amazon, the largest and most biodiverse river basin on Earth.

From Roots to Shoots: understanding how ants provide for pollinators.

Ms Gabrielle A Flinn[1], Prof Elva Robinson[1], Dr Claire Carvell[2], Mr Tim Goodall[2], Mr Carl Hawke[3]

[1]University of York. [2]UKCEH. [3]The National Trust

Abstract

The loss of semi-natural grasslands is a major contributor to the decline in pollinating insects, which rely on this habitat and the availability of floral resources. The restoration of grasslands has become an important focus in the efforts to conserve and recover pollinator populations and it is crucial to consider keystone species in restoration efforts. *Lasius flavus* is a keystone grassland species, influencing soil ecology, increasing heterogeneity of the grassland and creating microhabitats. We have been examining floral resources, bare soil availability and temperature on and off ant mounds in grasslands to consider what resources ant mounds may provide to pollinators. We also conducted insect behavioural surveys to examine interaction with mounds. This has taken place across two sites, in Scotland and England, and two seasons. The results will reveal how pollinators interact with ant mounds in grazed grasslands and how ants may benefit pollinators through ecosystem engineering.

Drivers of tree regeneration, recruitment and deer browsing damage in woodland creation sites

Josh Weaver[1], Matt Guy[1], Kevin Watts[1], Eleri Kent[2], Elisa Fuentes-Montemayor[2], Kirsty J Park[2]

[1]Forest Research. [2]University of Stirling

Abstract

Tree planting is routinely used to create new woodlands and provide valuable woodland habitats. The ecological value of these new woodlands is dependent on the balance between the regeneration and recruitment of new trees with the effect of deer browsing - however, the drivers of these processes are poorly understood. Through an extensive space-for-time natural experiment across areas of Scotland and England we investigate local and landscape-scale drivers.

Provisional results from Scotland suggest that herbivory pressure is higher in smaller woodlands, with lower basal area and increased tree density, and with more broadleaf cover in close proximity (500m). Tree regeneration was higher in sites with lower canopy cover, while regeneration and recruitment were surprisingly facilitated by herbivory pressure.

These results will be combined with results from England to inform woodland creation and management strategies to enhance the long-term ecological value of woodland creation sites.

Impacts of Urbanisation on Plant Biodiversity and Carbon Storage in Grassland and Woodland Soils

Miss Abigail J. Coole, Dr. Yue Sun, Mr. Peng Huang, Dr. Kirsty Watkinson, Professor David Johnson

University of Manchester

Abstract

Biodiversity plays an important role in providing ecosystem services, including carbon storage. An increase in soil C has been found to increase with soil biodiversity. How biodiversity is affected by urbanisation is poorly understood. Some studies indicate urbanisation leads to a decrease in biodiversity, while others report positive or unimodal relationships. We aim to examine the links between plant biodiversity, soil C and urbanisation.

Three large cities and fourteen smaller cities and towns across the UK were chosen to reflect an urban-rural gradient. Plant species surveys were conducted and tree productivity calculated. Soil samples were collected for biogeochemical analysis. We hypothesise that soil C will decrease with urbanisation, while species diversity may show more variation in response to urbanisation. Soil samples are still in the process of being analysed. Our results will help to understand dynamics of soil C storage and biodiversity with increasing urbanisation.

Monitoring the ecological impact of pig rootling in a rewilded landscape

Miss Grace V Moore[1], Professor Gemma Harvey[1], Dr Tim Newbold[2], Professor Alex Henshaw[1]

[1]Queen Mary University of London. [2]University College London

Abstract

Animals acting as ‘ecosystem engineers’ have diverse effects on geophysical and ecological systems and are increasingly being incorporated in landscape restoration and rewilding projects through species (re)introductions. Pigs, such as Tamworth, Iron Age and Mangalica, are being introduced at various sites as part of an assemblage of large herbivores that also include cattle, deer, ponies and bison. Pigs directly alter soil properties through rootling behaviour, which can initiate an ecological cascade, but little is known of these impacts in a rewilded landscape. This poster presents research being undertaken at the pioneering Knepp Estate rewilding project in West Sussex, UK. Repeat field sampling and surveys will explore impacts on soil properties, vegetation communities, and arthropod diversity and abundance using a control-impact research design. This project will help provide insight into the role large herbivores have in shaping rewilded ecosystems.

A functional Red List Index for tracking global changes in functional diversity.

Ms Kerry Stewart[1], Professor Joseph A Tobias[2], Professor Chris Venditti[1], Professor Carlos Pérez Carmona[3], Dr Chris Clements[4], Dr Manuela González-Suárez[1]

[1]University of Reading. [2]Imperial College London. [3]University of Tartu. [4]University of Bristol

Abstract

Functional diversity is projected to undergo disproportionate decline in response to future extinctions with potentially serious implications for ecosystem function and resilience. Despite this, there are few, if any, indicators, which can be used to track functional diversity change at continental to global scales. Here we present a functional Red List Index, applied to >95% of bird species, to monitor aggregate change in extinction risk over time, weighted by species' functional uniqueness. The functional Red List Index shows greater extinction risk than the standard Red List Index, owing to greater extinction risk in unique species. The functional Red List Index did not however show greater changes in extinction risk over time, as unique species were not more likely to be experiencing more severe escalations in extinction risk. Our findings advance efforts to include functional diversity in global conservation monitoring and planning, and provide insights into the vulnerability of unique species.

What is the ecological "condition" of wooded habitat? Consulting the Oracle of Delphi

Dr Ewan K McHenry, Mr Martin Hugi

Woodland Trust

Abstract

Objectives for quality habitat abound. Myriad actors seek "good" habitat, but few have a formal definition of what that is. Definitions often rely on subjective assessments and equal weighting of indicators, offering little rigor or repeatability. Biodiversity conservation demands more than vague notions. Statistical alternatives might relate indicators to measurements of population abundance, biodiversity indices, species richness etc, but these can lack generality beyond those taxa studied.

Our approach utilises value functions and differential weightings to represent how the biodiversity value of wooded habitats varies across 16 easily measurable indicators. To estimate these functions and weightings, we assembled a panel of 28 woodland practitioners and elicited their expert opinions using a Delphi method, allowing iterative revisions based on peer feedback. We believe the final estimates provide reliable priors for measuring wooded habitat quality, to be updated through adaptive management cycles as biodiversity responses to habitat changes are monitored.

Assessing mammal and soil biodiversity recovery in response to forest restoration in Colombia via environmental DNA metabarcoding

Monika Goralczyk[1,2], Dr Mailyn A Gonzalez[3], Dr Andrea Polanco Fernandez[4], Prof. Dr Loïc Pellissier[1,2]

[1]ETH Zürich. [2]WSL Birmensdorf. [3]Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. [4]Fundación Biodiversa Colombia

Abstract

In response to widespread deforestation and degradation, forest restoration efforts aim to maintain resilient ecosystems and sustain provision of their services to society. Fauna plays a vital role in forest recovery, but its monitoring remains challenging due to the lack of robust, standardized protocols. Here, we address this need by evaluating the use of environmental DNA (eDNA) metabarcoding in monitoring the diversity of mammals and soil fauna across a tropical forest succession gradient. We collected river and soil eDNA samples from six chronosequence sites in Colombia, each representing pre-restoration, restored, and target forest ecosystem conditions. We calculated taxonomic and functional indices from eDNA metabarcoding and fitted mixed effect models to investigate the effect of site condition and landscape context on biodiversity. Our findings highlight the potential of eDNA-based metrics to facilitate assessment of forest fauna recovery, providing a more comprehensive evaluation of restoration efforts.

Drought legacy effects are timescale and species dependent across dominant oaks in an easter deciduous forest in North America

Claudia Juliana Garnica Diaz[1], Siddarth Machado[2], Alexis Rodriguez[1,3], Raiza Castillo-Argaez[4], Nicholas A. Smith[1,5], Simon Riley[6], Jeremy Lichstein[1], Daniel J. Johnson[2], Grace P. John[1]

[1]University of Florida. Department of Biology. [2]University of Florida. School of Forest, Fisheries, and Geomatics Sciences. [3]University of Nevada, Reno. Natural Resources and Environmental Sciences. [4]University of Florida, UF Institute of Food and Agricultural Sciences (UF/IFAS). [5]Charles E. Schmidt College of Medicine, Florida Atlantic University, Boca Raton, FL, USA. [6]University of Florida, Statistical Consulting Unit, UF Institute of Food and Agricultural Sciences (UF/IFAS)

Abstract

Forests can dampen or amplify the effect of climate change by modulating energy and moisture fluxes on land surfaces. As droughts become more frequent and severe, understanding species and community responses to climate across timescales will improve assessments of climate resilience. We examined historical tree growth and performance for five dominant oak species in a North American forest and compared drought legacy effects apparent in tree rings over (1) short (current vs. previous year Standardized Precipitation-Evapotranspiration Index; SPEI) and (2) long (up to 20-year SPEI lag effects) timescales. We found that the previous year's drought conditions were a stronger predictor of growth across species and that these effects can accumulate over decades. Further, we found species-specific climate responses to be strongly dependent upon present leaf composition, anatomy/morphology, and physiology. Overall, these findings enhance our understanding of how drought history affects tree performance in temperate regions.

Environmental Physiology

Diurnal and seasonal variability of the sap flow in *Shorea robusta* in subtropical climatic conditions.

Ms Pragya Gautam, Dr Parmanand Kumar, Dr Hukum Singh

Forest Research Institute, Dehradun, Uttarakhand, India

Abstract

This study investigates the diurnal and seasonal patterns of sap flow in *Shorea robusta*, commonly known as Sal, under subtropical climatic conditions. Continuous monitoring of sap flow was achieved by installing Sapflow meters (SFM1) based on the HRM principle (Heat Ratio Method) on the trunks of Sal trees over the study period. Along with this meteorological data, LAI and LWP were also recorded. The findings revealed a daily cycle in sap flow, characterized by high activity during daytime hours that tapered off significantly overnight. Seasonally sapflow rate was typically greater during the summer season compared to the monsoon and winter seasons. This disparity may be due to the influence of air temperature, vapour pressure, relative humidity and soil moisture availability. The results provide valuable insights into the physiological responses of Sal trees to diurnal and seasonal environmental changes, which is critical for the sustainable management of this commercially important species.

Lead and zinc exposure disrupts oocyte maturation in female catfish *Mystus vittatus* (Bloch, 1794)

Mrs. Saheli Kumar[1], Dr. Adity Sarbajna[2], Dr. Suman Bhusan Chakraborty[1]

[1]University of Calcutta, West Bengal, India. [2]Surendranath College, University of Calcutta, West Bengal, India

Abstract

The present study investigated the effects of zinc and lead on oocyte maturation through modulation of the HPG axis in the bagrid catfish *Mystus vittatus* found in Indian subcontinent. Female fish (pre-ovulatory and ovulatory phases) were exposed to zinc sulphate and lead nitrate at 1/10th of LC_{50}. An *in vitro* oocyte culture with 12 hours metal exposure was also performed. Pb significantly altered all reproductive hormones. Metal exposure induced histopathological alterations of brain and ovary. Pb showed adverse effects on MPF formation and prolonged oocyte meiotic arrest. Pb showed inhibitory effect on GVBD. Pb was responsible for ROS generation within the oocytes and thus it stimulated nuclear translocation of NRF2. NRF2 might stimulate antioxidant genes to generate more antioxidant enzymes to cope up with metal-induced stress. Therefore, it is apparent that oocyte maturation in *Mystus vittatus* is greatly hampered by exposure to these two metals, especially Pb.

Thermal tolerance limits in a warming world

Dr. Enrico L Rezende[1], Dr. Mauricio J Carter[2], Dr. Ignacio Peralta-Maraver[3,4]

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Abstract

Ecological systems are under increased strain due to global warming and the rise in average temperatures and thermal extremes. Predictive models are urgently needed to forecast which organisms, communities, and ecosystems might be more vulnerable. While many heuristic approaches are currently employed, few mechanistic models predict vulnerability based on physiological knowledge. My seminar will focus on how thermal tolerance landscapes, which describe survival probability affected by temperature and exposure time in the laboratory, can be used to predict heat mortality in the field. This approach allows for predictions of the impact of thermally variable regimes without relying on arbitrary temperature indices. Originally developed for animals, thermal landscapes are now applied to other lineages, including plants. I will discuss these findings' implications and ways to combine this approach with other stressors, microclimatic data, and ecological interactions to predict future scenarios more accurately.

Reflections of stress: Ozone damage in broadleaf trees can be identified from hyperspectral leaf reflectance.

Ms Anna Lee Jones[1], Mr Adam Ormondroyd[2], Dr Christian Pfrang[3], Dr Felicity Hayes[4], Dr Elizabeth Jeffers[1]

[1]University of Oxford. [2]University of Cambridge. [3]University of Birmingham. [4]Centre for Ecology and Hydrology

Abstract

Tropospheric ozone (O_3) causes widespread damage to vegetation; however, monitoring of O_3 induced damage is reliant on manual leaf inspection. Reflectance spectroscopy of vegetation can identify and detect unique spectral signatures of different abiotic and biotic stressors. We first tested the use of hyperspectral leaf reflectance to detect O_3 stress in alder, beech, birch, crab apple, and oak saplings exposed to five long-term O_3 regimes in controlled conditions. Hyperspectral reflectance varied significantly between O_3 treatments, both in whole spectra analysis and when simplified to representative components. O_3 damage had a multivariate impact on leaf reflectance, underpinned by changes in pigment balance, water content and structural composition. We have now identified similar changes in hyperspectral leaf reflectance in mature oak trees exposed to naturally elevated ozone. These results demonstrate the potential application of hyperspectral reflectance as a high throughput method of O_3 damage detection in broadleaf trees.

Impact of Silicon on Wheat Resilience to Drought

Katie Shaw

University of Sheffield

Abstract

Drought stress is a major threat to global wheat yields, with the frequency and intensity of droughts increasing as climate change progresses. Silicon (Si) application has been shown to improve drought resilience in several key crops including wheat; however, the underpinning mechanisms have not been fully elucidated and improvements are likely genotype-specific. This research aims to characterise the response of several wheat genotypes to Si supplementation under well-watered and drought conditions. Si supplementation significantly increased wheat yields under drought stress for three of five genotypes studied, with several genotypes exhibiting higher levels of stomatal conductance (g_s) across different light intensities upon Si supplementation. Further experiments suggest a difference in root characteristics between wheat genotypes grown hydroponically with or without Si supplementation. These results suggest that Si may play a role in maintaining water uptake, g_s and thus photosynthesis under drought stress in a genotype-specific manner.

Bigger genomes provide environment-dependent growth benefits in grasses

Kimberley J Simpson[1,2], Sahr Mian[3], Elizabeth J Forrestel[4], Jan Hackel[5], Joseph A Morton[3], Andrew R Leitch[6], Ilia J Leitch[3]

[1]School of Biosciences, University of Sheffield, UK. [2]Department of Botany, Rhodes University, South Africa. [3]Royal Botanic Gardens at Kew, UK. [4]University of California, Davis, USA. [5]Department of Biology, University of Marburg, Germany. [6]School of Biological and Behavioural Sciences, Queen Mary University of London, UK

Abstract

Increasing genome size (GS) has been associated with slower rates of DNA replication and greater cellular nitrogen and phosphorus demands. Despite most plant species having small genomes, the existence of larger GS species suggests that such costs may be negligible or represent benefits under certain conditions.

Focussing on the widespread and diverse grass family (Poaceae), we used data on species' climatic niches and growth rates under different environmental conditions to test for growth costs or benefits associated with GS. The influence of photosynthetic pathway, life-history and evolutionary history on grass GS was also explored.

We found larger GS were associated with high nitrogen availability and, for perennial species, low growth-season temperature. Genomes were smaller in annual and C_4 species, the latter allowing for small cells necessary for C_4 leaf anatomy.

Our findings reveal that GS is a globally important predictor of grass performance dependent on environmental conditions.

Telomere dynamics of the European green toad (*Bufotes viridis*) in the context of urbanization and pollution

MSc Magdalena Spießberger[1,2], PhD Steven Smith[2], Gopi Munimanda[2], MSc Stephan Burgstaller[1], PhD Lukas Landler[1]

[1]Department of Integrative Biology and Biodiversity Research, Institute of Zoology, BOKU University, Vienna, Austria. [2]Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna, Vienna

Abstract

Environmental stressors such as chemical and light pollution can have detrimental effects on fitness, development, reproduction and survival of animals. One proposed link between these stressors and survival are telomeres, which play an important role in genome protection, ageing and somatic maintenance and are known to be shortened due to harsh environmental conditions. Amphibians are especially susceptible to environmental stressors because of their complex life cycle, characterized by metamorphosis from larvae to adults, and their permeable skin, making them an ideal model species to investigate possible effects of anthropogenic disturbance on telomere length. Therefore, we test the effects of chemical and light pollution on the telomere dynamics of the European green toad (*Bufotes viridis*) from larval stage until adulthood, in controlled lab experiments as well as in field studies in and around Vienna.

Temperature-driven modulation of reproductive development and fruit yield in apple trees (*Malus* x *domestica* Borkh.)

Bong M Salazar[1,2], Colin P Osborne[2]

[1]University of the Philippines Los Banos, The Philippines. [2]University of Sheffield, United Kingdom

Abstract

Temperature plays a crucial role in climate change, impacting both natural and agroecosystems. Although much research has examined temperature's effects on flowering time, a significant gap remains in understanding its impact on the yield of perennial crops like apple trees throughout the entire reproductive cycle. This study addresses this gap by exploring the relationship between temperature, reproductive development, and fruit yield in 'Red Windsor' apple trees under controlled conditions during the 2020 and 2021 seasons. Trees were exposed to ambient temperatures and deviations of ±4°C and +2°C for eight months. Temperature-induced shifts altered phenology, growth, leaf physiology, and the developmental overlap of reproductive and vegetative structures. While final fruit yield remained largely unaffected, warmer conditions led to an earlier harvest with fewer but larger fruits, whereas sub-ambient temperatures increased fruit set but caused higher fruit drop. These findings provide valuable insights for enhancing apple yield under changing climates.

Impacts of heatwaves on the survival and fertility of a model insect, *Tribolium castaneum.*

Benjamin J Cole

University of East Anglia

Abstract

Significant changes to Earth's climate are being seen due to human activities and heatwaves are becoming more common and intense while expanding in their distribution. Understanding the biological implications of these heatwaves is critical as climatic extremes are shifting more rapidly than mean temperatures. Research has started to elucidate the negative sub-lethal impacts of extreme heat on multiple aspects of insect reproduction. Here, we show the dramatic impacts of simulated short but intense heatwave conditions with varying duration and intensity on survival and fertility using a model insect, *Tribolium castaneum.*

Plasma-based dormancy breaking and enhancement of seed quality for tree production and ecological restoration

Ademola Emmanuel Adetunji[1], Rae Cook[2], Davide Gerna[1], Thalita Nishime[3], Elena Fouce Hernandez[1], Remy Wood[1], Billur Topbas[1], Charlotte Seal[1], Antje Wolff[4], Juergen Kolb[3], Johannes Wolff[4], Louise Colville[1]

[1]Royal Botanic Gardens, Kew, London, United Kingdom. [2]Elsoms Seeds Ltd. [3]Leibniz Institute for Plasma Science and Technology, Greifswald, Germany. [4]PhenoLytics GmbH, Germany

Abstract

Vigorous seedling establishment is key to enhancing ecological resilience. However, in many tree seeds, dormancy and low quality impose a barrier to successful seedling establishment. Breaking seed dormancy usually requires long periods of stratification, which are often only partially effective resulting in slow and unpredictable germination, limiting seedling production for tree planting. This study characterises the potential of various plasma treatments (PTs) to help seed dormancy release, enhance seed germination and vigour, and decrease microbial load in six UK tree species with distinct dormancy types. Seed exposure to plasma-treated air almost depleted microbes from the surface of all tested species. Other most promising effects of PTs on seed germination and seedling establishment, quantified through 3D X-ray phenotyping are presented. The results will expand our comprehension of dormancy mechanisms and germination requirements of tree seeds and inform novel propagation practice of trees from seeds for planting and woodland restoration.

Effects of larval starvation and adult mating on Harmonia axyridis life history traits and haemolymph parameters

Michal Knapp[1], Barbora Žabová[1], Pavel Dobeš[2], Michal Řeřicha[1]

[1]Department of Ecology, Faculty of Environmental Sciences, Czech University of Life Sciences Prague. [2]Department of Experimental Biology, Faculty of Science, Masaryk University, Brno, Czech Republic

Abstract

In the present study, we investigated the effects of starvation during larval stage and mating intensity on diverse life history traits and physiological parameters (longevity, fecundity, adult body mass, total protein concentration, total haemocyte concentration, antimicrobial activity against G+/- bacteria) in *Harmonia axyridis*. Longevity was significantly reduced for mated individuals, but no effect of larval starvation on adult survival was observed. Interestingly, larval starvation did not affect adult fecundity despite significant negative effects on adult body mass. Total haemocyte and protein concentrations significantly increased during early adulthood but slightly decreased later on. Larval starvation negatively reduced antimicrobial activity against G+/- bacteria and total protein concentration for 24-hour old adults, but the difference disappeared at older age. Our results indicate that larval starvation has short-term effects on diverse physiological parameters. Long-term effects were observed rather for mating intensity that significantly affected ladybird longevity.

Lasting impacts of fluctuating prepupal heatwaves on adult fertility in the solitary bee, *Osmia bicornis*

Mr Jamie L Smith

University of Hull

Abstract

Climate change is increasing the frequency and intensity of heatwaves and extreme weather events, threatening global biodiversity. Understanding how these climatic stressors disrupt species' reproductive mechanisms is crucial, particularly for ectothermic insects with often complex life cycles. *Osmia bicornis*, a vital pollinator, develops in nesting cavities during early summer, rendering larvae susceptible to heat stress during early development. We subjected *O. bicornis* larvae in the pre-pupal phase to a simulated 3-day fluctuating heatwave of <40°C and assessed fertility in the resulting adults just before emergence. Males subjected to a heatwave suffered a 44% drop in sperm numbers and a 53% drop in sperm motility compared to controls developing without a heatwave in otherwise identical conditions. These findings show that extreme weather events during development can have lasting effects that carry across months later into overwintered adults, severely compromising fertility of this important pollinator and potentially impacting key crop pollination.

Artificial seasonal warming induces precocious leaf unfolding and facilitate lammas shoot occurrence of *Pinus densiflora* seedlings

Ms. Heejae Jo, Ms. Gaeun Kim, Ms. Minyoung Kwon, Ms. Jae-Ah Lee, Dr. Yowhan Son

Department of Environmental Science and Ecological Engineering, Graduate School, Korea University

Abstract

Phenological responses of *Pinus densiflora* seedlings to warming in different seasons were investigated using seasonal open-field warming (+4°C) treatments (constant, spring and fall, summer, and control) in South Korea. Phenological responses (leaf unfolding stages (divided into 6 stages from 0 to 5) and lammas shoot occurrences) were examined monthly from May to August, 2024. Constant warming led to early leaf unfolding in June and July, with average stages of 4.39±0.05 and 4.87±0.03, compared to 3.67±0.05 and 4.38±0.04 under the control, respectively. Summer warming also advanced leaf unfolding in July (4.84±0.03). From July, lammas shoot occurrence increased under constant and summer warming, with rates of 25.5% and 19.2% in July, and 50.0% and 43.2% in August, respectively, compared to 2.7% and 3.4% in each month under the control. The results suggest that both constant and summer warming accelerate the phenological development of *P. densiflora* seedlings.

How the budburst of broad leaves tree delayed in forest with heavy snow: Limitation of xylem reactivation under snowpack and water use in winter buds toward bud burst.

Ms Shin SHOJI[1,2], Dr. Kenichi YOSHIMURA[1,2]

[1]Faculty of Agriculture, Yamagata University. [2]The United Graduate School of Agricultural Science-Iwate University

Abstract

In heavy snow forests, the post-dormancy behavior of tree buds in response to spring soil and stem temperature changes under snow cover is not well understood. Our aim was to elucidate how snowpack affects bud water absorption and swelling and delays budburst. We set up two sites with different snow depths in Japan. From winter to summer, we observed leaf phenology, vessel formation, and measured bud water contents in response ambient temperatures in canopy trees beech and oak.

The vessel maturation was restricted in the heavy snow forest, but did not limit bud water absorption because current year vessel maturation in both tree species and sites began after budburst. We clarified that cooling of the soil by snowpack suppressed water absorption and bud swelling, which began in early spring and delayed budburst in heavy snow forest. This study concluded that soil temperatures influence water absorption in winter buds toward budburst.

Exploring flexibility in hibernation behaviour of a suburban hedgehog population

Katie E Crawford, Dr Julia Nowack, Thomas O'Hagan, Ruby Orsman, Laura Parry

Liverpool John Moores University

Abstract

Temperate-zone species frequently employ hibernation as a winter energy-saving strategy. While hibernation is adaptive for surviving cold periods with limited food, it leaves hibernators particularly vulnerable to environmental changes. With European winter climates becoming increasingly unpredictable, a rigid hibernation pattern may pose a disadvantage and adaptability may be required under changing conditions.

We examined the hibernation pattern of a wild hedgehog *Erinaceus europaeus* population in a semi-rural habitat in the north-west of England, subject to a mild winter climate. While all animals employed hibernation, we found variation of up to 93 days in hibernation start date and 85 days in end date between individuals, although the general pattern of hibernation was similar. Some individuals used shorter torpor bouts prior to the onset and after termination of hibernation, allowing them to save energy. This flexibility in hibernation timing suggests that hedgehogs may be able to adapt to changing environmental conditions.

Predicting the effects of climate change on seed germination: implications for woodland regeneration and tree seed sourcing in the UK

Roberta L C Dayrell, Charlotte Seal, Efisio Mattana, Elena Fouce Hernandez, Kaitalin White, Lee Oliver, Pablo Gómez Barreiro, Ted Chapman

Royal Botanic Gardens, Kew

Abstract

Expanding and connecting woodlands requires a significant increase in tree planting, which relies on the availability of suitable native seeds. While sourcing seeds close to restoration sites was thought to guarantee optimal adaptation, local populations may not be well-suited to future climates, with their regeneration at potential risk. We investigated variation in seed germination traits within three UK native species (*Alnus glutinosa*, *Betula* pubescens, and *Pinus sylvestris*) to predict their responses to climate change. Seeds from six populations of each species, collected along a latitudinal gradient were tested for germination under different temperatures, both with and without cold stratification, to determine their thermal thresholds and stratification needs. Our results indicate that future climates may not meet cold stratification requirements, potentially causing germination to occur at an unfavourable time for seedling establishment or not at all, especially in southern UK populations. These findings help guide restoration and climate change mitigation efforts.

AI-Driven Optimisation of Bioremediation Strategies for River Pollution: A comprehensive review and future directions.

Dr. Ofeoritse Blessing Allen-Adebayo[1], Olateru Kehinde[2]

[1]Igbinedion Univerisity. [2]Zero Complex AI

Abstract

This narrative review presents a comprehensive overview of AI-driven optimisation of bioremediation systems for cleaning up river pollution and provides future directions and recommendations. The review is about the potential of AI-driven optimisation and the urgent need to address its challenges. The review begins by examining traditional and emerging bioremediation methods, emphasising their limits and the need for predictability. It then investigates the use of artificial intelligence (AI) technology in pollution monitoring and integrated bioremediation optimisations, citing examples and success stories from various literature. Challenges and constraints, including ethical concerns and technological barriers, are examined, focusing on addressing difficulties in AI-driven bioremediation, integration techniques with traditional technologies, and policy implications for improving river pollution control. Finally, future approaches and recommendations are discussed, stressing the potential of AI-driven optimisation to revolutionise bioremediation models and the need to resolve potential barriers to sustainable river ecosystem management.

Assessing the drought resilience of UK broadleaf woodlands

Dr Giulio Curioni, Dr Tom S. Ovenden, Mr Salvo Bonomo, Miss Anna Giannelli, Miss Eleanor Perkins

Forest Research

Abstract

Little is currently known about the drought resilience of different native broadleaf species and species mixtures in the UK, making it challenging to design forests that are robust to climate change. To meet this challenge, we collected over 2000 dendrochronological samples from 1000 broadleaved trees across 28 sites in England. This study characterises the intensity, duration and timing of all drought events over the last 100+ years and evaluates the drought response of different broadleaf species and species mixtures using these tree-ring width data in combination with modelling approaches (e.g. VS-Lite) to simulate scenarios with and without droughts. In doing so we will quantify the resistance, resilience and recovery dynamics of each species and develop an understanding of which species mixtures are more or less resilient to drought under a changing climate.

Effect of Artificial Light At Night on immunity and microbiome of common toads from natural populations.

Dr Louise Cheynel[1], Adeline Dumet[1], Dr Jean Secondi[1], Pr Emmanuelle Gilot-Fromont[2], Dr Benjamin Rey[3], Dr Eve Ramery[4], Corinne Régis[3], Vanessa Gardette[1], Dr Thierry Lengagne[1], Pr Nathalie Mondy[1]

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Abstract

Since the 19th century, Artificial Light At Night (ALAN) has dramatically increased worldwide and is now considered a major source of anthropic pollution. Although the impact of ALAN on wildlife health, especially immunity, is often suggested, few functional studies in the wild exist. A better understanding of these relationships are particularly important in amphibians species, where emerging viral and fungal diseases are a source of mass mortality in natural populations. In this study, we collected blood samples from 150 common toads from 15 sites in France chosen along an urban-rural gradient and contrasted in ALAN exposure. We described the immune phenotype of toads and tested if toads' immune phenotype varies as a function of exposure to ALAN. I will discussed these results in the perspective of future work on toads' microbial communities composition.

Investigating effects of heat on *Bombus terrestris* drinking behavior and cyanotoxin exposure

Dr Corrie Nyquist[1], Dr Björn Klatt[2], Dr Pablo Urrutia Cordero[3]

[1]Lund University. [2]Halmstad University. [3]IMDEA Water Institute

Abstract

Pollinators are threatened by stressors from modern agricultural practices and industrial pollution such as habitat loss, decreased floral diversity, and increased environmental toxins. Much of the research surrounding bee health and climate change has focused on terrestrial habitats with little attention to increased water demand in bees with climate warming and impaired water quality. Bees are known to collect water for their hives for thermoregulation and diluting honey. However, water foraging also increases their likelihood of exposure to aquatic toxins. Climate warming and human activity are linked to increased blooms of blue-green algae (Cyanobacteria) which can produce toxins harmful to many animals, including bees. In our study, we found bumblebees exposed to warm temperatures predicted under climate change sought more water in their diet but tended to avoid water with cyanobacteria. Additionally, colonies in heated treatments had reduced growth and colony size compared to colonies held at lower temperatures.

Unraveling the impact of climate change on tree growth phenology and dynamics in European forests

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Abstract

Understanding how climate change impacts tree growth phenology and dynamics across a wide range of climatic conditions of European forests remains limited. To address this, we analyzed precise growth data collected using automatic dendrometers installed on over 2500 trees across Europe for several years, including the warmest ones on record. The results revealed that the growing season was substantially shorter in hot years compared to climatically normal years across the whole climatic gradient, primarily due to earlier growth cessation, which offset an earlier growth onset after winter dormancy. The earlier growth cessation was caused by lower precipitation and higher VPD during peak growth months, while earlier growth onset was due to elevated early spring temperatures. These growth pattern changes led to a significant decline in tree productivity, indicating that shifts in growth phenology are likely to be the main driver of changes in carbon uptake by trees under climate change.

Increasing temperatures, caused by climate change, have differentially affected the entrance and exit times of the edible dormice (Glis glis) from hibernation.

Dr Shane D Morris, Dr Claudia Bieber

Research Institute of Wildlife Ecology, University of Veterinary Medicine Vienna

Abstract

Hibernation has been particularly affected by human induced climate change because it is triggered by temperature, photoperiod, and an animal's nutritional status. The difficulty in disentangling the effect of temperature from these each other factors has inhibited more general predictions about the effect of climate change on hibernators. We isolated the effect of temperature on the hibernation patterns of the edible dormice (*Glis glis*) over 20 years (2004-2024) in Vienna, Austria, by keeping them in semi-natural conditions. This exposed them to naturally changing ambient temperatures and photoperiod while allowing their diets to be controlled. Dormice now enter and exit hibernation two to three weeks later than they did 20 years ago. This later entrance is driven by a delay in the cooler ambient temperatures needed to trigger hibernation. This later exit was not due to temperature as we found no consistent shift in the temperatures that induce hibernation exit.

Advancing our understanding of plant thermal tolerance through thermal damage accumulation predictions

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Abstract

The thermal death time (TDT) model suggests that the duration a plant can tolerate thermal stress decreases exponentially as the intensity of the temperature becomes more extreme. However, the critical assumption of the TDT model, which is additive damage accumulation, remains unverified for plants. We assessed thermal damage in *Thymus vulgaris* under different heat and cold treatments and used TDT models to predict thermal failure of photosynthesis. We used TDT models to examine the role of plant's production of different monoterpenes in relation to thermal stress tolerance. We found that thermal damage is additive for both heat and cold stress, and that the TDT model can quantify the effect of monoterpene identity on plant thermal tolerance. Using published studies, we tested the general applicability of this framework in plants and found that traditional methods ignoring stress duration may inaccurately predict plant responses to global warming.

Vulnerability to Cavitation in Nothofagus Species: A Case study in Maule Region, Chile.

Paula Basualto, Dr Andrés Plaza-Aguilar

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Abstract

Climate change in Central Chile is leading to drier environmental conditions, affecting areas where critically endangered species of the genus *Nothofagus* are distributed. These changes are altering the survival of these species and its resilience to such events.

To understand hydraulic failure to drought, the centrifuge system Cavitron was used to quantify the percentage of loss of hydraulic conductivity (PLC) in six Nothofagus species of temperate forests. Also, measurements of hydraulic conductance (Ks) and wood density data were used to relate with hydraulic traits measured.

Significant differences were found among species for cavitation resistance ($p < 0.05$), where Nothofagus glauca appears as the most hydraulically resistant. However, no significant correlation was found between Ks and wood density.

Our findings offer valuable insights into the hydraulic adaptations of Nothofagus species in response to climatic changes and improve the basis for future research on the resilience of forests under adverse environmental conditions.

Unraveling Eco-Physiological Adaptations: How Muskoxen Respond to Arctic Environmental Change

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Abstract

Arctic wildlife, such as muskoxen (Ovibos moschatus), face unprecedented threats from rapid climate change, underscoring the need for sensitive bioindicators of population health and vulnerability. In this pioneering study, we applied NMR-based metabolomics to unravel the metabolic responses of muskoxen to environmental stressors, using serum samples from both wild and captive individuals. For the first time, we characterized the muskox serum metabolome, identifying 105 metabolites. Our findings revealed striking metabolic shifts across capture years in wild animals from East Greenland. Moreover, we found that captive muskoxen exhibit, for example, elevated levels of dimethyl sulfone, an exogenous metabolite linked to energy metabolism, while histidine and unsaturated lipid levels were significantly reduced compared to their wild counterparts. These biomarkers suggest that forage scarcity and environmental stress drive physiological changes in muskoxen. This research represents a breakthrough in understanding how species respond to environmental change, offering a powerful tool for assessing ecosystem resilience.

Thermal constraints on endotherm activity: mechanistic predictions of travel speed and aerobic scope

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Abstract

Animals exploit their mobility to seek out favorable microclimates, but predicting their responses to climate change remains challenging. The effectiveness these movement-induced avoidance behaviours depends both on the spatial structure of thermally heterogenous landscapes and on species' movement capacities. We derived a general allometric locomotion model that integrates biophysical constraints of body mass on metabolic energy use and heat dissipation to predict the aerobic travel speeds of flying, running, and swimming species. Using data from 532 species, we found that larger animals reduce their travel speeds to avoid hyperthermia. We extended this framework by deriving a model extension that jointly accounts for the influence of ambient temperature and muscular heat production to predict the travel speeds and aerobic scope of homeothermic endotherms across temperature gradients. Our results emphasise the regulation of metabolic activity as a form of behavioural thermoregulation, linking the realised movement capacities of endotherms to their thermal niches.

Are shorter species in herbaceous vegetation more shade-tolerant?

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Abstract

Competition experiments attribute several advantages to taller plants, namely in capturing more light than shorter plants. Although shorter plants often experience greater shading within natural vegetation, they remain abundant and ubiquitous across community datasets, and reach reproduction under shade. The possibility that short plants survive low light conditions via shade tolerance has not been investigated within natural herbaceous vegetation, despite experiencing stratification and shading comparable to some forests. We evaluated the incidence of shade tolerance adaptation, and 17 relevant functional traits (e.g., low chlorophyll a:b ratio), within a non-experimental old-field community. For 11 of these 17 traits, short maximum height was predictive of trait values consistent with shade tolerance. By assessing herbaceous plant physiological performance under natural canopy shade, we address two generalized assumptions (i.e., a size-advantage in light competition, and the absence of shade tolerance within herbaceous vegetation), which have lacked robust supporting or opposing evidence.

Metabolic responses to climate change in invertebrates

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Abstract

Understanding the impact of climate change on natural populations represents one of the foremost challenges in ecology. The impacts of warming are primary mediated through metabolic rate, which is a fundamental measure of physiological and ecological processes. However, depending on the climate and realms, animals adapt differently and adjust their metabolism-related processes, which can often manifest as latitudinal patterns. Here, we have assembled a large database on invertebrate metabolic rates to assess the current understanding of their plasticity and adaptations and to predict spatial variations in metabolic rate changes under the modest climate change scenario. We show that the thermal sensitivity of metabolic rates increases with latitude, rising at a slower rate in aquatic invertebrates compared to terrestrial ones. We predict that metabolic rates will increase by 35% in terrestrial invertebrates, while aquatic ones may see increases of up to 25% by 2100.

Thermal imaging and body mass change as non-invasive approaches for measuring and understanding physiological responses of wild animals to environmental stressors

Dr Ross Macleod[1], Dr Paul Jerem[2,3,4], Dr Ruedi Nager[4], Dr Dominic McCafferty[4], Mr Thomas Adjetey[1]

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Abstract

The ability to measure how animals respond physiologically to potential stressors is key to understanding how animals are impacted by environmental risks. Traditionally, measuring physiological responses to stress in wild animals has been limited by needing to capture individuals (for blood sampling) or collect faecal or fallen material, such as feathers. Such sampling is often invasive, low frequency or time-consuming and may be confounded by sampling stress. This study uses an experimental approach and blue tits (*Cyanistes caeruleus*) as a model system, to explore the utility of two non-invasive methods (thermal imaging video and automatically measured body mass) for tracking physiology. Across 398 feeding bouts (n=31 individuals) we demonstrate the ability to measure physiological change at high resolution, non-invasively and to detect significant changes under two common chronic environmental stressors (perceived predation risk and starvation risk). The results suggest potential for widespread use across ecophysiology and wild animal welfare research.

Evolutionary Ecology

Measuring natural selection to estimate a community-wide fitness landscape in the wild

Dr James T. Stroud

Georgia Institute of Technology

Abstract

What maintains species differences through time? The pervasive pattern that most species' phenotypes appear stable over long timescales is often attributed to persistent stabilizing selection, but direct evidence is lacking. I measured natural selection in four *Anolis* lizard species, revealing a complex fitness landscape with distinct peaks for each species. Surprisingly, species were maintained on these peaks by fluctuating, rather than persistent stabilizing selection. Over multiple periods, selection varied in form, strength, direction, and presence, with stabilizing selection occurring infrequently. The community-wide fitness landscape, characterized by local optima within species and valleys between them, acts as a barrier to adaptive change, preserving species differences and maintaining community structure through time. Here, by directly measuring natural selection in multiple coexisting species in the wild, we have some insights into complex interplay between evolutionary processes and the observed structure of ecological communities.

Chronic and acute thermal stressors have non-additive effects on fertility

Dr Natalie Pilakouta

University of St Andrews

Abstract

Climate change is driving both higher mean temperatures and a greater likelihood of heatwaves, which are becoming longer and more intense. Previous work has looked at these two types of thermal stressors in isolation, focusing either on the effects of small, long-term increases in temperature or large, short-term increases in temperature. Yet, a fundamental gap in our understanding is the combined effect of chronic and acute thermal stressors and, in particular, its impact on vital processes such as reproduction. Here, we investigated the independent and interactive effects of higher constant temperatures and short-term heatwave events on reproductive success in the burying beetle *Nicrophorus vespilloides*. We found a substantial reduction in fitness after exposure to both a heatwave and higher constant temperatures, but not after exposure to only one of these thermal stressors. This indicates that the effects of chronic and acute thermal stressors are amplified when they act in combination.

Rapid insurgence of phenotypic differentiation and postzygotic reproductive isolation between two ecotypes of the cliff carnation *Dianthus rupicola*

Ms Lucrezia Laccetti, Prof. Giovanni Scopece

University of Naples Federico II

Abstract

The Eurasian clade within the genus *Dianthus* is one of the most diverse plant groups in the Mediterranean, harbouring numerous endemic species with varying levels of phenotypic and genetic differentiation. This genus shows the most rapid diversification rate ever reported in plants, however, the underlying mechanisms remain unclear. Our study investigates the diversification mechanisms between two ecotypes of a recently diversified group within the Eurasian clade. We characterized environmental selective pressures, phenotyped plants in natural populations and common garden, and investigated inter-ecotype reproductive barriers and genomic patterns in sympatric and allopatric populations. The two ecotypes showed phenotypic divergence driven by different antagonistic biotic interactions, a strong postzygotic reproductive barrier involved in embryo degeneration and a limited gene flow in secondary contact zones. Our findings suggest that geographic fragmentation can lead to reproductive isolation in recently diverged ecotypes, highlighting a new speciation trajectory within homoploid groups of the hyperdiverse genus *Dianthus*.

Conservation genetics in the Critically Endangered Bermuda skink (*Plestiodon longirostris*)

Mr Owen Greenwood

Manchester Metropolitan University

Abstract

This project will investigate the genetic population structure, genetic diversity, breeding structure and population viability of the endemic, Critically Endangered Bermuda skink to provide key insights for their conservation management. A combination of buccal swab sampling and Capture-Mark-Recapture surveys in the field, followed by low coverage Whole Genome Sequencing of Single Nucleotide Polymorphisms and qPCR techniques will be used to achieve this. Insight into the population and genetic health of the Bermuda skink will provide conservation efforts with crucial information on how best to manage the remaining populations in Bermuda. This study will also provide feedback how reintroduction can be managed to increase the chances of successful rehabilitation into the wild over time.

Across a century of genetic change: context-dependency in plant-microbe interactions under environmental stress

Dr Candice Y Lumibao

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Abstract

It is widely accepted that intraspecific genetic variations in plants influence plant-microbial associations. However, it remains unclear how genetic changes over time and associated trait variations shape these interactions subject to environmental stress. To address this, century-old seed banks of *Schoenoplectus americanus* was leveraged by 'resurrecting' plants from 100-year-old (ancestral) and modern (descendant) seeds retrieved from coastal marshes in US, roughly circumscribing a century of genetic changes. Through multiple common-garden experiments, I examined how rhizosphere soil microbe mediation of *S. americanus* responses to stress is determined by genotypically-driven trait variations and age cohort. In turn, I also investigated how plant genetic differences shape microbial responses to stress. Overall, results allude to a highly dynamic and context-dependent plant-microbe associations and reciprocal mediation of stress responses. They also suggest that evolution can shape the fate of marsh ecosystems by altering directions and strength of plant-microbe responses to pressures linked to global change.

Linking social strategies and drought tolerance in soybeans

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Abstract

A key hypothesis of evolutionary agroecology is the existence of a trade-off between the performance of a plant genotype in a monoculture group and its individual fitness. We aim to exploit this trade-off to quantify genotypic variation in social strategies and identify more cooperative soybean genotypes and the traits and genes that underlie them. We conducted a factorial pot experiment in which 90 different soybean varieties were grown in hundreds of pairwise combinations, and ranked them from 'selfish' to 'cooperative' based on this trade-off. Through a GWAS we could identify a small genomic region in the soybean genome that is significantly associated with a varieties' social behavior. In this region we found a candidate gene known to play a role in drough susceptibility. Indeed, we subsequently observed that genotypes classified as more cooperative exhibit a higher water-use-efficiency leading to lower drought stress both for them and their neighbour plants.

Evolution of prey specificity in the highly diverse Crabronidae family of solitary wasps

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Abstract

The Crabronidae family of solitary wasps is highly diverse, comprising nearly 10,000 species globally. Between subfamilies and genera there are varying levels of prey specificity, with some species acting as highly specific predators of one prey type, while others are generalists. Despite their importance as apex predators and pest controllers in their ecosystems, literature on the Crabronidae is largely limited to natural history studies documenting their nesting behaviours and life histories, with little analysis of the proximate causes of these behaviours. Our work utilises an extensive, novel database of wasp-prey records extracted from the scientific literature, and applies phylogenetic methods such as ancestral state reconstruction to shed light on the drivers of variation in predator-prey interactions. Additionally, we consider how prey specificity in this family has evolved in relation to parental care strategies, with important insights into the evolution of sociality and behavioural flexibility in the aculeate Hymenoptera.

Temperature effects on fertility in wild animal populations: we know very little but we are running out of time

Mr Luke Crosby[1], Mr Ben Cole[2], Mr Jamie Smith[3], Dr Liam Dougherty[4], Ms Rose Agnew[4], Dr Graziella Iossa[1]

[1]University of Lincoln. [2]University of East Anglia. [3]University of Hull. [4]University of Liverpool

Abstract

Temperature affects all biological processes, including reproduction, a fundamental process for population survival. Yet, we know little on the impact of climate change-induced temperature increase on wild animal reproduction. Here we used a meta-analysis approach to assess the impact of temperature on the fertility of wild animal populations. We screened 2,300 papers and extracted correlation coefficients from 44 studies for a total of 73 independent effect sizes covering 6 phyla, 37 families and 45 species. Overall, there was a weakly-positive but non-significant effect of temperature on wild animal fertility, and substantial heterogeneity among effect sizes from different studies. Habitat did not explain differences in effect sizes, although there was a less positive effect in terrestrial compared to aquatic species. Fertility was more positively affected by temperature increase in poikilotherms than homeotherms. There were too few studies on this topic, and this led to uncertainty in detecting a true effect size.

Investigating co-evolution and trade-offs within a seasonal polyphenism at the continental scale.

Dr. Christophe W Patterson, Dr. Jonathan Drury

Durham University

Abstract

Many species exhibit seasonal polyphenism where multiple phenotypes arise across the year. In many polyphenic species developmental constraints limit the divergence between alternative morphs. For seasonally polyphenic species, selection in one season may constrain the phenotypes present in another. Smoky-rubyspots (*Hetaerina titia*), exhibit a striking seasonal polyphenism in wing melanisation, but this varies between regions. We quantified the phenotypes in >5,600 smoky-rubyspots through field research and a participatory science initiative. Using multivariate models of trait evolution, we test whether the peak and off-peak phenotypes have co-evolved and whether there is geographic variation in the tempo of evolution. We find evidence that the polyphenism is evolving under different selective regimes, suggesting different trade-offs in different regions or there has been developmental release. To our knowledge, we present the first empirical research into the evolution of polyphenism with sufficient data to model a seasonal polyphenism across the entire range of a species.

Multi-species assessment of local adaptation shows contrasting signals in indigenous and introduced crops

Dr Harriet Hunt[1], Dr Yann Dussert[2], Dr Jonathan Stocks[1], Dr Lucie Büchi[3], Dr Jianqiang Zhang[4], Dr Guillermo Friis[1], Dr Dawd Gashu[5], Dr Philippa Ryan[1], Prof Sebsebe Demissew[5], Dr Feleke Woldeyes[6], Prof Richard Nichols[7], Prof Richard Buggs[1], Dr Paul Wilkin[1], Dr Wendawek Abebe[5], Dr James S Borrell[1]

[1]Royal Botanic Gardens Kew, UK. [2]University of Poitiers, France. [3]Natural Resources Institute, University of Greenwich, UK. [4]Shaanxi Normal University, China. [5]Addis Ababa University, Ethiopia. [6]Ethiopian Biodiversity Institute, Ethiopia. [7]Queen Mary University of London, UK

Abstract

Climate change will necessitate a substantial re-arrangement of global agricultural systems. Shifting crop distributions are likely to significantly disrupt patterns of local adaptation, with consequences for global yields and food security. However, our understanding of the rate at which local adaptation evolves remains limited. Indigenous agricultural systems comprising both locally domesticated and more recently arrived species provide an opportunity to test this. Here, we compare evidence for local adaptation in 11 timber and food crops, comprising both indigenous and introduced species, along eight replicated elevational transects in the Ethiopian highlands – a major center of African crop diversity. Genome-environment association analysis across 3486 sequenced individuals revealed that environmental gradients explained significantly more genetic variation in indigenous versus introduced species, as well as annuals versus perennials, after accounting for confounding population structure. Conserving the patterns and processes that give rise to local adaptation remains crucial for maintaining food security.

Global Insect diversity pattern and biodiversity declining monitoring – SITE100 International Big Science Action

Prof. Dr. Ming Bai

Institute of Zoology, Chinese Academy of Sciences

Abstract

Insects are widely distributed, with complex behavior and diverse feeding habits, making them the most diverse biological group. Due to climate change and human activities, insect diversity is declining around the world at about twice the declining rate of vertebrate species. However, there are some problems in insect classification and monitoring technology, which can not efficiently and comprehensively obtain insect diversity pattern. Through the research and development of new AI model (PENet), new insect monitoring hardware (e.g. Big FIT, New Pitfall trap, Portable Funnel Light Trap, Water Exclusion Trap, Mycophagy Insect Windows Trap), a series studies established several sample sites through the SITE-100 international Grand Science Program, to promote the development of next-generation entomological taxonomy and obtain the national insect diversity pattern and formation mechanism.

Investigating the impacts of extreme temperature events on British butterflies using museum collections

Emily Wenban-Smith[1], Michael Boyle[2], Matthew Hayes[1], Edgar Turner[1], Andrew Bladon[1]

[1]University of Cambridge. [2]Hong Kong University

Abstract

The impacts of short-term extreme temperature events on insects may be distinct from those of long-term increases in mean temperatures, affecting short-term survival and reproduction, making it crucial to study the impacts of these events to date. We measured the wing morphology of museum specimens of nine British butterfly species with varying population trends, to investigate the impact of historical heatwaves during development on adult morphology, and whether this varied with the timing and severity of heatwaves. We found that specimens of four out of the nine species showed differences in wing length if they experienced heatwaves during development, and that responses varied between sexes and according to which life stage was exposed to extreme temperature. We compared these short-term responses to long-term trends in morphology, to assess the impacts of developmental responses to extreme temperatures. I will discuss my results and the implications for butterfly conservation under climate change.

Reassessing the responses of parturition date and birth weight to temperature in red deer.

Dr Kirsty H Macphie

University of Edinburgh

Abstract

Temporal trends in phenology are often attributed the changing climate, yet phenological thermal sensitivity is most studied in species likely to exhibit adaptive responses. For long-gestating mammals reproductive phenology is less likely to respond adaptively to temperature, thus it is important to scrutinise evidence of such effects. The birth date of red deer on the Isle of Rum, Scotland, has advanced whilst birth weight remains consistent, yet both are suggested to be sensitive to temperature. We returned to this topic deploying two new approaches: permutation tests, combatting anti-conservative aspects of sliding window analyses, and detrending, a valuable tool for climate attribution studies. Our results show no robust effect of temperature on partition date and that detrending within sliding window analyses has implications for the window identified and slope magnitude estimated. The birth weight results remained consistent with previous work. This study highlights the distinctions in phenological responses among taxonomic groups.

Understanding the effects of pH changes on aquatic animals

Miss Amber G Chatten, Dr Natalie Pilakouta

University of St Andrews

Abstract

Climate change has been shown to affect many physiological, behavioural, and life-history traits across a wide range of species. Increased atmospheric CO_2 absorption by oceans and freshwater bodies, leads to a decrease in water pH. Fertility is a key factor in population and species survival and is particularly vulnerable to pH changes; therefore, it is important to understand how and to what extent an organism's fertility is affected by climate change. Literature searches were conducted for the effect of pH on a range of gamete, gonad, and reproductive traits. A meta-analysis has been conducted on 50 freshwater and marine species to determine what effect pH changes have on a range of fertility traits and examine which species may be at most risk from the deleterious effects of anthropogenic climate change. This was done by synthesising data from 212 papers which look at effect of pH changes on aquatic animals.

Divergent nutrient preferences of two coexisting species of *Drosophila* fruit flies: *D. melanogaster* and *D. simulans*

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Abstract

Theories predict that species exploiting the same food resources cannot coexist because of strong competitive interactions among them. However, recent studies have begun to realize that the coexistence of species sharing similar feeding ecology can be maintained if they occupy different nutrient niches. *Drosophila melanogaster* and *Drosophila simulans* coexist and exploit the same food resources, making them ideal subjects for studying nutritional mechanisms underlying the coexistence of ecologically similar species. To extrapolate the nutrient niche divergence between these two species, we compared the preferred amount and balance of protein and carbohydrates consumed by the two species under a food choice. *D. simulans* ate less calories but self-composed a higher ratio of protein-to-carbohydrate (P:C=1:1.31) than *D. melanogaster* (1:1.84), reflecting the greater need for protein by *D. simulans* to support its higher reproductive capacity. Divergent nutrient preferences found between these two *Drosophila* species may facilitate their coexistence through nutrient niche partitioning.

Phenological fluctuations but no advance: exploring the drivers of breeding phenology in Soay sheep

Ellis Wiersma, Prof Albert Phillimore, Prof Daniel Nussey, Prof Loeske Kruuk

University of Edinburgh

Abstract

Phenological changes in response to climate change are well-documented across avian, plant, and insect systems, with many studies reporting strong shifts in the timing of life-history events. However, phenological changes have been much less studied in mammal systems. We use a long-term, individual-based system of Soay sheep to examine the sensitivity of parturition dates to demographic and environmental factors. We find some support for our prediction that high winds and rainfall during winter delays parturition dates, however we find no evidence for a trend, despite climate in this three-decade period showing warming of 0.5°C. While we find substantial individual and inter-annual variation, we were largely unable to attribute this variation to the traits of individuals or aspects of climate. This work further emphasises the importance of developing and maintaining long-term study systems, particularly in large mammals, which can show responses to climate change differing from other, more well-studied taxa.

Head shape is associated with prey traits and drives individual dietary specialization in two species of tropical frogs

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Abstract

Biomechanical models predict that the consumption of large prey by anurans requires wide heads and short jaws relative to head height, whereas long jaws relative to head height favor the capture of fast prey. Consequently, we should expect individuals with different head morphologies to differ in their prey size and mobility; and populations with stronger predator-prey trait associations to show higher degrees of interindividual diet variation. We tested these ideas in 11 populations of two congeneric species of Brazilian terrestrial frogs. Lateral head shape was not related to any prey traits, but wider and shorter dorsal shapes were associated with larger prey in both species. In one species, narrower and longer heads were associated with increased prey mobility. The degree of interindividual variation in prey size was positively correlated with the strength of morphology-prey size associations across populations, indicating that head shape is an important proximate cause of niche variation.

Is a generalist parasitic plant locally adapted to its plant hosts?

Grace Doherty

University of Edinburgh. Royal Botanic Garden Edinburgh

Abstract

Parasitic plants exhibit a full spectrum from generalists, with many diverse plant hosts, to specialists, with a narrower host range. However, it is uncertain whether generalist parasitic plant species actually have preferences for local hosts that have been overlooked in previous field observations and growth experiments. This has been tested using a large-scale common garden experiment, with seeds collected over a wide spatial scale. Fitness and survival were measured across thousands of pots with sympatric and allopatric combinations of parasite and host. The focal species, a photosynthesizing semi-parasitic grassland *Euphrasia* (Orobanchaceae), is part of a taxonomically complex group. This provides an ideal system for studying the dynamics of parasitic specialisation, and potential local adaptation, in the speciation process. Local adaptation to hosts has been largely unexplored in semi-parasitic plants but may provide insights into the maintenance of a generalist strategy despite pressures to adapt to hosts in these co-evolutionary relationships.

How does parental age at reproduction affect offspring longevity and early-life performance?

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Abstract

Across invertebrates, the offspring of older parents exhibit a tendency for reduced longevity compared to the offspring of younger parents. However, such a reduction in total lifespan may not impact fitness if shorter-lived offspring from old parents can accelerate their development and maximise early-life fecundity. Here, using individually-housed two-spotted crickets (*Gryllus bimaculatus*) in a within-animal longitudinal study design, we observed that as parental age at reproduction increased, offspring post-natal developmental rates and offspring adult body mass decreased. Surprisingly, no effects of parental age on offspring lifespan were observed. This lack of effect may be due to benign laboratory conditions potentially masking any negative effects of parental age on offspring longevity, which could require an environmental challenge (e.g. competition, pathogens, predation) to be revealed. Future work will focus on how parental age impacts offspring reproductive performance as well as offspring baseline and age-specific mortality rates.

The secret acoustic world of leopards: A paired camera trap and bioacoustics survey facilitates the individual identification of leopards via their roars.

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Abstract

Here, we conducted the first, large-scale (~350 km^2) paired passive acoustic monitoring and camera trapping survey, for large African carnivores, in Nyerere National Park, Tanzania. We tested whether leopards could be individually distinguished by their vocalisations. We identified individual leopards from camera trap images and then extracted their roaring bouts in the concurrent audio.

When using Hidden-Markov Models to evaluate the temporal pattern of a leopard's roar, individual identification was achieved, with an overall accuracy of 92.9%. Because leopards can be identified from their vocalisations, bioacoustics could be used as a non-invasive method for monitoring leopards and potentially other vocal, elusive species.

More broadly, deploying multiple modes of technology, which record complementary data, can be used to discover novel species traits. Thus, paired surveys are a promising monitoring methodology which exploit a wider variety of species traits, to monitor and inform species conservation more efficiently, than single technology studies alone.

Population genomics and body size shifts in the great banded furrow bee, *Halictus scabiosae*, within the urban ecosystem

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Abstract

Urbanization is a global phenomenon that poses a significant threat to biodiversity. However, the ecological impacts of urbanization on phenotypic traits and the evolution of wild bee populations remain poorly understood. In this study, we investigated the effects of urbanization on the body size and population genomics of the wild bee *Halictus scabiosae*. We sampled 18 populations, measured the body size of 167 individuals and whole genome sequenced 180 individuals to generate genome-wide SNP data, assessing both neutral and adaptive genomic diversity. Our findings suggest that the local availability of food resources and semi-natural cover at the landscape scale are the most critical environmental factors influencing shifts in the body size of *H. scabiosae*. Additionally, we present results on genetic divergence, gene flow and outlier genes related to local adaptation to urbanization. These data will help identify the importance of specific urban habitats for gene flow and genetic diversity.

Reviewing primate dietary profiles worldwide: a continuum of dietary strategies

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Abstract

Non-human primate diets have been the focus of a vast cumulative field observational effort which now enable an enhanced level of comparative analysis. Classification of dietary strategies into discrete categories inevitably leads to a loss of detail and often overlooks geographic, seasonal, and other forms of variation. We review the feeding ecology and major dietary profiles of wild non-human primates worldwide. For 72 genera, we show the relative three-way contributions of folivory, frugivory and faunivory, and explore the association between diet and the anatomical constraint of body size. The dietary flexibility demonstrated in specialist and generalist feeders highlights the challenge of assigning primate species into fixed, discrete categories, and the concept of a continuum of dietary strategies offers the possibility of a more informative approach. We hope to motivate more detailed regional assessments of primate diets, eventually culminating in a worldwide synthesis and accompanying database of primate feeding studies.

The impact of oil pollution on diet and parasitism in Trinidadian guppies (*Poecilia reticulata*).

Miss Hannah McGovern[1], Ms Katherine Jeffress[1], Prof. David Morritt[1], Dr. Amy Deacon[2], Dr. Rudiger Riesch[1]

[1]Royal Holloway University of London. [2]University of the West Indies

Abstract

Oil pollution can have major impacts on ecosystem functioning, for example via increased mortality and reduced species richness, which directly affects the ecology of inhabiting species. For example, due to reduced species richness, oil pollution directly impacts availability of food for omnivorous species and could provide safe havens from many parasites (i.e., the pathogen refuge hypothesis). In Trinidad, guppies (*Poecilia reticulata*) have established populations in a variety of oil-polluted habitats, including the naturally polluted Pitch Lake. Here we investigate diet and parasitism in this omnivorous species through gut-content and parasitological dissections. We found fish from polluted habitats to have greater relative gut length, suggesting a greater reliance on detritus, but contrary to the pathogen refuge hypothesis, parasitism differed on the level of populations rather than habitat type. We discuss our results in the context of other, ongoing research in this system.

Does early-life adversity explain variation in senescence in the Soay sheep (Ovis aries) of St Kilda?

Miss Elizabeth D Drake, Dr Sanjana Ravindran, Prof Daniel H Nussey, Dr Hannah Froy

University of Edinburgh

Abstract

Rates of senescence can vary between individuals of the same population, although the drivers of this high variability of senescence patterns are often poorly understood. Previous studies of wild vertebrates have demonstrated that developmental conditions can have consequences for adult performance, including the onset and rate of senescence. This study aims to investigate the impact of early-life adversity on senescence in the Soay sheep population of St Kilda, Scotland. Our study offers an unusually complete characterisation of the early-life environment to test the hypothesis that individuals experiencing greater early-life adversity pay greater costs in later-life, such as earlier onset of ageing or more rapid senescent declines. Here we test the relationships between measures of the early-life environment (population density, climatic conditions, birth weight) and survival, annual breeding probability and adult morphological traits. In this analysis, we seek to understand possible drivers of variation in senescence in natural populations.

Traits for conservation: using phenotype to determine extinction risk and recovery in birds.

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Abstract

As threats to vertebrate biodiversity continue to increase, understanding a species' extinction risk is becoming ever more important. Although traits such as size and island endemism can be linked to extinction, little is known about the effects of ecological and morphological traits more widely. Here, we use the IUCN Red List and the AVONET database to link bird species population size and IUCN status to phenotypic traits. We use hypervolume analysis to investigate the functional similarity among species that have declined, recovered or remained in the same Red List population bracket since 1950, finding more functional similarity between recovering species and those that remain at the same risk, and that specific traits such as aquatic and insectivorous lifestyles and short beak length are associated with increased threat status. Our results show that birds exhibiting certain ecological and morphological traits are more at risk, enabling focussed conservation planning to take place.

Geographic variation in evolutionary rescue under climate change in a crop pest–predator system

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Abstract

Species distribution models (SDMs) are often built upon the “niche conservatism” assumption and ignore the possibility of “evolutionary rescue”, which may underestimate species' future range limits under climate change. We select aphids and ladybirds as model species and develop an eco-evolutionary model to explore evolutionary rescue in a predator–prey system under climate change. We model the adaptive change of species' thermal performances, accounting for biotic interactions. We find that, without considering adaptation, the warming climate reduces aphid populations and drives ladybirds to extinction across much of the U.S. However, incorporating evolutionary adaptation allows aphids to survive, while ladybirds show geographic variation in rescue potential. Southern ladybirds are more likely to adapt, but northern populations face extinction due to severe warming and seasonality. Together, these findings reveal the complex interplay between ecological and evolutionary dynamics in the context of evolutionary adaptation to climate change.

Can genetic rescue be used to promote resilience to extreme climatic events in *Drosophila* populations?

Megan Higgie[1], Lexie Edwards[2], Michelle Van der Sluijs[1], Cara Shelley[1], Jinlin Chen[2], Jon R. Bridle[3], Conrad J. Hoskin[1], Owen T. Lewis[2]

[1]James Cook University. [2]University of Oxford. [3]University College London

Abstract

Extreme climatic events, such as heatwaves, pose severe challenges to species already affected by habitat loss, invasive species, and disease. Resilience, recovery, and response to these extreme events may be limited for isolated communities, such as those in the mountain-tops of the Australian Wet Tropics, due to population size reductions and lack of migration between isolated populations following these events causing inbreeding depression. One potential management solution is 'genetic rescue', which involves deliberately introducing genetic diversity to counteract loss of genetic diversity and inbreeding depression. This study tests whether genetic rescue affects resilience to heatwaves of a tropical *Drosophila* species' suffering from inbreeding depression caused by a prior heatwave. This project's aim is to determine whether increased genetic variation improves survival rates and reproductive success during subsequent extreme climatic events, offering insights into the effectiveness of genetic interventions for enhancing resilience in the face of climate change.

Myo-Inositol as a Key Regulator of Avian Metabolism: From Cellular Mechanisms to Seasonal Behaviour

Dr. Adi Domer, Dr. Robert Dudley

University of California, Berkeley

Abstract

Birds, being naturally hyperglycemic, can maintain twice the plasma-glucose concentration of mammals at equivalent size and are relatively insensitive to insulin. Whether this hyperglycemia is an adaptive mechanism or constraint remains unclear. Recent evidence points to myo-inositol (MI) as a key factor in hyperglycemia regulation across avian and mammalian species. MI is involved in several biochemical pathways, including glucose regulation, fat metabolism, and oxidative stress reduction. Our study investigated the role of MI in avian metabolism at three levels: organismal, genetic, and cellular. We investigated Anna's Hummingbirds to see how dietary MI influences body mass, analyzed the conservation of MI transporters across bird species, and explored MI's effect on mitochondrial fuel use in avian muscle cells. We show that MI transporters are highly conserved, and that MI enhances fatty-acid oxidation while reducing fat accumulation. Interestingly MI consumption was behaviouraly regulated and consumption rate varied with seasons and migratory body-mass changes.

Spatio-seasonal parasite exposure and density-dependence interact to shape the evolution of seasonal migration

Dr Stephen H. Vickers[1], Dr Ana Payo-Payo[2], Prof. Emma J.A. Cunningham[3], Dr Thomas R. Haaland[4], Dr Sarah J. Burthe[5], Prof. Francis Daunt[5], Prof. Jane Reid[4,1]

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Abstract

Parasites are ubiquitous across natural ecosystems and can substantially shape host population and evolutionary dynamics. Previous theory shows how parasites can drive evolution of host migration, if movement allows escape or recovery from infection. However, such theory only considers scenarios where migration benefits hosts, and largely ignores other key drivers and constraints, limiting real-world applicability. We first provide a novel comprehensive conceptual framework for parasite-migration associations, incorporating migratory reduction and relapse alongside escape and recovery. We then use an evolutionary individual-based model to demonstrate how different degrees of spatio-seasonal parasite exposure, density-dependence and migratory culling of infected hosts can jointly drive evolution of diverse strategies of full or partial migration or year-round residence. We thereby identify realistic parameter spaces where parasite-mediated migration is most likely to arise and either reduce or increase parasite burdens, and highlight conditions where such drivers will leave observable signatures in contemporary wild populations.

Intersexual differences in patterns and rates of wing wear in a solitary bee species

Miss Ava Nelson, Ms Alix N Prybyla, Mr Graham N Stone

University of Edinburgh

Abstract

A bee's wings accumulate damage (wear) over the course of its life. While wing wear has proven to be a valuable metric for inferring bee age, researchers have never investigated the potential differences between male and female wing wear accrual. This study investigates whether the differential evolutionary and ecological pressures faced by males and females result in unique rates and patterns of wear. We conducted a mark-recapture study on a subset (n_{female} = 146, n_{male} = 111) of a univoltine population of hairy-footed flower bees (Anthophora plumipes) in Edinburgh, Scotland. Photographs of both forewings were taken upon an individual's capture and subsequent recaptures until the individual was no longer locatable. ImageJ was used to measure the decrease in wing area and fluctuations in wing perimeter to quantify wear over time. Preliminary analysis using t- tests suggest males' wings wear more rapidly than females' ($t = -3.07$, $p = 0.005$)

Standing genetic diversity, adaptive potential and dynamic conservation of heavily fragmented UK *Juniperus communis* populations

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Abstract

The common juniper is one of only three conifers native to the UK. Despite being one of the most widespread conifers in the world, juniper populations in the UK and Europe have been in a state of decline for the past century due to several factors, including habitat fragmentation and the introduction of *Phytopthera austrocedrii.* This project aims to measure the impacts of these effects by quantifying the genetic diversity in juniper populations using genetic fingerprinting, common garden trials and a germination trial. Our findings suggest distinct genetic groups among UK *Juniperus communis* populations and identifies both conserved and plastic adaptations. These findings can provide valuable insights to conservation managers about the resilience and adaptability of remnant juniper populations.

Contrasting signals of adaptive capacity to ocean warming in seagrass and rockweed

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Abstract

Populations of coastal foundation species can be exposed to extreme variation in thermal regime along latitudinal gradients and on local spatial scales. Life history differences will determine the spatial scale of evolutionary processes impacting different co-occuring species. Seagrasses (Zostera marina) and rockweeds (Ascophyllum nodosum) are co-occuring foundation species in the North Atlantic that vary in reproductive strategy and dispersal potential. Here, we use population genomics to reveal that seagrass populations are structured with limited connectivity while rockweed populations have high connectivity across regions. We use common garden experiments to support genomic data. In common garden, seagrass populations decline in productivity for every 1C of warming above home-site temperatures. In contrast, all rockweed populations are highly plastic in response to temperature treatments in terms of growth rate and photosynthetic efficiency. Contrasting evolutionary response in species to warming will determine future seascape dynamics across ecosystems and have implications for planning seascape restoration.

IGF-1 concentrations predict summer weight and overwinter survival in wild Soay sheep lambs

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Abstract

Food availability in the wild can fluctuate due to changes in environmental conditions. This can have strong, lasting impacts on individual life histories since the amount of resources available can influence how individuals allocate them among competing life-history traits. Nutrient-sensing pathways such as the insulin/insulin-like growth factor (IGF) signalling (IIS) could potentially underlie the plastic response of individuals to changes in resource availability. Laboratory studies found IGF-1 to be sensitive to nutrient status with positive effects on growth, reproduction and longevity. However, our understanding of IGF-1 in wild animal populations is limited. Here, we measured circulating IGF-1 concentrations in lambs from a wild Soay sheep population (n=669). We found IGF-1 to vary with sex, litter size, population density and maternal age. We also found IGF-1 to predict summer body condition and overwinter survival. This demonstrates support for the role of IGF-1 in mediating the life-history response to environmental variation.

Repeated host shifting in the global radiation of oak gallwasps (Hymenoptera: Cynipidae: Cynipini)

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Abstract

Evolutionary drivers of host shifting have shaped the present-day structure of plant-insect communities, and can inform predictions of future community change. We investigated patterns of host shifting by using a global phylogeny of oak gallwasps, specialist herbivores that induce galls on different lineages within Fagaceae, to reconstruct ancestral gallwasps' host use. Codiversification of plants and gallwasps would leave a signature of herbivore shifts onto increasingly derived host lineages, whereas biogeographic influences on host associations should enable frequent shifts between hosts with a long history of geographic co-occurrence. We demonstrate early diversification of Cynipini on two sections of oaks (*Quercus*), and repeated shifts onto other (often older) Fagaceae lineages. Host shifting was faster between both closely related hosts and hosts that co-occur in geographic regions. Phylogenetic conservatism in plant developmental traits may constrain gallwasps' ability to shift hosts, and explain why the association with Fagaceae has been so long-lasting.

Trait evolution in host-parasitoid communities following a single heatwave event that induced drastic species turnover

Jinlin Chen[1], Lexie Edwards[1], Megan Higgie[2], Jan Hrcek[3], Jon Bridle[4], Owen Lewis[1]

[1]University of Oxford. [2]James Cook University. [3]Biology Centre, Czech Academy of Sciences. [4]University College London

Abstract

Extreme events, such as heatwaves, are becoming more frequent, with immediate and long-lasting effects on biodiversity. In the meantime, such destructive events potentially select for increased tolerance to extremes, enhancing resilience to future extremes. However, the direction and longevity of such evolutionary changes are likely regulated by ecological and evolutionary pressures from co-occurring species, which may also undergo drastic shifts after an extreme event. Empirical data on simultaneous ecological and evolutionary changes in closely interacting communities are scarce but crucial for understanding the limit of adaptation to increasingly extreme climates. We imposed a variety of heatwave events on mountain-top *Drosophila*-parasitoid communities freshly collected from the Wet Tropics and observed a rapid and long-lasting species turnover. We further investigate across multiple species how traits related to survival, reproduction, and biotic interactions evolve as these communities recover from extreme events.

Thermal acclimation effects translated into field conditions in Drosophila

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Abstract

Empirical research based on fixed critical temperatures from short-term ramping assays often predicts a limited capacity for ectotherms to acclimate to heat stress. We applied a novel methodology that accounts for the detrimental and cumulative effects of heat stress in variable thermal regimes to assess the impact of thermal acclimation. Four Drosophila species were acclimated to five constant temperatures, and their tolerance landscapes were developed to predict survival over an entire year under natural conditions. Our findings reveal that, while acclimation moderately improves thermal tolerance in short-term lab trials, its effects become far more pronounced when viewed over ecologically relevant timescales. Acclimation to warmer conditions notably enhanced thermal tolerance, challenging the notion that acclimation has only a minor effect in ectotherms. Our study highlights the crucial role of acclimation in helping species cope with the escalating thermal challenges posed by global warming.

Historical thermal variation influences reproduction responses to heat stress in the moth, *Plodia interpunctella*

Mr Jasper W Rees, Dr Steve Sait, Dr Elizabeth Duncan

University of Leeds

Abstract

Insect reproduction is increasingly impacted by thermal stress associated with climate change. However, past experience of thermal variability over multiple generations could modify reproduction responses to thermal stress, but this is poorly understood. We investigated how historical exposure to stochastic temperature variation affected reproductive traits in *Plodia interpunctella*, when larvae from populations maintained in constant temperatures (28°C), or exposed to high (26°C ±2.5SD) or low (26°C ±1.5SD) historical thermal variability for 4 generations, were subjected to heat stress. Ovary size of heat-stressed individuals exposed to high thermal variability were smaller compared with those from constant, or low variable temperatures. Exposure to low variable temperatures also increased body size compared to constant, or high variable temperatures. These results revealed that the level of historical thermal variability has a critical impact on responses to heat stress; it can act as a buffer or increase vulnerability to heat stress.

Heterosis is more important than seed formation rates for a widespread and invasive hybrid aquatic plant (*Typha* x *glauca*) in North America

Prof Joanna Freeland, Prof Marcel Dorken, Ms Olivia Kowalczyk, Ms Sanjuti Deb Joyee, Ms Margaret Brennan

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Abstract

Repeated hybridization between two species generates novel genome combinations that can have highly variable outcomes, and the likelihood of favourable outcomes should increase with higher rates of hybrid formation. This is analogous to the idea that high propagule pressure facilitates biological invasions, but has seldom been investigated as a potential driver of hybrid success. We used a combination of fieldwork and experiments to test the hypothesis that high seed formation rates help to explain the success of *Typha* x *glauca*, a widespread invasive hybrid that dominates wetlands across large regions of North America. Our data do not support the hypothesis but instead suggest that although hybrid formation is relatively infrequent, heterosis facilitates wetland invasion by *T.* x *glauca* in both established and leading-edge populations. Our findings can help to explain the maintenance of an invasive hybrid zone, even when parent species become relatively uncommon.

Enhancing biotic resistance of native plant communities to invasion: Role of native seed densities and priority effects

Mr. Jangho Lee, Dr. Kripal Singh, Prof. Chaeho Byun

Andong National University, Republic of Korea

Abstract

This study tested role of native seed density and priority effects in enhancing the biotic resistance of native communities to invasion. To investigate this an experiment was established by sowing a suite of four native species at three seed densities (low, medium, and high), and invasive species was introduced to the native community at various time intervals (2 weeks early, same time, 2, 4 and 6 weeks later) and measuring height, density, and cover of all species at different growth stages and biomass at maturity. The relative competitive index and its average were calculated for each response variable and their average, respectively to measure the competitive effects of native species to resist invasion. The high-density native species resulted in a greater reduction in growth (cover, height, and density) and productivity (biomass) of invasive species. The establishment and growth of invasive species were affected by natives depending on their arrival time.

AInimal Detector: Pilot Study of an Artificial Intelligence Software for Identifying Dogs and Cats in Camera-Trap Records

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Abstract

Camera traps brought recognized advances in ecological research but have also created challenges, generating huge amounts of data and making the process of animal identification time-consuming. We developed *AInimal Detector* software to address these issues, focusing on identifying domestic dogs and cats, which often appear in camera trap projects and can impact biodiversity, especially in regions with endangered species such as the Atlantic Forest. Using the YOLOv8 framework, we trained a Deep Neural Network with a dataset comprising 2,949 training images, 716 for validation, and 211 for testing. The model achieved an accuracy of approximately 77%, with Precision and Recall also around 0.77, and a Mean Average Precision (mAP50) of 0.72. For cats, mAP50 was 0.51 due to dataset limitations. *AInimal Detector* is user-friendly, accessible under an End User License Agreement, and effectively detects cats and dogs across various conditions and environments.

Predicting the global economic costs of biological invasions by tetrapods

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Abstract

Accelerating global biological invasion rates are producing rapidly expanding socio-economic costs alongside substantial environmental perturbations. However, the pathways that lead invasive species to become economically impactful remain poorly understood. Here, we test the hypothesis that adaptive traits that influence demographic resilience predict economic costs, using global data on invasive terrestrial vertebrates given their well-catalogued impacts and characteristics. Total global costs of invasive tetrapods are conservatively in the tens of billions of dollars. These monetary impacts are predicted by longevity, female maturation age, diet and invasion pathway traits, although the directionality of impacts also varied across classes for some traits. The huge socio-economic costs demonstrate the necessity of mitigating tetrapod invasions and filling knowledge gaps. Effective identification of traits predictive of costs among and within these groups can facilitate this through prioritisation of necessarily limited resources to efficiently target the most damaging existing and emerging invasive tetrapod species.

Native range habitat generalism and abundance of marine fishes predict invasiveness but show few shifts following introduction

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Abstract

The spread of non-indigenous species (NIS) threatens native biodiversity. Identifying the invasiveness potential of species remains a global ecological challenge. While habitat generalists are predicted to show high invasiveness, this is mostly studied in the invaded range, thus offering limited predictive power in identifying future NIS. To elucidate how invasiveness relates to species properties, and in an attempt to predict future introductions, we studied Red Sea fish introduced into the Mediterranean Sea. Using 247 underwater-video samples, in both the native and invaded ranges, we recorded 230 species of which 31 are known from both the Red Sea and Mediterranean Sea. We revealed that NIS in their native range have larger habitat breadth and higher relative abundance than non-introduced Red Sea species. As native-range habitat preferences and abundance can be easily assessed across numerous species and wide spatial scales, these properties are applicable for predicting the identity of future introductions.

Invasive Cichlids in Urban Neotropical Streams: Establishment Patterns and Feeding Behavior Assessment

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Abstract

Amphilophus labiatus is an exotic species of cichlid cataloged as invasive in tropical ecosystems. This study evaluates the feeding behavior of invasive cichlids to assess their role within urban riverine ecosystems. The organisms were collected in four different river transects of increasing urbanization downstream across the Río Piedras Watershed, Puerto Rico. The specimens were dissected to extract gut content to obtain dietary preferences, trophic levels, and ingestion of anthropogenic particulate in relation to different individuals biological and geographical features. The population demonstrated opportunistic and aggressive feeding behaviors with no significant seasonal plasticity. The sample at the catchment scale displayed an herbivorous functionality; however, the degree of omnivory differed according to sex and reach scale. Microplastic fibers were found in all individuals, higher amounts in individuals within highly urban sub-catchments and greater omnivorous behavior. These strategies allow their establishment, exploitation of resources, and displacement of native organism within Río Piedras Watershed.

Searching for the greater white-toothed shrew (*Crocidura russula*) in the North East of England.

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[1]Department of Biosciences, University of Durham. [2]Department of Anthropology, University of Durham

Abstract

The greater white-toothed shrew, *Crocidura russula*, is perhaps best known from its invasion of Ireland in the past 20 years where it has earned invasive status through competition with Ireland's only native shrew species, the pygmy shrew *Sorex minutus*. Recent records of *C. russula* in the north east of England from live trapping, owl pellet analysis, and from specimens brought in by domestic cats have sparked concerns about a potential invasion in the UK. Using camera traps optimised to detect small mammals, this research aimed to detect the invasive shrews at sites they are known to be present relying on a new method of observing small mammals. To date, there have been no positive detections of *C. russula* despite detections of all three native UK shrews, suggesting that *C. russula* is not present in high densities in the UK, tempering concerns about its invasive potential as demonstrated in Ireland.

Group Ecology and The Biocontrol Paradox

Prof Stephen P Bonser

UNSW Sydney

Abstract

The effectiveness of biocontrol is assessed by its impact on individuals, but the goal of biocontrol is to control populations or groups. Many invasive plants form single-species groups, and the performance of these groups can be greatest where competitive interactions are minimised. Biocontrol agents can minimise shade avoidance competitive responses by disrupting apical dominance through feeding on apical tissue, and through a trade-off between shade avoidance and defence responses. Thus, biocontrol can reduce the performance of individuals but *increase* the performance of groups of invaders (The Biocontrol Paradox). I tested the biocontrol paradox in assemblages of the invasive plant *Chrysanthemoides monilifera* in Australia. Biocontrol caterpillars significantly increased branching, reproduction, and light interception in *C monilifera* assemblages. However, the reduction in shade avoidance was not significant. The impact of biocontrol on group performance may help to explain why biocontrol is often not successful in controlling invasive species.

Spatial distribution and temporal trends (1995-2022) of soft-bottom marine benthic alien species from the Basque Country (southeastern Bay of Biscay)

Azeez Olalekan Baki[1,2], Izaskun Zorita[1], Ángel Borja[1], Iñigo Muxika[1]

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Abstract

This study presents an updated list of 373 marine macroinvertebrate species that can be considered alien, cryptogenic and invasive in the Bay of Biscay based on recent publications. From a total of 26,960 benthic species records collected between 1995 and 2022 at 51 coastal and estuarine stations sampled along the Basque Country, 937 records were Non-Indigenous Species (NIS) (3.5%). The number of NIS species and records increased over time. The highest number of NIS were detected at coastal stations, possibly related to the shifting baselines due to changes in water temperature, and in estuaries where international ports are located (introduced by shipping). Of all the NIS, the mussel *Xenostrobus securis* was the only invasive species and was detected in degraded areas with low salinities. These results highlight the need for specific monitoring to manage the spread of NIS in the region. Work funded by the Basque Water Agency (URA).

The Extent of Genetic Variability of the Invasive California Kingsnake (Lampropeltis californiae) in Gran Canaria

Mr Al-Fida M. Ahmed

Edge Hill University

Abstract

Invasive species represent a significant threats to the multitudes of vulnerable species globally, with them often impacting both the biodiversity and ecosystem negatively. This is cause for great concern when Invasive species begin to establish within island ecosystems, which not only hold greater concentrations of the the worlds biodiversity, they additionally host delicate ecosystems that are vulnerable to disturbances. *Lampropeltis californiae* is one such example, with its invasion of Gran Canaria currently devastating the local endemic lizard populations that are vital for the ecosystems function. This study aims to fill a critical gap in the literature by analysing the population genetics, genetic structure and phylogenetics of the multiple expanding populations. unlike with previous observational studies, this study will provide valuable genetic insight that is essential for developing conservation strategies and update our current genetic insight.

Using the Light Brown Apple moth, Epiphyas postvittana, to test eDNA sampling methods for plant pests and invasive insects

Mr Stewart Rosell[1,2], Dr Archie K Murchie[2], Dr John Baird[1]

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Abstract

Non-native herbivorous insects can be introduced on plants via horticultural trade and pose a threat to plant health. Environmental DNA (eDNA) sampling methods can detect insects on foliage. These methods can detect pests from insect fragments or frass, which are not sufficient to identify insects when using traditional inspection methods. To apply these methods to biosecurity and surveillance for pests more optimized and interpretable methods need to be developed.

I am using Light Brown Apple moth (*Epiphyas postvittana*) to test eDNA sampling on types of plants important for biosecurity. *E. postvittana* is polyphagous and easy to rear making it suitable for experiments on a range of relevant plant species. This species is taxonomically and ecologically similar to important plant pests such as the torticid genera *Choristoneura*, *Acleris*, *Archips*, and other lepidoptera pests so the findings will help optimize eDNA sampling for economically important pests and introduction pathways.

A Survey of Pine-Associated Nematode Fauna of Great Britain

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Abstract

Pine wilt disease (PWD), caused by the pinewood nematode (PWN), *Bursaphelenchus xylophilus*, and spread by *Monochamus* beetles, is a significant global threat to conifer forestry. Despite rigorous border surveillance and containment efforts, PWN continues to spread. PWN and other *Bursaphelenchus* nematodes have been intercepted in infested material entering UK ports and processing sites, with incidents expected to rise. To preserve the UK's PWN-free status, annual nationwide surveys of coniferous forests are conducted to detect infections. A comprehensive survey of nematode fauna associated with declining pine trees across Great Britain was recently undertaken, with 100 samples analysed. Preliminary findings suggest that while PWN remains absent, other plant parasitic nematodes are present within UK coniferous forest stands. Beyond preventing the introduction of *B. xylophilus*, this survey enhances our understanding of native nematode species.

Microbial diversity might facilitate the growth and invasion success of the seagrass *Halophila stipulacea* in the Mediterranean Sea

Emma Hoza-Frederick[1], Dr. Sergio Martinez-Campos Gutierrez[2], Dr. Paul H. Barber[3], Dr. Marlen I. Vasquez[4], Dr Vassilis Fotopoulos[5], Dr. Kelcie L. Chiquillo[1]

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Abstract

It is believed that microbes can facilitate the invasion success of introduced species into new habitats. Here, we hypothesized that increased microbial diversity may impact the invasion success of the invasive seagrass, *Halophila stipulacea*. We investigated microbial diversity and biochemical analyses from the phyllosphere of native, invasive, and mixed treatment groups from the Mediterranean. We found that native seagrass hosted more phyla than invasive seagrass with an increase in taxa over time, yet experienced higher stress. We saw the reverse trend in the invasive seagrass, which depicted lower diversity than native seagrass, a decrease in phyla over time, and lower stress. Critically, we found that the invasive seagrass hosted more microbes in a mixed environment, where it was growing with native seagrass, which corresponded to the treatment possessing the greatest growth. Our findings suggest that microbes might act as facilitators of *H. stipulacea* growth and invasion success in the Mediterranean.

Environmental resistance to non-native plant invasion across the United Kingdom

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Abstract

Ongoing introductions of non-native species outside their native range is a global driver of plant community change. Here we use: (1) a comprehensive list of 3,495 native and non-native plant species from the 2020 PlantAtlas, (2) species occurrences from 591 CEH Countryside Survey vegetation plot data, the GB non-native species information portal and GBIF, and (3) the native range for 1,614 non-native species from WCVP and BIEN. This data was combined to calculate environmental resistance based on biotic characteristics of native species in the United Kingdom. We found that (1) areas with lower environmental resistance had higher species turnover rates and, in some cases, local extinctions, and (2) potential extinction debts exist in areas of low environmental resistance. We use this approach to visualise and understand current and future invasion risks.

Enhancing understanding of invasive non-native species across UK Overseas Territories

Dr Diana Bowler[1], Dr Jakovos Demetriou[2], Dr Angeliki Martinou[3], Stephanie Rorke[1], Dr David Roy[1], Professor Helen Roy[1], Megan Williams[1]

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Abstract

Invasive non-native species (INNS) are recognized as a major and growing threat to biodiversity and ecosystems. The impact of INNS on small islands is often more severe than on mainland due to the relative isolation of native flora and fauna from external threats. Globally, there are significant gaps in baseline knowledge of INNS, particularly on small islands such as the 14 UK Overseas Territories (OTs) where the threat of INNS is especially critical.

Through a Darwin Funded project (DPLUS175), we are compiling a comprehensive inventory of INNS present in each OT. These inventories will ultimately be consolidated through the Non-Native Species Secretariat website, they are intended to inform conservation, education, research, and disaster recovery strategies in response to climate change. In this poster, I will explore the challenges and potential future developments of these inventories to help OTs assess, manage, and control INNS populations more effectively.

Using the UK Pollinator Monitoring Scheme's FIT count app to compare wildflower and Himalayan balsam use in Lancashire.

Miss Radhika Bradley, Dr Frankie J Kerridge

Myerscough University Centre

Abstract

Since 1930 the UK has lost 97% of wildflower meadows due to urbanisation and changing agricultural practices while invertebrate populations are also in decline therefore fast-growing pioneer floral species may provide a useful food source for pollinators in marginal habitats. This study investigated whether Himalayan balsam, a widespread invasive alien species, is used as an alternative food source by pollinating invertebrates. The Pollinator Monitoring Scheme FIT Count app was used to conduct 120 surveys during July to September 2023. Survey areas were either dominated by Himalayan balsam, free of balsam, or contained balsam in proximity to wildflowers. Results indicated few preferences for wildflowers over Himalayan balsam whereas bumblebees, wasps and hoverflies preferred balsam in the mixed sites. Studies such as this demonstrate that balsam can be important for invertebrate pollinators in areas where it is difficult to eradicate completely.

Vegetation ecology of urban parks and discourses around an ‘invasive’ tree *Leucaena leucocephala* in New Delhi

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Abstract

The nature of nature in a city is often understood as non-native or exotic species coexisting with some native biota. The objective of this study is to understand the distribution of an invasive tree species, *Leucaena leucocephala* in urban parks and its habitat associates. For the purpose of this research, I used conventional vegetation sampling datasets to investigate species assemblages across five community parks in different parts of Delhi, India. Using semi-structured surveys, I studied people’s perception of Leucaena leucocephala and also conducted a brief discourse analysis to understand various discourses around this species. Results show that in urban parks non-native – native associations are quite evident. It is also found that the global discourses are in an inter- conflict with each other and the discourse which regulates the management of invasive species takes a top-down approach in its framework which is thus followed at the local scale.

Herbaceous plant species naturalized outside Europe occupy a nitrogen-limited stoichiometric niche

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Abstract

The number of naturalized plant species shows no sign of saturation while the number of threatened plant species is globally rising. It has been proposed that mechanisms underlying threatened status are similar to those explaining naturalized and invasive status. Using a European herbaceous vegetation dataset (building on Scheifes et al., (2024)), we tested whether plant species status differs along (1) their functional life history and growth traits and (2) their nutrient stoichiometric niche position. Compared to non-naturalized and threatened species, our findings do not provide clear evidence that species naturalized outside of Europe exhibit distinct morphological and functional traits. Naturalized species predominantly occupied a nutrient-rich and nitrogen-limited stoichiometric niche; however, nutrient stoichiometric niche did not differ between invasive and non-invasive species. We recommend adopting an integral global strategy to reduce phosphorus fertilization, as it poses a significant threat to both species naturalization and extinction.

The invasive advantage: *Ligustrum lucidum* dominance in seed rain and dispersal across all seasons in subtropical successional forests

Priscila Ana Powell[1], Candela Russo[1], Mariana Baricco[1], Valentina Irrazabal Alarcón[2], José Sebastián Rodriguez[1], Florencia Tannure[1], Lía Fernanda Montti[3], David FRP Burslem[4]

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Abstract

This study investigated the fruiting patterns and bird dispersal of native and exotic plant species in subtropical forests (Northwestern Argentina). From August 2021 to July 2023, we monitored and identified, at the species level, the whole and digested fruits that fell on 288 fruit traps distributed in six 3-hectare plots. 261816 fruits were collected, belonging to 25 species (six of them exotic). From those, 44168 items were digested by birds. The fruiting season of the non-pioneer invasive *Ligustrum lucidum* spans all months, similar to three native late-successional species: *Myrsine laetevirens*, *Ocotea porphyria* and *Psychotria cartagenensis*. *L.lucidum* and *P.cartagenensis* fruits were the most abundant throughout the year and exhibited high amounts of digested seeds across all seasons. The other exotic species had fruits in precise seasons. These findings contribute to the understanding of the invasive potential of non-pioneer alien species in closed-canopy forests and their interactions with native ecosystems.

Hungry Hungry Harmonia – Using Functional Genomics to Measure the Predatory Impact of Invasive Ladybirds *Harmonia axyridis*

Mr Nathanael J. Litlekalsoy[1], Professor Jaimie T. A. Dick[2], Doctor Greta Bocedi[1], Doctor Ross Cuthbert[2], Doctor Fabio Manfredini[1]

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Abstract

Invasive alien species' (IAS) impacts are among the leading drivers of biodiversity loss globally with increasing prevalence and magnitude. These impacts are driven by behavioural traits that are expressed differently across the species' invaded range. Functional genomics offers a window into the molecular underpinnings of such biological processes. Adult female *Harmonia axyridis* ladybirds were sampled across an invasion axis running South to North of Great Britain (oldest to newest range) and subjected to three feeding regimes, including non-feeders. RNA samples were isolated from the brains of 54 individuals for RNA-Sequencing. Comparing the oldest and the newest range, 4.1% of genes were significantly differentially expressed ($p < 0.05$), indicating a time since invasion effect. Whereas 8.7% of genes were significantly differentially expressed between feeding regimes, suggesting a transcriptome-behaviour relationship for impactful predatory behaviour in *H. axyridis*. Integrating these results into impact predictions have the potential to revolutionise IAS impact modelling.

Effect of non-native flora on natural biogeographic regionalization of global flora

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Abstract

Human activities have altered the composition of biotas worldwide by introducing non-native species, breaking down biogeographical boundaries. Using global distribution data of 279,437 native and 11,589 non-native seed plant species, we analyzed the impact of species introductions on natural biogeographic boundaries based on taxonomic and phylogenetic compositions of 548 regions. We found that the dispersal of non-native species reshaped natural biogeographical patterns, leading to a reduction of floristic kingdoms. Based on taxonomic dissimilarity, eight natural floristic kingdoms broke down into tropical, non-tropical and Australian regions after species introductions. Geographical distances, accounting for dispersal barriers including water, mountains, or unsuitable climates, important in explaining natural patterns, lost their importance when including non-native species. However, environmental factors consistently exerted a strong influence on native and non-native species. Our findings show that human-mediated dispersal results in the breakdown of biogeographical barriers and redefines the global biogeography of plants.

The Plant Ionome as a Functional Trait: Variation across Bioclimatic Regions and Functional Groups

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Abstract

Plant chemical composition is a trait gaining increasing importance in plant ecology. We conducted an analysis of ionomes utilising X-ray fluorescence techniques on 85 plant species from four distinct functional groups, across 15 sites located in both the desert and Mediterranean bioclimatic regions. The primary factors influencing variations in ionomes are predominantly attributed to bioclimatic factors rather than soil element availability. Across all functional groups, plants from the Mediterranean region are characterised by greater association with calcium, whereas desert plants exhibit a higher affinity for strontium, suggesting its potential role in drought tolerance. Grasses uniquely exhibit distinct ionomic features, primarily due to their higher silicon concentrations. Plant species' affinities for certain elements and their interactions are likely driven by physiological constraints, whereas variations within a functional group are mostly driven by environmental conditions.

Increased signal of fishing pressure on community life-history traits at larger spatial scales

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Abstract

We need to understanding species' differing responses to human pressure to sustainably manage marine communities. Despite theory and empirical evidence that fishing pressure affects marine life-history strategies, several recent large-scale studies have not shown strong relationships between fishing pressure and community composition. We collate extensive scientific biodiversity surveys for 229 taxa in the North East Atlantic, testing whether community mean weighted life-history traits correlate with fishing pressure, temperature and depth, and whether the strength of these relationships are scale dependant. We show fish community life-history strategy correlates with fishing pressure, and that the relative importance of fishing pressure increases with the scale of the community. We suggest this scale dependence is mediated by the spatial extent over which covariates vary, and how the communities experience this variability. Our findings highlight how studying systems at ecologically relevant scales is necessary to detect and appropriately interpret the impacts of global change.

Climatic conditions and resource availability along tropical and temperate gradients of the Americas impact the co-occurrence pattern of nectarivorous species

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Abstract

Biodiversity trends and patterns are shaped by biotic interactions and abiotic factors. However, we lack sufficient knowledge of how biotic and abiotic factors individually or concurrently determine species co-occurrence and biodiversity trends and patterns. Here, we assessed how changes in environmental conditions influence the co-occurrence between species of two nectarivorous families, Sphingidae (hawk moths) and Trochilidae (hummingbirds), using occurrence data from the Global Biodiversity Information Facility. Our analysis showed that extreme environmental conditions, such as colder temperatures, drier conditions, and low resources decrease the co-occurrence of hummingbirds and hawk moths. Strikingly, we found that hummingbirds' abundance and richness were higher at higher elevations compared to hawk moths, indicating a decline in their co-occurrence in extreme environmental conditions. This may lead to niche partitioning as elevation increases due to the advantages of hummingbirds' physiological and behavioural traits (endothermy, respiration, diurnality) at higher elevations over hawkmoths.

Elucidating global change impacts on trophic interactions of generalist consumers: insights from a novel database

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Abstract

Global change disrupts trophic interactions essential for food web stability and ecosystem functioning. Large, mobile generalist consumers, such as mammalian omnivores, exhibit high behavioural flexibility and are anticipated to adapt their trophic interactions in response to changes in seasonality and resource availability. Despite their ubiquity, our empirical understanding of how omnivores respond to changing environmental conditions in terrestrial ecosystems is limited.

Here, we present a highly resolved global database on the trophic interactions of 61 omnivorous species in the order Carnivora, compiled from the literature. This spatially and temporally resolved database will enable detailed analyses of (i) seasonal and geographic variation of trophic interactions within and across species, (ii) the extent to which this seasonal and geographic variation in trophic interactions is determined by climate and resource availability, and (iii) the influence of species traits on trophic responses to environmental conditions.

Species distribution modelling bridges the Wallacean shortfall for freshwater macroinvertebrates in the Guineo-Congolian Region

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Abstract

The Guineo-Congolian region is an important biodiversity hotspot in Africa, with many rare and threatened species. It has numerous outstanding freshwater systems, which are grossly underreported. We prepared an extensive database of all available freshwater macroinvertebrate species occurrence records from 14 countries. We also employed open-source software such as GRASS-GIS and R to estimate the potential geographical distribution of species across a newly-developed, high-resolution hydrographic network to assess the biogeographic patterns of freshwater macroinvertebrates in this unique hotspot. We also estimated the potential effects of global change on species distributions using projections for future climate. Current and future scenarios of the modelled species indicate that the Lower Guinea Forest of West Africa and the Congo Basin are potentially higher biodiversity hotspots than the Upper Guinea Forest. The findings of this research have a very high potential to guide conservation efforts in the region.

Predicting temporal change of species distributions from static snapshots

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Abstract

Limited temporally replicated data restricts our ability to assess temporal biodiversity trends. This study seeks to infer temporal biodiversity trends from single snapshots of species distributions without needing time-series data. Using breeding bird atlases from four regions worldwide, we examined temporal change in terms of direction and magnitude. We calculated static predictors based on species' spatial distribution, traits, diversity metrics, and regional characteristics, and used machine learning to link these predictors to temporal change. While the static predictors couldn't predict the direction of change, they successfully predicted its magnitude, suggesting that spatial configuration alone can estimate the extent of temporal change. This approach holds promise for estimating biodiversity change in scenarios with limited temporal data.

Latitudinal gradients in predation persist in urbanized environments

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Abstract

Urbanization is creating a new global biome, but while this profoundly affects local ecology we know little about whether it disrupts large-scale macroecological patterns. We tested whether urbanization disrupts a macroecological pattern central to ecological and evolutionary theory: the increase in predation intensity from high to low latitudes. Across 14,000 km of latitude spanning the Americas, we compared predation intensity on standardized experimental seeds in urbanized and natural areas. In natural areas, seed predation increased 5-fold from high latitudes to the tropics, one of the strongest latitudinal gradients in species interactions documented so far. Surprisingly, while urbanization reduced predation by vertebrates, latitudinal predation gradients were equally strong in urbanized areas. Our results show that macroecological patterns can persist in urbanized environments, even as urbanization alters the relative importance of predators and potentially the evolutionary trajectory of urban populations.

A global comparison of stream diatom beta diversity on islands vs. continents across scales

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Abstract

In this work, we aim to evaluate the patterns of stream diatom beta diversity in islands vs. continents across scales. We used beta diversity partitioning to compare diatom beta diversity between islands and continents at large (between islands / continental) and small (within islands / equivalent continental areas) scales, partial Mantel test and distance-decay curves to assess how diatom beta diversity on islands and in continents is affected by spatial and environmental distances, and linear mixed models to evaluate the relationship between island beta diversity their latitude, area, age, and isolation. Diatom beta diversity on islands vs. continents is scale- and region-dependent. Beta diversity was mainly caused by species turnover, with spatial and environmental distances shaping diatom beta diversity at large, but not at small scales. Moreover, diatom beta diversity on islands was affected by island latitude, age, and isolation, but not by island area.

Failure to include historical information on species occurrences leads to underestimates in the breadth of their thermal niches

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Abstract

Species distribution models often use species records only from recent years (e.g. post-1970), yet this standard practice may bias thermal niche estimates if recent land-use changes restrict species to a narrow part of their full thermal niche. We use species records for swallowtail (Papilionidae) and satyrine (Satyrinae) butterflies of Sulawesi (Indonesia) to test how the inclusion of historical climate and occurrence data (1853-1970) affects estimates of species thermal niches compared with models using data only since 1970. We found that the inclusion of historical data results in a median increase in species thermal range breadth by 3.6°C (IQR 0.1-7.5). 13/46 species (28%) had hotter hot range limits and we estimate that the inclusion of historical data predicts occurrence in climatically-suitable areas being as much as two-fold larger. Future studies should incorporate historic data, where such data are available, and be wary of underestimating species hot limits from recent data.

Winner-loser species replacements with land-use intensification

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[1]University of Bern. [2]Technische Universität München. [3]Technische Universität Darmstadt

Abstract

Land-use intensification leads to the decline of many species (losers) and the proliferation of a few (winners), but the variation in winner-loser replacements across taxa and land-use change drivers is poorly understood. We quantify the niche of nearly 5,000 species—from bacteria to plants, invertebrates and vertebrates— examining their responses to mowing, fertilization and grazing across grasslands, and tree harvesting, dead-wood removal and non-native species across forests, in Germany. While most species showed neutral responses, there were winner-loser replacements across all taxa-driver combinations, with 20% winners and 27% losers on average. There were unique species affected by each driver, with fertilization and dead-wood removal being the most impactful. Traditional diversity measures failed to capture these changes. Winners were more widespread than losers in grasslands, but were confined to high-intensity plots in forests. Our findings highlight that land-use intensification threatens a wide range of taxa, resulting in significant species turnover.

Past climate stability and present habitat conditions and heterogeneity structure functional diversity patterns of birds in Euro-Mediterranean forests

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Abstract

Studying the relative importance of historical and contemporary environmental and anthropic changes in shaping diversity patterns helps us comprehend the long-term impacts of the ongoing transformation of the earth system. In this study, we test several complementary mechanisms to understand how past and current drivers may shape the functional richness, dispersion, and distinctiveness of birds in Euro-Mediterranean forests.

Using Machine Learning algorithms, we aim to determine the relative importance of past climate stability, present climatic and habitat mean characteristics and their spatial heterogeneity, disturbances and past and present land use, in shaping current patterns of functional diversity, and to discern the directionality of their impact. Then, Structural Equation Models were used to unravel whether these drivers act directly or indirectly as determinants of functional diversity patterns while considering interactions among drivers.

GeoPl@ntNet: A Deep Learning Workflow for Mapping European Plant Species and Habitats at Very-High Resolution

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Abstract

We introduce GeoPl@ntNet, a deep-learning based workflow aiming at mapping European plant species (over 10,000 organisms) and ecosystems (over 200 EUNIS habitats) at very-high resolution (50m) and deriving biodiversity indicators (e.g., species richness and diversity, presence of protected or threatened species, and number of invasive species). The pipeline is based on computer vision (convolutional neural networks) and natural language processing (transformers) and uses millions of heterogeneous presence-only records coupled with hundreds of thousands standardized presence-absence surveys. In particular, it focuses on (i) image classification (plant assemblages are created with satellite images and rasterized environmental data), (ii) fill-mask (predicted species are translated into a modelled ecological process) and (iii) text classification (habitats are assigned to sentences describing species compositions). We will discuss the validation and interpretability of the results as well as the potential benefits and risks of GeoPl@ntNet as a powerful tool for understanding and monitoring biodiversity dynamics across Europe.

El Niño Variability contributes to climate change driven declines in terrestrial vertebrates

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Abstract

El Niño Southern Oscillation (ENSO) is the largest driver of interannual atmospheric circulation variability which influences global weather patterns. This weather variability along with changes in the global climate, could combine to increase species' extinction risk. Using global population time series data for 1,631 bird, mammal, and reptile species, we tested how climate change and ENSO impacted population trends over time. Population trends responded more negatively under increasingly intense and variable ENSO conditions. We observed that more variable ENSO conditions weaken the positive response of population trends to increasingly wet conditions. Further, climate change driven warming and higher ENSO variability interacted, driving stronger negative responses of population trends. This effect was most pronounced in species that were in closer to their upper thermal tolerance limits. These results highlight the combined impacts of the two largest drivers of global climate and weather patterns on population persistence and extinction risk over time.

Partitioning landscape-diversity landscape-functioning effects in space and time: a continental study in North America

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Abstract

Today's terrestrial surface resembles a mosaic of different natural and anthropogenic ecosystems. We showed that this landscape diversity is positively associated with landscape primary productivity. Here we partition net landscape diversity effects into complementarity and selection effects. Using ~50.000 plots covering North America and 15 years of satellite-sensed 30m resolution productivity, we find that diversity effects are mainly driven by positive complementarity and negative selection effects. This pattern resembles results from species diversity experiments. Temporal variation in water availability was a large driver of temporal variability of productivity, yet the specific land covers driving this effect did not depend on drought. In contrast, they differed between locations, indicating that a wide diversity of landscape compositions is important for the productivity of large land units (spatial insurance effect). We argue that, in addition to the conservation of species diversity, targeted landscape planning could also be leveraged to promote ecosystem service.

Patterns in habitat selection across terrestrial mammal species

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Abstract

Environmental change affects movement and space use of animals, but little is known about global patterns in habitat selection at finer temporal and spatial scales across species. Such patterns would allow us to infer movement patterns for data-poor species and improve our understanding of animals' responses to environmental change. We examined cross-species habitat selection patterns by fitting integrated step-selection functions to >1300 individual tracks across 49 mammal species. We estimated selection coefficients for environmental and anthropogenic drivers of movement as well as selection-independent step length distributions. We investigated these for signals of species traits and found some allometric patterns in selection-independent step lengths but did not identify traits as consistent predictors of species' selection of covariates such as terrain and NDVI. These findings suggest that local movement is largely driven by environmental variability, while the allometric relationships observed in previous literature are an emergent property only observed over larger scales.

Species richness across trophic levels is unlikely pyramidal and may have uniform proportions globally

Luis F Camacho, Miguel B Araújo

Museo Nacional de Ciencias Naturales

Abstract

Thermodynamics imposes a well-known pyramidal trophic distribution of biomass upon ecosystems but whether the trophic distribution of species richness follows the same pattern remains unclear. This study examines the global distribution of species trophic groups across all known terrestrial tetrapod and arthropod species. By categorising species into their fundamental trophic levels, we found that 46% of species are herbivores, 43% are predators, and 11% are trophic generalists, revealing that the trophic stratification of terrestrial consumer species is not pyramidal but rather squared. Moreover, we uncover the trophic level composition of terrestrial mammal and bird species is nearly identical across the globe irrespective of geographical location or total species number. A non-pyramidal distribution of diversity across trophic levels with a potentially uniform structure across the globe, challenges previous assumptions derived from local observations and underscores the need for an integrated approach to studying ecosystem energetics, organizing properties, and biodiversity.

Transforming coral reef monitoring: multi-scale integration of aerial and underwater imagery

Matteo Contini[1], Victor Illien[1], Mervyn Ravitchandirane[1], Sylvain Bonhommeau[1], Serge Bernard[2], Julien Barde[3], Alexis Joly[4]

[1]Ifremer. [2]Cnrs. [3]Ird. [4]Inria

Abstract

Coral reefs are among the world's most biodiverse ecosystems, but they face increasing pressures from human activities and climate change. Effective monitoring is essential for their conservation. We propose a novel multi-scale monitoring approach combining underwater and aerial imagery. Underwater images are captured using an Autonomous Surface Vehicle, while aerial images are obtained via a Mavic 2 Pro drone. Georeferencing, necessary for transferring information between scales, is achieved using differential GPS and Ground Control Points (GCPs). A transformer-based deep learning model classifies underwater images into coral morphotypes and marine habitat classes. Later, we train a second model on aerial images passing underwater predictions as annotations. Our results demonstrate high accuracy in identifying marine organisms, offering a powerful tool for coral reef monitoring and conservation. This approach enables large-scale monitoring through aerial drone imagery while preserving the precision and granularity of underwater observations by integrating data from both sources.

How effectively do Key Biodiversity Areas represent avian diversity globally?

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[1]University of Sheffield. [2]BirdLife International. [3]University of Cambridge

Abstract

Key Biodiversity Areas (KBAs) are the largest and most complete network of significant sites for the global persistence of biodiversity. A total of 16,333 KBAs have been identified spanning all countries and terrestrial, freshwater, and marine realms. We identify bird species, orders, habitats, and geographic regions that are under-represented by KBAs. We found that almost all species have at least one part of their seasonal distribution in one or more KBAs, but that 29 species have no overlap with KBAs and 1,900 have <8% of their Area of Habitat (AOH) overlapping with KBAs. We highlight bird species for potential KBA identification, mainly due to recent changes in species' taxonomy or IUCN Red List category. Identifying poorly represented species and where they occur highlights shortfalls where expansion of the network could bring conservation benefits.

How do species traits and their association with the landscape vary between native and non-native plant?

Lira Lewis, Dr Hannah White, Dr Joseph Bailey, Dr Peter Brown

Anglia Ruskin University

Abstract

Land-use and climate change are crucial to biodiversity patterns. Nevertheless, at the landscape scale, species distributions are closely related to land surface and sub-surface features, such as landforms, hydrology and geology, Studying these relationships using novel geospatial data and species traits gets us closer to understanding the mechanisms behind biodiversity patterns. We studied native and non-native plants (2,012 species) and their traits (e.g., height and seed mass) across Great Britain using BSBI distribution data and trait data (mainly from TRY). Trait-landscape association strength was examined with fourth corner analysis and Fridman-test. There was significant differences across species groups' trait-landscape associations strength ($X^2(2) = 475.27$, df = 260, $P < 0.01$). Historic non-native plant height increased with metamorphic rock ($r=0.055$, $P = 0.027$) and was stronger than the native negative association ($r = -0.029$, $P = 0.042$). Further research could be applied to monitor species in protected areas and their effectiveness.

Is there a similar latitudinal diversity gradient in soil seed bank and aboveground vegetation?

Yantong Zhao, Jiajia Liu

Fudan University

Abstract

The latitudinal diversity gradient, in which the species number increases from poles to the Equator, is one of the major biodiversity patterns on Earth. Previous plant biogeographical patterns focused on aboveground vegetation, while such patterns of belowground soil seed banks, which is an irreplaceable natural resource that provides multifaceted benefits to terrestrial ecosystem, remain unclear. Here, we compiled paired plant diversity data of soil seed bank and aboveground vegetation from 496 plant communities with 2,484 species in China, to detect whether the latitudinal diversity gradient of soil seed bank differs from that of aboveground vegetation. We found that soil seed bank exhibited a weaker latitudinal diversity gradient than aboveground vegetation, especially in ecosystems dominated by herbaceous plants. These results provide empirical evidence that aboveground-focused conservation may fail to protect plant diversity stored in the soil seed banks.

Biogeographical patterns and tail-dependent spatial synchrony in European beech masting

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Abstract

Spatial synchrony, the tendency of spatially separated populations to exhibit similar temporal fluctuations, is crucial for understanding regional ecosystem functioning, yet its underlying mechanisms remain complex. In European beech (*Fagus sylvatica*), the synchrony of weather cues driving interannual reproductive variation closely matches the regional spatial synchrony of masting. Our study reveals a distinct biogeographical pattern in beech masting synchrony, which decreases from northwest to southeast Europe. By separating synchrony into peaks and troughs, we found that seed scarcity synchronizes across the species' range, affecting populations up to 1800 km apart, while mast peaks show synchronization within 1000 km, particularly concentrated in northeastern Europe. These findings highlight the role of environmental factors in shaping spatial synchrony and underscore the importance of considering both peaks and troughs to fully understand the biogeography of masting.

Providing a Baseline Understanding of Greenland's Offshore Benthic Ecosystem for Management Purposes

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Abstract

Polar ecosystems are at the forefront of climate change, yet much of them remain unexplored, hindering our ability to detect changes and hampering global, science driven conservation efforts. In Greenland, which is heavily reliant on demersal fisheries, this also complicates sustainability certification, impacting the economy. Using data from a 9-year benthic bycatch monitoring program, we established a baseline for Greenland's benthic ecosystem. We assessed taxon richness, rarity, and vulnerable marine ecosystem indicators across 21% of Greenland's EEZ and identified seven areas for management consideration. We found distinct patterns between East and West Greenland, with greater biomass in the East and greater species richness and rare species presence in the West. Greenlandic taxon richness generally aligns with global patterns, with some exceptions. Overall, taxa were widely distributed with few endemic or rare species. This is the largest assessment of Greenland's benthic shelf ecosystem and will provide crucial guidance to Arctic policymakers.

Does 3D forest structure predict resilience to drought?

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Abstract

The insurance hypothesis suggests that there is an urgent need to create biodiverse forests to effectively manage the rising threat from climate extremes such as drought. However, previous research comparing tree species mixtures and monocultures has shown that species mixing does not necessarily result in higher drought resilience. Instead, forest 3D structure has been suggested to play an important and overlooked role in shaping how forests respond to drought. Here, using National LiDAR datasets and Sentinel-2 time series, we quantify the structure of forests and woodlands in England and Wales and their response to recent drought events. We investigate how the relationship between structure and resilience varies between broadleaf, conifer, and mixed forests, and present a national assessment of drought risk based on forest structure. Drawing from our preliminary findings, we explore whether diversifying forest structure could be a promising strategy for sustainable, climate-smart forest management.

Temporal and spatial declines in functional diversity of sharks and rays under simulated extinctions

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Abstract

Overfishing threatens over one-third of elasmobranch species with extinction, while climate change shifts their spatial ranges poleward. The extent to which these stressors will impact functional diversity remains unexplored. Here, we forecast changes in elasmobranch functional diversity under four IUCN-based extinction scenarios: 77, 150 and 200 years into the future, and one where all currently threatened species go extinct. We project 20-40% decline in functional richness and 13-35% increase in functional uniqueness across scenarios. Functional richness losses were greater than expected due to functionally unique and specialised species facing greater extinction risk. Spatial analyses based on the year 2100, which account for simulated extinctions and climate changed-induced range shifts, further indicate 39-78% loss of functional richness in coastal and tropical habitats and 5-12% increases in functional uniqueness globally. Our results point to a future where elasmobranch ecological roles are diminished under current IUCN trajectories, compromising marine ecosystem functioning worldwide.

Macro-scale relationship between body mass and timing of bird migration

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Abstract

Clarifying migration timing and its link with underlying drivers is fundamental to understanding the evolution of bird migration. However, previous studies have focused mainly on environmental drivers such as the latitudes of seasonal distributions and migration distance, while the effect of intrinsic biological traits remains unclear. Here, we compile a global dataset on the annual cycle of migratory birds obtained by tracking 1531 individuals from 186 species and investigate how body mass, influenced migration timings. We find that body mass has a strong direct effect on departure date from non-breeding and breeding sites, and indirect effects on arrival date at breeding and non-breeding sites, mainly through effects on migration distance and carry-over effect. Our results suggest that environmental factors strongly affect spring migration, while body mass affects both spring and autumn migration. Our study provides a new foundation for future research on the causes of species distribution and movement.

Road density simplifies regional food webs

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Abstract

Roads and traffic are significant threats to biodiversity, impacting ecosystems and ecosystem services. Understanding their effects on ecological interactions is crucial but understudied. We explored how road density affects species vulnerability and food webs across Europe. We assessed potential trophic interaction losses due to roadkill by analysing road density thresholds and trophic interactions. Our study of 551 species across three trophic levels revealed severe, spatially varied impacts, with some areas near major cities experiencing over 90% potential loss of trophic interactions. Additionally, 15% of species had more than 10% of their range with road density exceeding their vulnerability threshold, risking local extinction. Apex predators showed lower direct impacts, while basal species faced higher risks, potentially disrupting ecological networks. These findings highlight the need for conservation measures to mitigate roadkill and preserve ecological networks amid road expansion.

Soil seed bank diversity across local habitats and global biomes

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Abstract

Many plant species store their seeds in soil seed banks as a mechanism for buffering periods of environmental unsuitability. The spatial spread and global abundance of ecologists interested in seed banks means that there is a wonderful opportunity to discover and understand patterns of seed diversity in the soil. We created a database of seed bank richness, density and abundance using 1442 studies which counted over 35 million seeds from all seven continents. Results show that the density of seeds in the soil is largely separated according to biome (reflecting eco-evolutionary patterns), while species richness depends more on the local habitat type and condition (reflecting individual species' strategies and disturbance regimes). Importantly, seed bank diversity is scale dependent. In some cases, increasing spatial scale reversed differences between biomes or habitats. This has consequences both for our understanding of soil seed banks and the interpretation of other global comparisons of diversity.

Harnessing Historical Data Sources for the Conservation of Sub-Saharan Birds

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University of Oxford

Abstract

Distributional data is key for understanding how species and communities respond to ongoing abiotic and biotic change. Access to large occurrence databases allows for critical insight on the impact of anthropogenic activities on biodiversity, but these datasets often lack a historical perspective, with the majority of occurrence data deriving from the last 25 years. Thus, assessment of biodiversity change potentially omits significant events occurring prior to existing large data compilations.

Therefore, it is essential to develop methodologies which facilitate easy access to untapped data sources. The goal of the method detailed here is to extract marker identities and locations from digitised maps.

We show the utility of this approach using two Bird Atlases of Speciation, compiled with data up to 1975. Our proof-of-concept work provides 150,000 occurrences across ~1200 species of sub-Saharan African birds, which can now be compared to modern data to assess potential changes in distribution and habitat.

Climate change impacts on the Arctic tundra-forest ecotone change – present and future

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Abstract

The forest-tundra ecotone (FTE) is the transition zone between the northern boreal forest and Arctic tundra. In response to climate warming, boreal forests may, as in the past, migrate northwards with potential consequent increases in tree growth, canopy density, and stand productivity. Or they may perhaps remain stationary or even retreat. Such outcomes may then influence energy balance as well as above and below ground carbon stocks and hence feedback to Earth's climate system.

The Fennoscandian Arctic climate spans from predominantly oceanic in the west to continental in the east. Forest advance may not be uniform across this east-west transition. How climate and microclimate interact leading to advance, stationarity, or retreat of the boreal forest is being investigated. Approaches include a novel combination of remote sensing, terrestrial laser scanning plus microclimate data in combination with machine learning and ecological models is utilised to predict future forest extent under climate warming.

Identifying global hotspots of mammal-borne viruses of high public health priority

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Abstract

Zoonotic outbreaks in recent decades have highlighted viruses as a group of pathogens with remarkable pandemic potential. Mammal-borne viral zoonoses have been recognised as a major threath to public health and targeted by risk prevention strategies. Still, the full spectrum of reservoir hosts of viruses of primary public health concern remains severely underestimated. Here, we implemented a trait-based predictive pipeline to predict currently unknown wild mammals that may serve as reservoirs of high-risk viral zoonoses that require priority research attention according to the World Health Organisation (WHO)'s blueprint of infectious diseases. Using trait similarity and phylogenetic proximity with known reservoir species, we predicted unrecognised viral reservoirs and mapped their geographical distribution to identify neglected hotspots of viral hazard at the global scale. We show that the diversity of viral reservoirs is currently underestimated, with implications for spillover prevention at the human-wildlife interface.

National scale nocturnal arthropod declines revealed by weather radar

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Abstract

Arthropod declines have been widely reported, but the lack of standardised, broad-scale and wide-spectrum monitoring makes it difficult to assess the geographical and taxonomic extent of such changes, or to assess likely drivers. We used open-access data from the United Kingdom's Met Office weather radars to quantify aerial abundance of diurnal and nocturnal arthropods across the UK between 2014 and 2021, with a spatial coverage over 35,000 km². Aerial suction trap data provided validation for the novel methodology. Our analysis revealed national-scale declines in abundance of nocturnal – but not diurnal – arthropods, with more pronounced losses of both in northern regions. The observed spatio-temporal patterns are most strongly associated with variation in light pollution, land cover and weather. We demonstrate the potential for weather radar to provide standardised and nearly continuous data on aerial populations over wide spatial extents, enhancing our understanding of abundance trends and their causes.

Studying forest biodiversity-stability relationship across scales using representative big tree-ring data

Dr. Ruben D Manzanedo

University of Bern

Abstract

Biodiversity is crucial for ecological stability, yet our understanding of its role in long-term forest resilience remains limited, at least in part due to the lack of representative long-term data. The OpenRing project, launching at the University of Bern in September 2024, seeks to address this challenge by, first developing and implementing methods to reduce data bias in long-term forest growth databases, and then integrating these databases with other large-scale ecological data to explore biodiversity-stability relationships across spatial and temporal scales. OpenRing will utilize existing open-access dendrochronological databases to identify priority sampling areas that most increase the dataset's representativeness and comprehensiveness. The project focuses both on direct targeted sampling and actively engaging data collectors, hoping to push towards increased cooperation, transparency and proper recognition of their work. Here, we present the project's starting steps, preliminary results, and the theoretical foundation of the approaches we will implement.

Long-term changes in Andes-Amazon tree species richness reveal regional-specific patterns and drivers

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Abstract

In recent decades climate change and other disturbances have altered tree species survival across the Andes and Amazon, leading to changes in species distributions and potentially regional and local tree diversity. We developed and analyzed a unique dataset that tracks tree species composition over 406 intact forest plots across the Amazon and tropical Andes to evaluate changes in richness as well as its drivers.

We found an apparent overall richness stability but masking substantial variation in richness trends across Amazon-Andes regions. Hot, dry, and seasonal forests and those getting warmer and more seasonal are losing species but forests with more trees and higher landscape integrity are gaining them. Specifically, the Northern Andes and Western Amazon showed an increase in richness while the Central Andes, Guyana, and Central-Eastern Amazon exhibited a decline. Drivers affecting richness are region-specific, with climate, particularly temperature, and demographics being the most important modulators.

Building a global community ecology for plants, wildlife and humanity

Dr. Ian McFadden

Queen Mary University of London

Abstract

How many of Earth's flowers were visited by pollinators in the time it took you to read this sentence? Though we may never answer this question directly, we are now closer than ever due to revolutions in environmental data science, machine learning, computer vision and remote sensing, to name a few. These revolutions have expanded the focus of global ecology and biogeography beyond analyzing numbers and types of species into the realm of local community ecology- which asks how interactions shape the diversity, coexistence and resilience of co-occuring species. I will share a brief history of my research on ecological interactions, starting at the local scale in tropical forests and expanding upwards to the global scale. Looking forward, I will discuss how computer vision and machine learning can be used to build global maps of species interactions, and how such maps are useful for ecologists, conservation biologists and policymakers.

Global meta-analysis reveals overall negative impacts of invasive species on terrestrial insects, despite highly variable responses.

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[1]UK Centre for Ecology & Hydrology. [2]Natural History Museum

Abstract

Invasive species are among the top-rated threats to biodiversity, with the number of new alien species rising annually. While invasions typically have negative impacts, responses can be variable. Given the ongoing concern around insect declines, there is a growing need to synthesise evidence on how invasive species affect insects specifically, especially since research has historically focused on insects as invaders rather than victims. Thus, we conducted a global meta-analysis encompassing over 300 effect sizes from 54 studies to assess the impact of invasive species on terrestrial insects. We found declines in overall insect abundance and species richness in response to invasive species. Invasive animals had stronger negative effects than invasive plants, and Hemiptera (true bugs) and Hymenoptera (bees, wasps, ants) were more affected than Coleoptera (beetles). Understanding how insects—the most diverse taxonomic group—are affected by invasive species is vital for prioritising conservation action that could limit future impacts.

Integrating data to understand key animal movement processes: Environmental and human influences in aquatic systems

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Abstract

Movement underpins species survival and shapes biodiversity patterns and processes. Foraging, dispersal, and migration - the three common types of animal movement - are influenced by a combination of trait-specific, environmental, and human-driven factors, which impact species' adaptability to global changes. While existing research often focuses on terrestrial systems and individual movement types, we present a unified global movement database for comprehensive analysis across various movement types and ecosystems. Our database encompasses 92,452 observations spanning 4,054 species and 56 classes, integrating essential data on movement processes, including metrics for area, distance, and speed. Using this database, we showcase the relative importance of different environmental and human factors for movement processes in aquatic systems. Overall, we offer a valuable resource that provides an integrated perspective on animal movement and illustrates how such a broad view can help disentangle the consequences of environmental and human pressures across different movement processes.

Understanding and predicting the present – and future – of the world's coral reef distribution with machine learning

Mr Orlando Timmerman, Dr Oscar Branson

University of Cambridge

Abstract

Coral reefs are complex systems of animal-plant symbiosis on which millions of people rely for food, protection from coastal storms, and income. Shallow-water coral species – and the biodiversity they support – are threatened with functional extinction over the coming decades due to changing oceanographic conditions driven by anthropogenic greenhouse gas emissions.

Reef conservation projects are incredibly time- and resource-intensive. Robust, quantitative, and interpretable methods are therefore necessary to direct these efforts – for example implementation of MPAs, or assisted migration – to areas in which future environmental conditions will be most conducive to long-term coral growth.

To predict potential future reef distribution, features encapsulating historic oceanographic conditions were engineered from CMIP models and downscaled. These were input to an advanced boosted regression tree algorithm which was able to recreate a map of present-day reef occurrence. Future work will improve this model and apply it to forecasted data of representative climate change scenarios.

Does resource stability through symbiosis promote diversity? – A comparative biogeographic perspective

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Abstract

A symbiotic lifestyle should increase resource stability which has long been hypothesized as a key factor in promoting biodiversity. Yet, symbiotic species are rare, for example, making up ~8% shallow-marine bivalves (~7000 extant species). Here, we investigate the ecological and thus evolutionary advantages in the different symbiotic bivalve lifestyles via a global comparison of their biogeography and functional traits. Our analyses found species of different lifestyles (including photosymbiosis, chemosymbiosis and commensalism) have significantly differences in two key biological properties: their geographic distribution and body size, with the latter being stronger possibly due to the functional requirement of the symbiotic interactions (e.g. resistance to predation and surface area for photosymbiosis or physical limitation on commensal species with burrowing hosts). In particular, commensalism and photosymbiosis select for contrasting body sizes, but both exemplify the ecological trade-off between specialization for reliable resource supply and dispersal limitation, thereby hindering expansion of their geographic distribution.

Focused comparisons highlight divergent impacts of land-use change on insect orders

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Abstract

In the last decade, increasing studies have reported on declines in insect abundance, diversity, distribution and biomass, but there is as yet no consensus on the true global picture. Given the vast diversity of insects, a uniform trend across the globe would be surprising since drivers of change are geographically patterned.Even within a relatively small region like the UK, different insect orders have shown different temporal trends in species occupancy. This is unsurprising given their ecological differences, and raises the question: are all insect orders responding the same way to major drivers of change? To resolve this question we have assimilated data from studies that have sampled multiple co-occurring insect orders in the same sites and at the same times, minimising the influence of phylogenetic and spatial bias and allowing like-for-like comparisons.

An omics-to-ecosystems approach to tracking climate driven change in intertidal ecosystems.

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Abstract

Pervasive climate change, an increase in extreme weather events, and ocean acidification are occurring throughout the global oceans, and the biogeographic ranges of species are shifting to higher latitudes as temperatures and oceanic pH levels change. Long-term time-series are invaluable in tracking these shifts and providing contextual data with which to analyse the rates of change. Attribution of changes to specific drivers, however, requires an understanding of the underpinning biological mechanisms. Emergent technology is facilitating a novel omics-to-ecosystem approach to determine which factors are causing observed shifts in population abundances and range limits of marine species, and how species are responding at genetic and physiological levels. Using the rocky intertidal as a test system, impacts of multiple stressors are being tracked and quantified around the coastlines of the UK and northern Europe, and the development of ecological genomics is furthering our knowledge of how and why species-specific responses are occurring.

Ant mutualists as a biotic interaction filter of flowering plant colonization on islands

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Abstract

Island floras generally represent disharmonic assemblages compared to their source pools, which are traditionally considered to be shaped by the processes of dispersal, environment and biotic interactions. However, evidence for biotic interactions driving the disharmonic composition of insular floras is scarce, and the interaction between these processes remains poorly understood. Using a novel dataset spanning 186 tropical oceanic islands, we test for the role of ant-plant mutualisms as a biotic interaction filter by analyzing the taxonomic representation and phylogenetic structure of native flowering plants bearing domatia and extrafloral nectaries (EFNs). We find that the representation of ant-associated plants on islands relative to their source pools is influenced by the interaction between the presence of arboreal ants and island characteristics. Our results suggest that the interaction filter and its interaction with other factors shape island plant assemblages and highlight the importance of integrating interaction filter into the study of plant biogeography.

Impacts of wind-power farms on biodiversity: interspecific variation in collision mortality for European birds and bats.

Dr Adrienne Etard

International Institute for Applied Systems Analysis

Abstract

In line with Europe's decarbonization goals, the number and capacity of wind-power farms in Europe is projected to increase in coming decades. However, wind farms pose risks to biodiversity: flying animals can fatally collide with wind-farm infrastructure and bats can experience deadly barotrauma when flying close to turbines. To inform the deployment of wind farms at the European scale and minimize the risk to wildlife, we aimed to assess collision mortality across European birds and bats. We used an existing compilation of recorded collisions for birds and bats from published papers, which we combined with data on species traits, wind farm and landscape characteristics, and we investigated associations between collision mortality and these variables. We then used our models' outcomes to create collision-mortality maps for European birds and bats, with the aim of informing spatial deployment of wind-power projects and possible mitigation measures.

What do we really know about insect biodiversity change?

Dr Rob Cooke[1], Dr Joseph Millard[2], Dr Charlotte Outhwaite[3,4], Dr Nick Isaac[1]

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Abstract

The biodiversity crisis requires large-scale knowledge to inform policy and mobilise action. Recently, concerns around insect declines have grown. Yet global insect data is unrepresentative, and the extent of declines remains unclear. Still, a better understanding of insect trends is possible without comprehensive data. Here, we demonstrate how to assess the reliability of model-based inferences in regions of the world where no data exists (transfers). We present a large-scale analysis of changes in insect species richness in response to land-use change and formally quantify the transferability of our results. We find that our predictions of changes in insect species richness are valid across large portions of the globe, due to a transferable model and strong environmental similarities between sampled and unsampled regions. However, we also identify large knowledge gaps and considerable uncertainty. Overall, we quantify the magnitude of insect declines while acknowledging the limits to generality.

The biodiversity of trees on Indonesian islands

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Abstract

Although islands only comprise 6.67% of the world's landmass, they play host to a disproportionate 20% of biodiversity on the planet. The islands of the Indonesia are an example of this, with its rainforests containing some of the highest biodiversity per unit area compared to other tropical regions. The also retain many of their threatened species, making the region key to global biodiversity conservation targets. This project analyses trait data from *c.* 2000 tree species in 200 forest plots across the archipelago to quantify the functional diversity in this region. The analysis finds an epicentre of functional diversity despite a lower species richness on oceanic islands, suggesting that isolation and island location are important in driving dispersal of floras and facilitating evolution of unique species. Understanding the multi-scale processes shaping biodiversity on islands is key to our ability to effectively conserve these valuable habitats and the ecosystem services they provide.

Species contributions to biotic homogenisation and differentiation

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Abstract

Increased homogenisation (decreased beta-diversity) among biological assemblages is often attributed to relatively common species becoming even more widespread. However, species contributions are poorly understood. Here, we consider species contributions to spatial beta-diversity over decades to millennia, within different taxonomic groups. When considering a single time point, the species occurring in around 50% of sites individually and as a group, generally, contributed most to spatial beta-diversity but not to change through time. The overall contribution of species found initially in >60% of sites to beta-diversity change was also relatively small except when assemblage nestedness was high. In contrast, localised species (initially in <20% of sites) contributed most to both community homogenisation (when they decline) and to differentiation (when they increase). Conservation interventions to increase the range sizes of localised species would therefore do more to limit homogenisation than attempts to control already-widespread species or prevent others becoming widespread.

Widespread Exposure to Ecological Novelty Across the Terrestrial Biosphere

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Abstract

Human activities dominate much of the land surface, transforming many remaining wild and semi-wild ecosystems into novel states. The emergence of novel conditions has poorly understood ecological implications and without knowing the current global distribution of novelty, predicting future states in ecosystem structure remains difficult. We construct global maps of three processes of novel conditions (climate change, defaunation, and floristic disruption). We show that the terrestrial biosphere is widely exposed to novel conditions, with 58% of the total area exposed to high levels of total novelty. Additionally, we find that protected areas and key biodiversity areas are equally exposed to novelty. Exposure to these novel conditions represents a shift in the trajectories of ecosystems into unpredictable futures, implying that many existing policy objectives may be unattainable. Our results highlight the importance of investigating ecosystem and biodiversity responses to rising ecological novelty for understanding, safeguarding, and managing the biosphere.

The response of Hymenopteran (Bees, Wasps & Ants) biodiversity to a changing world.

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Abstract

An increasing number of studies have shown that insect biodiversity is in decline. These studies present data from different regions of the world and from different taxonomic groups. However, there has been little research into the specific impacts of the direct drivers of these insect declines across large scales. Of course, we can name the various pressures that insects are under, from land use change, pollution and pesticide application, to climate change. However, the relative importance and the quantified changes in biodiversity in response to these drivers, particularly at large scales, is not well understood. Using Hymenoptera (bees, wasps and ants) as a case study, we bring together global maps representing key pressures on this group and data from the PREDICTS database to assess how Hymenopteran total abundance and species richness responds to a broad set of drivers at the global scale.

Biome types determine direction of phylogenetic diversity changes depending on spatial scale considered

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Abstract

Palaearctic grasslands host a significant portion of world biodiversity, shaped by water, nutrient, and human influence. Phylogenetic diversity varies across spatial scales, but how this change relates to biome types has not been well documented. We assessed phylogenetic diversity at seven plot sizes (ranging from 0.0001 to 100 m^2) across Palaearctic biome types. We obtained the phylogeny of plant taxa, and phylogenetic diversity was calculated using RaoQ index. Our results showed an increase in phylogenetic diversity at smaller plot sizes (0.0001 m^2), particularly in mires, springs, and dune ecosystems. Conversely, a marked linear decrease in phylogenetic diversity was observed particularly at the larger grain sizes (100 m^2) in wet and mesic grasslands, as well as rocky and alpine communities. These findings highlight the influence of the biome types on phylogenetic diversity, showing important roles of biogeographic history in determining the regional clade pools.

Drivers of Intraspecific Genetic Diversity: Insights from Nearctic and Neotropical Amphibians

Dineesha L Premathilake, Dr. Katharine Marske

The University of Oklahoma

Abstract

Understanding the influence of contemporary environmental conditions and historical climatic stability on intraspecific genetic diversity is key to unraveling the evolutionary processes shaping biodiversity. In Nearctic and Neotropical amphibians, this helps clarify the factors driving genetic variation and how these species have accrued over time. We analyzed 10295 mitochondrial DNA sequences from 207 species (co1) and 336 species (cytb) using generalized linear models. These models tested correlations between intraspecific genetic diversity and latitude, current temperature, precipitation, climate stability, and seasonality. Preliminary results suggest that latitude is not a strong predictor of within-species genetic diversity, indicating other factors are at play. We are further exploring the impact of these variables, particularly climate stability since the Last Glacial Maximum. Understanding how historical bioclimatic factors shape contemporary genetic patterns is crucial for predicting species' responses to future climate change and assessing their potential resilience or vulnerability to global shifts.

Range characteristics influence cross-taxa species richness patterns in the Western Ghats of India

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Abstract

Geometric models show that extremely realistic patterns of species richness can be obtained by 'throwing' randomly sampled ranges within a bounded domain. A distinctive result is that of the mid-domain effect, wherein species richness is highest at the center of the domain when sampling continuous ranges. However, the literature on geometric constraints has not explicitly differentiated between the two major properties of ranges that ultimately determine SR patterns- range size and range cohesion (the degree of continuity of a range). We have built models that simulate how the interactions between these properties on an environmentally heterogenous landscape with varying dispersal barrier permeability can explain extant richness patterns. We intend to validate our models with comprehensive primary and secondary data on freshwater fish, frogs, lizards, birds and woody plants within the Western Ghats biodiversity hotspot. This study will highlight a novel, widely applicable dimension to understanding species richness patterns.

Anthropogenic influences on British butterfly diversity: species richness and turnover

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Abstract

Anthropogenic change threatens insect diversity at large scales by reducing both site-level richness and between-site turnover. However, the relative importance of different threats to insect diversity and how impacts vary across species with different ecological characteristics is still unclear. To fill this knowledge gap, we examine the relationships of climate and habitat variables with richness and turnover of habitat specialist and habitat generalist butterflies in Great Britain. We find that richness and turnover are influenced by climatic variables for both specialists and generalists, but the specialists respond to a far greater number of habitat variables. We argue that, without mitigation, anthropogenic change will reduce regional butterfly diversity by reducing between-site diversity via local extinction of specialists due to climate and habitat change.

What traits tell us: Who is threatened where and by what?

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Abstract

Determining the drivers of species extinction risk remains a significant challenge. In particular, the relationships between extinction risk and frequently proposed predictors, such as body size and life history traits, are often clade- and region-specific, possibly because different species react differently to different threats, which also vary geographically. Here, we investigate geographic and taxonomic nuances in trait-threat relationships using a global dataset of 4,814 reptile species. We find that direct exploitation consistently affects large species and those with large clutches, but the effects of other threats (climate change, pollution, alien species, habitat modification) are highly variable. Taking into account region- and clade-specific relationships, we then propose an initial estimate of the probability of being threatened by a specific threat for 4,759 currently unassessed reptile species. Our approach can be extended to other clades to complete the large-scale extinction threat assessments needed for effective conservation actions.

Use high resolution remote sensed imagery to capture small-scale agriculture related expansion's unique impact on forest fragmentation in Chingola, Copperbelt Province, Zambia.

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Abstract

The Miombo woodland ecosystem in sub-Saharan Africa, including Zambia, is highly fragmented due to small-scale agriculture and settlement expansion. Existing studies often generalise findings without quantifying the specific impact of each land cover change, particularly from small-scale agriculture. The prevalent use of Landsat (30m) imagery has inadequately captured the unique fragmentation caused by small-scale agricultural expansion. This study used PlanetScope (3m) imagery, object-based image segmentation, and random forest classification to quantify the specific contribution of small-scale agriculture to forest fragmentation. Between 2016 and 2023, small-scale agriculture expanded by 45%, contributing to a 26% reduction in forest cover. Despite this, changes in configuration metrics (shape, cohesion, patch density, ENN, and CONTAG) showed minimal and positive impacts on fragmentation due to small-scale expansion, leaving small forest fragments within and around agricultural fields. This study recommends prioritising conservation efforts for these small forest fragments to maintain the landscape configuration crucial for biodiversity conservation.

Unravelling the seasonal distribution of birds in mountains

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Abstract

Altitudinal migration – the seasonal movement of species along mountain slopes – is a widespread, yet understudied, behaviour in the animal kingdom. While altitudinal migration has been reported in hundreds of avian species worldwide, it remains unknown how this phenomenon affects the distribution of bird diversity along elevational gradients, and the underlying ecological drivers remain poorly understood. In this study, we use data from eBird to estimate 7220 species' seasonal elevational ranges along 25 mountain slopes across the world. We found that the patterns of the seasonal distribution of birds in mountains are condensed versions of the equivalent global latitudinal pattern. Using a mechanistic model, we show that altitudinal migration is a behavioural adaptation that allows birds to optimise their energy budget in the face of seasonality and competition in mountain regions. Thus, this work provides a tool to better understand and predict how mountain birds will respond to environmental change.

Broadscale geographical and climatic patterns of juvenile-adult distribution difference approach to complex mechanisms of tree species range shifts

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Abstract

Under contemporary global warming, quick detections of plant species distribution change and its ecological mechanism approach are crucial for proper climate change adaptation in the natural ecosystem. Juvenile-adult distribution difference is suggested as a simple indicator of past distribution shifts of long-living tree species. However, spatial patterns of the juvenile-adult difference and its possible drivers are not deeply analyzed, preventing us from declaring ecological mechanisms behind the phenomenon (e.g., climate change, ontogenetic niche shift, species interactions, functional traits) in wide geographic scales. Here we precisely analyzed the geographic and climatic patterns of the juvenile-adult difference of tree species in Japan and Europe by splitting broad-range vegetation plot data into several region groups. Results showed different juvenile-adult difference patterns along climatic gradients among several functional types and positions (i.e., mean, leading edge, and trailing edge), suggesting different drivers creating complex in-situ range shifts.

Comparative analysis of the role of morphological and ecological traits in the evolution of birds on archipelagos

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Abstract

Species diversity on islands is influenced by isolation and fragmented habitats, prompting the question of how species' functional traits have evolved to meet the challenges of island life. We use a trait-based analytical approach to examine how species present on the mainland, single islands, and archipelagos differ in their dispersal-related functional traits. Additionally, we analyse how these traits shape species composition and vary between the tropics and non-tropics. We combined bird range data, functional traits, and a database of global island boundaries in a phylogenetic comparative framework. Our results show island species are more migratory than mainland species, adapting to scarce resources and varied habitats through evolved traits like higher hand wing index and kipps distance, enhancing flight efficiency. Their varied diets, foraging tactics, and use of different habitat levels help them thrive with fewer competitors. These adaptations increase island birds' dispersal ability and ecological diversification, ensuring their survival.

Correlating Erawashdah Forest Ecosystem Trends With Climate Patterns: Would the Current Climatic Regime Induce persistent ecological transformation?

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Abstract

Erawashdah Forest, eastern Sudan is witnessing accelerated ecosystem and land cover changes making it among the country's top deforestation hotspots. Literature consensually attributed the remarkable changes in Erawashdah to various causatives, including the physical processes, administrative practices and anthropogenic activities. Nevertheless, the exact quantitative and qualitative correlation between forest's biogeographic trend and climatic variables is unclear and shrouded in uncertainties. Likewise, knowledge of whether current regional climate regime is persistent climate change or short-term climatic fluctuation is yet conflicting. Thus, defining the relationship and direct implications of climate in the forest is mandatory to clarify uncertainties, enhance adaptation strategies and guide forest sustainability. This paper compared rainfall and temperature records in Erawashdah to several forest indicators' trends over 1983-2023. Findings indicate, except in prolonged drought periods, there is neither significant correlation nor influence of climate on biophysical forest conditions. Degradation is rather referenced to man activity in the forest biosphere.

Simulating and analysing seabird flyways: An approach combining least-cost path modelling and machine learning.

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Abstract

Seabird migration is driven by general wind circulation and productive ocean regions. As a result, it takes place along distinct corridors or "flyways" that have evolved by Earth's large-scale atmospheric circulation patterns. These flyways link climate and bird migration, and by simulating them, we might better understand present corridors and predict potential future impacts of climate change. We use climatic data and a least-cost-path modelling approach to simulate and describe multiple seabird flyways. By combining bird tracking data and machine learning, we infer whether the used flyways optimise time and/or energy. We show that a bird's effort is influenced by tailwinds, crosswinds, and food availability. Finally, we calculate how close to the theoretical optimal migration (time- or energy-minimising) these birds actually fly. We conclude that it is possible to recreate observed flyways using environmental data and that these simulations can generate predictions about the effect of future climate change.

Analysis of neoecological and palaeoecological assemblage time series shows that species-time relationships are not scale-invariant

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Abstract

The longer we monitor an ecological community, the more species we observe. Beyond an initial sampling phase, this species-time relationship (STR) has been hypothesised to follow a power-law form, which is scale-invariant: the number of species increases by a constant proportion as the timespan of observation multiplies. The STR slope reflects temporal turnover rate; power-law STRs allow simple extrapolation across timescales, facilitating comparison of modern and ancient turnover. We examined STRs from >4,000 assemblage time series spanning decades to millennia from the publicly-available BioDeepTime database. Rather than a power-law function, most STRs were better fit by a logarithmic or exponential function, where turnover rates decline at longer observation durations. Longer time series showed weaker support for a power-law STR. These results are not due to the differing temporal resolutions of neo- and palaeoecological records. Instead, we attribute them to processes that affect turnover differently at ecological and evolutionary timescales.

Sensitivity analyses and the robustness of mycorrhizal ecology research

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Abstract

Biogeographic-scale studies implicating the mycorrhizal symbiosis in ecosystem structure and functioning have become increasingly common. However, these studies are characterized by numerous analysis and data management decisions, the impacts of which are rarely considered. For example, how should plants of dual- (e.g. arbuscular + ectomycorrhizal; AM + EM) or unknown mycorrhizal type be treated in the analysis? By way of an example study seeking to explain variation in the abundance of understory AM and EM host plants across the conterminous USA, we show that both the magnitude and sign of model coefficients of commonly-considered climate and soil predictors can change depending on the combination of decisions made. This mirrors the inconsistency of results across published studies, most of which describe and apply only one combination of decisions from the many possible. Our findings underscore the importance of being transparent about all analytical decisions, and evaluating the sensitivity of outcomes to those decisions.

National trends hide strong regional variation in plant distribution changes across a bioclimatic gradient

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Abstract

Biodiversity and biodiversity change are scale dependent. We take advantage of newly digitized historical range maps to estimate national frequency trends for more than one thousand vascular plant species across a 1400 km spatial gradient in Sweden, comparing them to trends across four bioclimatic regions, from temperate to boreal. A majority of species show stable or increasing frequencies over the last 30-50 years, but nearly half of all species' regional trends deviate from the national trends. In the southernmost region, where extensive areas have been converted for agriculture, one-third of the species with positive national trends are actually declining. Species associated with grassland habitats are least likely to show positive national trends, and a majority of these species shift to negative trends in the southernmost region. Our results stress the importance of assessing trends at relevant scales to better manage and preserve biodiversity.

Spatial autocorrelation of bird diversity and distributions in time and across spatial scales

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Abstract

Understanding biodiversity change has become crucial. While existing analyses primarily focus on species occupancy, their spatial structure remains understudied. Spatial structure can be quantified through spatial autocorrelation, indicating the degree of aggregation or segregation, potentially helping identify species threatened by population isolation.

Here, we explore spatial autocorrelation patterns of bird diversity and distributions across the Northern Hemisphere over time and spatial scales, using data from temporally replicated Breeding Bird Atlases. We computed Moran's I of species diversity and the Join-count statistic of species distributions at different grain sizes and analyzed their trends over time and spatial scales. We observed a consistent decrease in autocorrelation with increasing spatial scale across all study areas and periods. Notably, no discernible temporal trend existed in the average spatial autocorrelation of species distributions or richness. Our analyses revealed that occupancy and spatial autocorrelation are independent, highlighting the distinctiveness of range size and structure.

Macroecological variability in bird sensitivity to forest cover

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Abstract

Current large-scale predictions of biodiversity change in the face of anthropogenic pressures tend to assume that all populations of the same species will respond similarly to land-use change. Here, we investigate how bird sensitivity to forest cover varies with proximity to different types of range edges. We show that populations closer to their species' geographic range edges and thermal niche limits are more sensitive to forest cover. We then investigate how warmer microclimates in fragmented forests may play a role in driving this macroecological variability in sensitivity to forest cover. Our results contribute to a growing body of evidence which challenges the prevailing notion that all populations respond similarly to land-use change and highlights the concerning synergistic effects of land-use change and climate change in driving biodiversity decline.

Ecological genomics of replicate range shifts of the blue-tailed damselfly, *Ischnura elegans*, in Scotland and Fennoscandia

Nicky Lustenhouwer[1], Kara Layton[2], Rachael Y. Dudaniec[3], Robert N. Fitt[4], Bengt Hansson[5], Laura Penny[6], Erik Svensson[5], Maren Wellenreuther[7,8], Mark Williamson[1], Lesley T. Lancaster[1]

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Abstract

With climate change, range shifts to higher latitudes are now widely observed across plants and animals. Insects have shown especially rapid poleward movement, but the genomic processes underlying range shifts in the wild are still poorly understood. We conducted low coverage whole genome sequencing of 957 individuals of the blue-tailed damselfly, from 81 sites along 4 latitudinal transects spanning 1700km in Scotland, Norway, Sweden, and Finland. To study neutral and adaptive genomic changes along the transects, we analyzed the sequencing data using a genotype likelihood framework in ANGSD. Population structure strongly differed between the transects, consistent with differences in dispersal barriers in the landscape. Surprisingly, we found high genetic turnover through time at the Swedish range limit, by resampling sites with available RAD sequencing data collected 10 years previously. Admixture between range-edge populations from Sweden and Finland across the Baltic Sea may have further promoted this rapid range shift.

Freshwater insect abundance trends vary between continents and families.

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Abstract

With concern mounting that insect biodiversity is being harmed by human activities there is an urgent need for robust evidence to support or refute these contentions. In many high-income countries, river insect communities have been regularly sampled for decades for national water quality monitoring purposes. Here, such data, from Europe, North America and South Korea, have been compiled and analysed to quantify trends in the abundance and prevalence of insect families. There was not a consistent pattern in trends of abundance across all locations for individual insect families, with different territories potentially being subject to different pressures or at different stages along the environmental degradation/recovery trajectory. The extent to which intrinsic biological traits can account for variation in trends between taxa is also explored.

Thermal exposure and sensitivity determine mountain butterfly range shifts

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Abstract

Frameworks to assess climate change vulnerability based on the sensitivity, exposure and adaptive capacity of species have limited empirical support from observed range contractions. To test whether rates of range contraction depend on species' thermal niche (sensitivity), elevation limits (exposure), and/or traits relating to adaptive capacity, we examined the elevation shifts of 85 butterfly species between historical (1984-2005) and recent (2017-2022) surveys across 166 mountain sites in central Spain. Phylogenetic models showed the greatest uphill shifts occurred for species with low Species Temperature Index (STI) based on their geographic range (high sensitivity) and low historical elevation range limits (high exposure). Wingspan, voltinism and host plant generalism also influenced rates of range contraction, although not in a way consistent with buffering due to greater adaptive capacity. Our results lend critical support to the idea that thermally sensitive populations occurring at warm range edges are at disproportionate risk from climate change.

Understanding patterns in long-term insect occurrence data suggests a precautionary approach to estimating trends: expert evidence from 19 UK insect groups.

Dr Gary D Powney, Dr Claire Carvell

UK Centre for Ecology & Hydrology

Abstract

Insects have gained significant attention with numerous studies reporting substantial declines. These studies tend to be based on large-scale species occurrence datasets collected without systematic survey design. Given this, and the potential disconnect between the data collection process and the analyst, it is essential that the suitability of the data and modelling approach are assessed and communicated. We demonstrate the value of a risk-of-bias assessment framework, integrating data-driven bias assessments with expert evaluations to assess a widely used occupancy modelling approach. Occupancy models suggested UK insects have declined by 15% on average since 1970, with species responsible for pollination and pest control showing the most severe declines. Critical assessment of trend model outputs via expert entomologists alongside data-driven assessments revealed multiple major risks-of-bias. While a third of experts felt the model performed well, most experts agreed the trends are partly driven by unaccounted for spatial, temporal, and taxonomic bias.

Shifting boundaries: how habitat structure and climate change contribute to disequilibrium in species distributions

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Abstract

Species distributions rarely match the environmental conditions they are adapted to, but the drivers of such disequilibrium are not well understood. We investigated how habitat conditions (light and disturbance), climate change, and lags in species responses contribute to distributional disequilibrium across 3,047 European plant species. Models incorporating habitat conditions significantly outperformed conventional static-climate-based models for 99.3% of species. Habitat-driven disequilibrium was most pronounced for habitat specialists in lowland central Europe. Temporally dynamic models using a moving-window average for climate variables performed significantly better for 42% of species, where climate-driven disequilibrium was most severe among species distributed in areas affected by drought and heatwaves. Additionally, species in closed-canopy forests and seasonal environments exhibited more significant response lags to recent climate shifts. Our findings highlight the critical need to detect and address habitat- and climate-driven disequilibrium, which will likely intensify, to inform conservation strategies such as protected area designation and ecosystem restoration.

What drives body mass biogeographical patterns in forests? An analysis using multiple taxa in the Mediterranean Basin

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Abstract

Body mass encapsulates biological and ecological information such as metabolic rate, energy fluxes, reproductive strategies and population dynamics. The distribution of body mass within an ecosystem—characterised by metrics such as skewness (rarity) and kurtosis (evenness)—can serve as a significant indicator of ecosystem functioning, capturing multiple processes simultaneously. Here we explore the geographic patterns and possible drivers that explain the body mass geographical distribution of trees, butterflies, reptiles, birds and mammals in the Mediterranean forest. For this, we measure how far the body mass distributions of the species observed in a 50x50 km grid are from the optimal evenness based on the skewness-kurtosis relationship. Our preliminary results have shown that the evenness of body mass is not homogenously distributed in space and differs between taxa with spatial correlations less than 0.3 due to different drivers. These results could contribute to identifying hot spots of highly functional ecosystems for conservation.

Distribution of Naturalized Alien Plant Functional Traits Across Europe

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Abstract

Over several centuries, globalization and human activities have allowed many plants to rapidly cross historical biogeographic boundaries and dramatically expand their ranges. A portion of these introduced species have naturalized, some becoming invasive and causing widespread problems. Functional traits likely play an important role in an alien plant's success, but little is known about how the traits of successful invaders vary across environmental contexts. Here, we quantify traits in communities across geographic and climatic boundaries throughout Europe in order to discern whether successful aliens share traits with natives in a specific environment, or if their associations with humans allow them to adopt different strategies. While some alien traits mirrored environmental patterns of natives (e.g. decreasing height towards colder climates), others deviated. In particular, aliens tended towards acquisitive growth strategies regardless of environmental context. Predicting traits of successful invaders therefore requires joint consideration of both anthropogenic and natural environmental filters.

Explaining the journeys of trans-Saharan migrant birds: drivers of routes and timings

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Abstract

Every year, millions of birds cross the planet in the pursuit of resources; but what determines the routes and timings of migratory journeys? Here, using Spatially-explicit Adaptive Migration models (SAMMs), we disentangle the roles of environmental conditions and species' traits in driving complex migratory behaviours. Using case study species, including pied flycatcher (*Ficedula hypoleuca*), red-backed shrike (*Lanius collurio*), and common cuckoo (*Cuculus canorus*), we show that the migratory journeys of many species respond predictably to spatiotemporal variations in resource quality and habitat availability. Consistencies in the drivers of migratory journeys between species with differing ecologies, suggests that the routes and timings of migratory journeys are driven by general and predictable mechanisms, with substantial implications for informing the conservation of migratory species. Finally, we show how this approach can be used to identify how species will need to adapt their migratory journeys if they are to survive in a changing world.

Niche modelling predicts local population dynamics in vertebrates

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Abstract

Population abundance and variability are two key measures of longevity and vulnerability. Smaller and more variable populations are at greater risk of extirpation. Niche theory provides a framework to predict how abundance and variability should change across abiotic gradients at macroecological scales. The core-periphery hypothesis predicts a species niche core contains optimal ecological conditions and therefore should maximise fitness and population performance. Niche peripheries, on the other hand, are predicted to be marginal resulting in smaller and more variable populations. Here, we use ecological niche modelling to investigate how abundance and variability of ~800 vertebrate species across ~5500 populations vary across their abiotic niche spaces at a global scale. We find that vertebrate populations at niche edges are usually smaller and more variable. Hence, proximity to niche edges is an important predictor of population vulnerability and risk at a global scale.

Assessing community structure in sympatric specialist riverine birds of the world

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Abstract

Understanding trait distributions and phylogenetic structure within the community is essential towards delineating the opposing effects of environmental filtering and competitive interactions in structuring community assembly and coexistence of related species. Some birds have undergone specialization to live in terrestrial-aquatic continuum habitats across complex riverine habitats across the world. We obtained occurrence data for specialist riverine birds and sorted geographically overlapping species into sympatric communities. Using standard protocol, we built a phylogenetic tree for the target species and collated trait data on key morphological features related to foraging strategies and vagility. We report that sympatric assemblages of specialist riverine bird assemblages consist of a random phylogenetic sample of species but are morphologically divergent in most parts of the world. We found evidence that morphological traits in specialist riverine birds are filtered across gradients of elevation and riverine habitat character.

Tetrapod species-area relationships across the Cretaceous-Paleogene mass extinction

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University of Oxford

Abstract

Species-area relationships (SARs), or how species richness increases with increasing sample area, is one of the few nearly ubiquitous phenomena in ecology. These relationships capture how many species live in a single location and how rapidly different species turn over across space. However, despite their universality it is unclear how they have varied in the wake of mass extinction events when the majority of life on Earth disappeared. Here, we use fossil data and simulation modelling to quantify SARs in North American terrestrial tetrapods across the Cretaceous-Paleogene mass extinction. We show that SARs varied extensively through time and among taxonomic groups. In particular, after the extinction of non-avian dinosaurs, mammals initially show increases in turnover followed by local diversity increases millions of years later. This illustrates the asynchronous change in SARs and recovery dynamics of biodiversity through deep time.

Navigating Extremes: Assessing Migratory Birds' Exposure to Cyclones and Drought in a Changing Climate

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Abstract

Anthropogenic climate change is increasing the frequency and intensity of extreme climatic events, such as droughts and cyclones, with potentially severe consequences for migratory species and the ecosystems they rely on. Migratory birds, which often traverse vast geographic ranges, are thought to be particularly vulnerable to these events across their migratory ranges. This study examines their exposure to these extreme events globally.

Using spatially explicit historical data on cyclones and droughts, we identify species highly exposed to both events across their migratory cycles and determine which ranges are most affected. We also assess whether threatened species experience greater exposure and pinpoint global hotspots where these risks are concentrated. This analysis represents a crucial step towards understanding the vulnerability of migratory birds to climate change. The talk will provide insights into the mounting challenges these species face as extreme weather events become more frequent.

Human impacts are crucial to explain the prevalence of threatened species on islands across the globe

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Abstract

Islands serve as model systems for studying species assembly processes and are home to the majority of global extinctions and threatened species. However, few studies have examined the global distribution of threatened species on islands. While island characteristics such as area and isolation influence overall biodiversity, it remains unclear whether they also shape the occurrence of threatened species or if human impacts play a more significant role. We compiled bird species data, conservation status, environmental conditions, and land use for over 1,200 islands globally to determine the drivers of threatened species prevalence. Our findings show that models incorporating human impacts, particularly urbanization, significantly outperformed those using only island characteristics. Together, island characteristics and human impacts explained approximately 40% of the variation in threatened species prevalence. Future research should explore the interactions between human impacts and island characteristics, particularly considering land use change, human population density, and trade infrastructure.

Microbial Ecology

Microbial photosynthesis mitigates carbon loss from northern peatlands under climate warming

Dr Vincent EJ Jassey, Dr Samuel Hamard, Sophie Planchenault, Mixopeat project Consortium

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Abstract

The future of the northern peatland carbon sink is uncertain because of unclear effects of warming on microorganisms. While increased microbial CO_2 emissions are expected under warming, the response of microbial photosynthesis remains unknown, complicating predictions of net microbial effects on peatland carbon emissions. Here, we pair experimental observations and biogeochemical models to project future microbial photosynthetic rates across northern peatlands. We find that elevated temperatures increase microbial photosynthesis across seasons by 68% (CI 95%: 61–75%). Under the 'Middle of the Road' scenario for 2050 (SSP2), microbial primary productivity increases by 8.6 million tonnes (TgC yr^{-1}), offsetting ~20% of projected peatland CO_2 emissions under climate change. Additionally, a microcosm experiment indicates that increased microbial photosynthesis indirectly promotes plant CO_2 assimilation (+86%; 95% CI: 81–88%) by enhancing microbial mineralization. These results underscore the importance of photosynthetic microbes for mitigating carbon emissions and preserving future carbon sequestration in peatlands.

Diversity and importance of CO_2 fixing micro-organisms for the peatland carbon cycle

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Abstract

CO_2-fixing microorganisms (CFMs) are crucial for the C cycle as they can contribute to C uptake and C sequestration in soils through various metabolic pathways. Despite their significance, they remain poorly studied, especially in peatlands. Here, we show that CFMs comprise about 34% of the total bacterial abundance in peatlands. Using digital droplet PCR targeting different CFM populations, we find that oxygenic phototrophs are the most abundant in peatlands, followed by chemoautotrophs and aerobic anoxygenic phototrophs. Our results also reveal that CFMs' diversity and community structure strongly varied with depth and peatland type. In particular, we find that pH, nutrients and soil temperature drive CFM communities. In conclusion, our findings show that CFMs are crucial for the peatland C cycle and interrogate their potential to mitigate peatland C emissions, which is essential to study for advancing our prediction of C losses from peatlands in a changing world.

Hibecovirus (genus Betacoronavirus) infection linked to gut microbial dysbiosis in bats

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Ulm University

Abstract

Little is known about how viral infections manifest in virus reservoirs such as bats. Sub-Saharan *Hipposideridae* were recently found to differ in their susceptibility to several coronaviruses albeit appearing physically healthy. We hypothesized that the gut microbiota of wild *Hipposideros ruber* lineage D changed when infected the distantly SARS-related hibecovirus 2B, which the species is susceptible to, but not when infected with two other coronaviruses. Indeed, only infections with the hibecovirus 2B altered the gut microbial diversity and composition. The gut microbial community of infected bats become progressively less diverse and more dissimilar with infection intensity, arguing for dysbiosis as per the Anna-Karenina principle. Especially beneficial bacteria, such as from the genus *Alistipes* and *Christensenella*, decreased with infection intensity, while potentially pathogenic bacteria, namely *Mycoplasma* and *Staphylococcus*, increased. Infections with enterically replicating viruses may therefore cause gut dysbiosis with potential negative health consequences even in putative viral reservoirs.

The interplay between interaction network structures affects microbe-plasmid communities

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Abstract

Plasmids shape the community dynamics and fuel the evolution of microbes. Microbe-plasmid community dynamics result from the interplay between microbe-plasmid interactions (e.g., plasmid host range) and plasmid-plasmid interactions inside the microbial cell (e.g., co-existence). However, how the interplay between these interaction structures affects dynamics remains unstudied. We used an agent-based model to simulate the dynamics of a multimicrobe-multiplasmid system in which we manipulated the structure of the interaction networks. We showed that the interplay between non-random network structures affects microbe coexistence and population composition, as well as plasmid prevalence and infection dynamics. For instance, the presence of incompatible plasmids promoted microbe co-existence when the plasmid-microbe network was full but not nested. These consequences were largely driven by the structure-induced heterogeneous persistence of the plasmid-free and co-infected individuals in microbial populations. Our study demonstrates how the interplay between interaction structures affects the community dynamics of infectious agents and their hosts.

Patterns in bacterial diversity across northern peatlands

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Abstract

Microbial communities play a significant role in the carbon balance of northern peatlands. However, a comprehensive understanding of these communities and their diversity at the global scale is still lacking. Here, we aim to investigate bacterial communities in *Sphagnum*-dominated peatlands across the northern hemisphere and identify the primary drivers of their diversity patterns. We analyzed 199 samples of 16S rRNA gene sequences from 18 countries, alongside environmental variables derived from satellite data. Despite substantial variation in absolute species richness, the relative abundance of dominant bacterial groups remained consistent across sites. Moreover, certain bacterial taxa were found in over 85% of samples, indicating the presence of a core microbiota across these peatlands on a broad geographical scale. These findings suggest strong environmental filtering, selecting from a global pool of bacteria adapted to peatlands' acidic, humid conditions, thus supporting Baas Becking-like hypothesis: "Everything is everywhere, but the environment selects".

Distinct drivers of host-microbe network structures for core and rare microbes along a land use change gradient

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Abstract

The microbiome significantly influences host health and function, yet the environmental factors shaping the microbiome in wild hosts are poorly understood. We studied the gut microbiome (bacterial ASVs) of wild rat (Rattus rattus) individuals across different land-use types in rural Madagascar. We categorized ASVs into Core (>20%), Non-core (2-20%), and Rare (1-2%) prevalence groups and constructed bipartite networks linking individual rats to ASVs. We used modularity to identify clusters of tightly interacting rats and microbes. We used compositional and phylogenetic turnovers to identify the processes driving microbial distributions. The network's modules reflected the dispersal limitation of Rare microbes and the selective differences for Non-core microbes, while neutral processes dominated for Core microbes. Additionally, the composition of modules for Rare and Non-core microbes varied with land-use. These results underscore the complex interplay between environmental factors, the host, and microbial community structures, offering insights into how land-use change impacts wild host microbiome.

Investigating the effects of glyphosate-based herbicides and their alternatives on the soil microbiome

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Abstract

The use of herbicides, such as glyphosate, has become controversial over recent years. Widely used in agriculture for weed control, its use on public and amenity lands has come under scrutiny. There is a growing body of evidence that herbicides like glyphosate may pose detrimental effects to public health, biodiversity and the environment.

Our research aimed to assess the impact of different weed control methods (two glyphosate and three alternatives) on the soil microbiome and vegetation cover. Soil samples were analysed for changes in fungal and bacterial communities using ITS and 16S sequencing   MicroRespC was also used to determine differences in microbial population structure based on changes in carbon source preference.

Our preliminary findings indicate that differences in fungal (and to a lesser extent bacterial) profiles across the different timepoints are associated with the different treatments and that some of the alternatives are very effective at plant control.

Exploring the Ecological Implications of Acute Oak Decline: A Focus on Avian Breeding Behaviour and Insect Herbivory

Carys Cunningham

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Abstract

Acute Oak Decline (AOD) is a bacterial syndrome that can lead to the rapid death of oak trees, yet its broader ecological effects are largely unexplored. This research, the first of its kind, examines the ecological impacts of AOD, focusing on bird breeding behaviours and insect herbivory.

Over four years in Epping Forest, Essex, I studied the breeding behaviours of Great Tits and Blue Tits in relation to AOD-affected sites. The findings reveal a link between AOD presence and bird breeding intent, along with increased insect herbivory on symptomatic trees. These results suggest that a broader ecological perspective is essential in understanding tree disease dynamics and managing AOD's impacts on forest ecosystems.

Bacterial community responses to environmental change

Dr Kaitlin A Schaal[1], Dr Ying-Jie Wang[2], Dr Johannes Nauta[3], Dr Manlio de Domenico[3], Dr Shai Pilosof[2], Dr James PJ Hall[1]

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Abstract

Anthropogenic environmental changes can have a profound impact on the soil microbial communities that are crucial for ecosystem functioning and food security. Using a combination of microbial communities in simple soil microcosms, multi-layer network modelling, and agent-based modelling, we examine how interactions among species are impacted by environmental changes, and how these interactions evolve. We focus on selection from antibiotics, mercury, and nutrient levels as environmental changes, all of which are relevant by-products of human activity near soils. We explore the effect of environmental change on the balance of positive and negative interactions over time as species evolve, and the impact of plasmids and HGT on community- and individual-level responses to environmental perturbations. This work will allow us to synthesize across biological levels – plasmid to species to communities – as we seek to better understand the effect of human-induced environmental changes on microbial communities, especially their robustness and overall ecological function.

Ecosystem productivity shapes the soil active microbiome at a continental scale

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Abstract

Soil microbes are the most abundant and diverse organisms of the planet, which regulate all known functions. Much less is known, however, about the drivers and distributions of the active microbiome. Here, we report results from 601 sites across China, wherein we quantified the proportion of active microbiome (SAM%) using CTC (5-cyano-2,3-ditolyltetrazolium chloride) staining. Less than 2% of all microbes were active in our soils. Moreover, we further provide solid evidences that net primary productivity shapes the active microbiome size, regulated by MAP and mediated by mineral protection. This knowledge is critical to better forecast the future of soil function under climate change.

Assessing the structure and function of the permafrost microbiome worldwide

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Abstract

Permafrost soils support 25-50% of the global soil carbon (C) stocks. However, they are highly vulnerable to climate change which may result in important carbon losses under global warming. Soil microbes are the fundamental regulators of soil-atmosphere carbon balance by soil organic matter. Yet, the structure and function, and the climate sensitivity, of the permafrost microbiome remains poorly understood across environmental gradients. Here, we conducted a comprehensive analysis of 194 global soil metagenomes to evaluate the structure and function of the permafrost microbiome across temperature gradients. Our database provide a valuable resource to advance our knowledge on the structure and functionalities of permafrost microbiomes, contributing to future predictions of climate change impacts.

Associations between cloacal bacterial communities and nesting success in sea turtles in Cyprus.

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[1]University of Exeter. [2]Society for the Protection of Turtles (SPOT)

Abstract

Host-associated microbes provide vital physiological functions for animals, including protection from pathogens. In terrestrial vertebrates there is evidence that maternal transfer of bacteria during egg laying decreases probability of pathogenic infection and increases reproductive success. However this relationship remains unclear for marine reptiles such as sea turtles. Here we investigate the link between cloacal microbiome composition, female age and nesting success in Green (*Chelonia mydas*) and Loggerhead (Caretta caretta) sea turtles in Cyprus. We test the prediction that high cloacal bacterial diversity would be associated with higher nesting success and egg viability, where an intact, complex bacterial microbiota would be more able to resist colonization by opportunistic pathogens. Our results have important implications for our understanding of the forces shaping and maintaining microbiome composition in long-lived species, and the role of vertical microbiome transfer for reproductive success.

Disentangling the relative importance of host and environment in driving microbiome dynamics in European Badgers (*Meles meles*)

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Abstract

Host-associated microbes are key components of animal physiology, with particular importance for determining responses to pathogen infection. The gut microbiota is highly variable at the individual level, being shaped by a multitude of factors including diet, social behaviour, and age. Yet the relative influence of these traits on microbiota composition, and the consequences of this variation for host responses to pathogens remain unresolved. Here we investigate factors that shape the faecal microbiome in longitudinally sampled European badgers (*Meles meles*). We explore the relative influences of age, social group and putative infection with *Mycobacterium bovis* on individual microbiome dynamics, and investigate the potential for indirect horizontal transmission of microbes via the environment using samples from setts and latrines. These data shed light on the relative roles of host and environment as conduits of microbial transmission, with implications for our understanding of the factors determining spread of both pathogenic and commensal microbes.

Climate linked microbial interactions in green tide causing seaweed

Catherine Philip

Plymouth Marine Laboratory. University of East Anglia

Abstract

Ulva seaweeds, known for causing green tides, are major producers of dimethyl sulfoniopropionate (DMSP), one of Earth's most abundant organosulfur molecules and can cleave DMSP to release the climate-cooling gas dimethylsulphide (DMS).The precise role of DMSP in *Ulva* is unclear, but could relate to anti-stress mechanisms, or to the signalling and recruitment of beneficial bacteria which use DMSP as a nutrient and facilitate further DMS production. The current study investigated the bacterial communities associated with *Ulva* using DNA-stable isotope probing and metagenomics, targeting both culture-dependent and independent communities. Nine bacterial species were isolated and identified through 16S amplicon sequencing belonging to the *Flavobacteriaceae, Nocardiaceae, Micrococcaceae, Vibrionaceae, Psychromonadaceae, Alteromonadaceae,* and *Pseudoalteromonadaceae* families. Four of these isolates used DMSP as the sole carbon source, indicating their active role in DMSP metabolism on *Ulva*. These findings provide new insights into the microbial interactions that influence sulphur cycling in the marine environment.

Cheats can boost the success of a cooperative microbial invader

Dr Luke Lear, Prof Angus Buckling, Dr Elze Hesse

University of Exeter

Abstract

Microbial invaders can use cooperative public goods, such as siderophores, to increase their competitive ability. However, siderophore production can be exploited by non-producing cheats that benefit from their production without any associated costs. Here, we test the importance of cooperation for the invasion of a bacterial community by *Pseudomonas aeruginosa*. We do this by comparing the success of a siderophore-producing strain, a siderophore-deficient mutant strain, and a 50:50 mix, both in environments with weak and strong siderophore requirements. Invader type had no effect on success under weak siderophore requirements, but a large effect under strong siderophore requirements. Here, mixed invader strains coexisted and had the greatest success, whilst producer-only populations had intermediate success and cheat-only populations the lowest. Similarly, invader type only affected resident diversity under strong siderophore requirement. In conclusion, we show that the presence of diverse social strategies can increase invader success, but that this is context dependent.

Soil saprotrophic fungi show limited ability to thermally acclimate in laboratory conditions

MSc María Moreno Druet[1,2], Prof. François Rineau[1], Prof. Nadia Soudzilovskaia[1], Prof. Frederik De Laender[2]

[1]Hasselt Universiteit. [2]Université de Namur

Abstract

Higher fungal activity due to higher temperatures caused by heatwaves could lead to more soil carbon losses and increase the positive carbon feedback. However, thermal acclimation may reduce this feedback by reducing the microbial response to higher temperatures. We exposed seven soil saprotrophic fungal strains to reference and heatwave temperatures in monocultures in agar to test: (1) whether these strains experienced thermal acclimation by measuring the effect of the temperature treatments on intrinsic growth and self-limitation, and (2) whether we could predict acclimation response based on pigmentation and spore load. Our results showed that thermal acclimation was strain dependent, and in the strains where we found it, it was not strong. Finally, we could not predict acclimation with the measured traits. These results indicate that thermal acclimation is not widespread among these fungi. A more realistic setting would provide more insights into the response of soil saprotrophic fungi to warming.

Biocidal antifouling coatings change fouling-invertebrate microbiomes

Jess L Clarke[1,2], Dr Andy Nelson[2], Prof Tony Clare[1], Dr Tom Vance[3], Dr Nick Aldred[4], Anna Yunnie[3]

[1]Newcastle University. [2]Northumbria University. [3]PML Applications. [4]University of Essex

Abstract

This study investigates the microbiome response of fouling marine invertebrates to biocidal antifouling coatings, specifically focusing on two species, *Ciona intestinalis* and *Bugula neritina*. The study employs 16s rRNA sequencing and community resistance assays to analyse the microbial composition and their responses to different coatings and antibiotic treatments. The results demonstrate significant differences in microbial community compositions between biocidal and non-biocidal treatments. The findings also suggest that specific bacterial taxa exhibit resistance to various antibiotics, depending on the type of coating. The study concludes that antifouling coatings can cause compositional changes within the microbiomes of marine fouling invertebrates, indicating the need for further research into the implications of these changes in regards to resistance profiles and the spread of undesirable microbes associated with invasive species.

Cross-Kingdom Covariations in Host-associated Microbial Communities

Dr Kirsty J Marsh, Dr Xavier A Harrison

University of Exeter, Centre for Ecology and Conservation

Abstract

Our knowledge of gut bacterial communities ('microbiomes') is ever increasing, yet bacteria form only one portion of the diverse multi-kingdom assembly of vertebrate gastrointestinal (GI) tracts. Understanding variation among other gut-associated kingdoms such as fungi ('mycobiomes') is severely lagging behind, particularly in wild host species. Fungi represent the majority of eukaryotes within the GI tract and harbour several opportunistic pathogens. Here we present a cross-kingdom study of the GI assembly of a wild host species, the light-bellied brent goose. We pair metabarcoding of the 16S and 18S regions with detailed host ecological data to understand patterns of covariation of microbiome and mycobiome communities, alongside factors such as pathogen infection status and social foraging. We use advanced statistical tools to uncover social foraging effects on the gut community, identify taxon-specific associations and reveal bacteria-fungi co-occurrence patterns. This study provides a base for further understanding of the functional consequences of cross-kingdom dynamics.

Phycosphere alchemy: Phytoplankton compounds promote pathogenic *Vibrio* interaction

Ann Mary V B[1,2], Dr Mahasweta Saha[1], Dr. Robert Brewin[3], Dr Shubha Sathyendranath[1], Dr Craig Baker Austin[4]

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Abstract

Species interactions in nature vary at different levels and degrees. Phycosphere, being one of the most unique and dynamic natural micro-platforms, is understudied. The underlying chemical mechanisms of communication between phytoplankton and pathogenic *Vibrio* species are the prime focus of this research. In this study, we evaluated the settlement of pathogenic *Vibrio* species (*V.alginolyticus*,*V.vulnificus*, *V.parahaemolyticus*, *V.mimicus* and *V. furnissi*) on intracellular and extracellular crude extracts of six phytoplankton species grown at three different growth phases. Additionally, polar and non-polar fractions from crude extracts of phytoplankton were also analysed for settlement effects. Our results showed the presence of 'pro- *Vibrio*' compounds favoring the bacterial settlement from intra-cellular and extracellular decline phase extracts of phytoplankton. This information will enable us to understand phytoplankton-pathogenic marine bacterial interactions, particularly with *Vibrios*, that represent an emerging disease threat due to climate change, in Europe and other higher latitudes.

From Soil to Gut: the Role of Urban and Forest Soil in Bank Vole Gut Microbiota

Dr Toni Jernfors[1], Dr Esa Koskela[2], Dr Giulio Galla[1], Dr Heidi C Hauffe[1], Prof Phillip C Watts[2], Prof Tapio Mappes[2], Dr Eva Kallio[2]

[1]Fondazione Edmund Mach. [2]University of Jyväskylä

Abstract

Growing evidence supports the biodiversity hypothesis, which posits that exposure to diverse environmental microbiomes is essential for the development of a balanced immune system. For humans, this hypothesis, together with the rapid expansion of urban areas, may explain the rise in allergies and other inflammatory disorders. However, little is known about how this exposure to urban and forest microbiota affect gut microbiota development, especially in wildlife.

In this study, first generation captive bank voles (*Myodes glareolus*) were exposed to soil collected from urban forests and national parks. Over four weeks, we monitored changes in body measurements and gut bacterial and fungal microbiota. We found that while soil exposure significantly affected gut fungal composition, bacterial communities remained relatively stable. Notably, changes in certain beneficial taxa, such as Bifidobacteria, suggest potential health benefits for hosts.

Interactive Effects of Pesticide Exposure and Flooding Stress on Riparian Soil and Rhizosphere Fungal Communities

Elyssa Dubois, Chiara Berres, Franziska Fiolka, Sierra Grange, Max Masset, Professor Dr. Stefanie Müller-Schüssele, Dr. Kai Riess

RPTU University of Kaiserslautern-Landau

Abstract

With climate change driving more frequent and severe flooding, riparian ecosystems face increased pesticide dispersal and hypoxia. In wine-growing regions, extensive pesticide use for grapevine protection substantially contributes to pollution in downstream riparian areas (via e.g. surface run-off). These pesticides then reach non-target microbial communities in the soil and rhizosphere. Understanding the combined effects of waterlogging and pesticides on soil communities, particularly fungi, is vital due to their central role in nutrient cycling and plant health. We conducted a pot experiment with native riparian plants to examine how these stressors—alone and in combination—affect fungal communities in both free soil and the *Epilobium hirsutum* rhizosphere. By analysing metabarcoding data, we aim to assess whether waterlogging, pesticide contamination, or their combination drive shifts in fungal community structure and potential function in soil and rhizosphere. [Analyses in progress at the time of abstract submission]

It’s what’s on the inside! Microbial communities associated with alpine cryptogams

Mr Josh Thurston, Dr Rob Mills

University of York

Abstract

The climatic conditions of alpine environments impose a selective stress on plant communities that favour low-stature organisms. This creates unique ecosystems dominated by cryptogams, including mosses, lichens, and other non-vascular plants. Cryptogams support diverse communities of microorganisms which contribute to ecosystem processes, including nutrient acquisition and organic matter degradation. Current evidence suggests that cryptogam microbiomes are predominantly species-specific, however the effect of environmental variation and ecosystem heterogeneity on microbial community composition and function remains unclear. Here, we take advantage of alpine ecosystems present within the Scottish Highlands to investigate the seasonal dynamics of cryptogam-associated microbiomes over a 12-month period. Using a combination of ‘omics tools, we reaffirm the host-specificity of cryptogam microbiomes, reveal the remarkable resilience of these microbial communities to the environmental stressors present within alpine ecosystems, and provide evidence for local-scale environmental heterogeneity as a key driver of intraspecific variation in cryptogam-associated microbial communities.

Manatees Make Space for Aliens: Assessing Seagrass Feeding Preferences and Associated Microbiome in San Juan, Puerto Rico

Sherly A Hernández Ramos, Kelcie Chiquillo

University of Puerto Rico - Rio Piedras Campus

Abstract

Manatees are especially vulnerable due to boat collisions, low reproductive rates and climate change. Seagrass beds, their primary food source, are also decreasing worldwide. The rapidly spreading invasive seagrass *Halophila stipulacea* represents an emerging issue for the conservation of the Greater Caribbean manatee (*Trichechus manatus manatus*) by displacing native species and disrupting trophic interactions. As marine herbivores, manatees also depend on specialized hindgut microbes that digest fiber. We are characterizing feeding preferences of manatees in Laguna Condado by analyzing seagrass species within herbivory marked patches. We aim to assess the composition of manatee hindgut microbial communities from fecal samples in relation to those found in seagrasses. We hypothesize manatees will show preference for native species, allowing the invasive population to increase. We expect the composition of manatee hindgut microbial communities will serve as an indicator for these feeding preferences, providing better understanding of their diet composition to improve conservation efforts.

Nature and Humans

Human-beaver Coexistence in a Nature Emergency: how does range expansion of Scotland's 'ecosystem engineers' affect the wellbeing of beavers?

Miss Alice Turner

University of Stirling

Abstract

We are in a nature emergency, and the re-establishment of beavers is one solution to restore biodiversity and ecosystem function. Yet, their relationship with humans, with whom they share their environment, remains largely under-researched. There are many studies which demonstrate the impact of human activity on wildlife, as well as how species adapt to human proximity and anthropogenic disturbances, but our understanding of this in a beaver context is limited. Future ecosystem management must go beyond reintroduction schemes and allow both humans and beavers to engineer the environment without generating conflict. This PhD will measure human disturbances (land use, noise, light and water pollution) and the impacts on beavers (foraging behaviour and activity, resource use, stress and contaminant levels). It is expected that proximity to high human disturbances will have a negative effect on beavers.

Ethnographic stratigraphy: a new multidisciplinary method for thinking with/about rivers in the Anthropocene

Molly Desorgher

University of Leicester

Abstract

Learning to live differently in the Anthropocene demands new methods for thinking about the world, which move away from patterns of quantification and resourcification and towards naturalcultural understandings of the landscapes we live in. Applying this idea to waterways, I propose ethnographic stratigraphy as a multidisciplinary methodology for developing an understanding of a specific body of water as both social and hydrological, rather than just one or the other.

Ethnographic stratigraphy weaves the geological method of stratigraphy together with more-than-human ethnography in order to develop a hydrosocial retelling of the River Soar in Leicestershire, England, which is (literally) grounded in the geological memory of the river. Working from a sediment core taken from the river at Aylestone Meadows (within the city of Leicester) in Summer 2023, I combine geochemical and palaeontological datasets with historical data and participant observation to begin to develop a naturalcultural understanding of an Anthropocene waterway.

Wildcat Reintroduction in South-West England: A Social Feasibility Study

Dr Roger E Auster[1], Ms Sian Moody[1], Dr Sarah L Crowley[1], Dr Thomas Dando[2], Professor Stewart W Barr[1], Professor Richard E Brazier[1]

[1]University of Exeter. [2]Durrell Wildlife Conservation Trust

Abstract

Through 2023 and 2024, the South West Wildcat Project has been investigating whether it is socially and ecologically possible to reintroduce European wildcat (*Felis sylvestris*) into south-west England. At the time of writing, no reintroduction is planned and results of both social and ecological feasibility studies will inform decisions on whether (and if so how) to proceed.

The authors undertook a twelve-month, mixed-methods social feasibility study to understand human perspectives on wildcats and reintroduction, among both key interest groups and wider publics. This presentation will introduce results of this work, outlining:

- shared perspectives of representatives of key interest groups (identified using Q-Methodology);
- relationships between those perspectives and demographic characteristics;
- how far publics align with distinguishing characteristics of identified viewpoints (in both representative and self-selecting online survey samples).

Finally, the talk will conclude with analytical reflections from the researchers on the social feasibility of wildcat reintroduction.

Artificial Light at Night leads to a decline in body condition in great tit (Parus major) nestlings but no effects on oxidative stress or corticosterone.

Miss Rachel Rose Reid[1], Dr Neal Dawson[1], Professor Neil Evans[1], Mr Christopher Mitchell[2], Dr Davide Dominoni[1], Dr Jelle Boonekamp[1]

[1]University of Glasgow. [2]University of Exeter

Abstract

Wildlife that live in urban environments face many novel stressors, including artificial light at night (ALAN). ALAN has been shown to have many negative consequences for wildlife through disrupting circadian rhythms and causing behavioural and physiological changes. Yet we still understand little about the knock-on effects ALAN may have for health. There are limited studies that have investigated this issue with field experiments and via assessing multiple health traits simultaneously. We have conducted an experiment exposing great tit *(Parus major)* nestlings to ALAN in the field throughout their development period. We assessed multiple biomarkers of health including body condition, oxidative stress and feather corticosterone levels. Our results show that ALAN causes reduced body condition in great tits but has no conclusive effects on oxidative stress or corticosterone levels. Future studies should elucidate the physiological and behavioural mechanisms that might underlie the decline in body condition as a consequence of ALAN.

Biologically realistic home range estimation in colonial animals: implications for spatial risk assessment

Ms Holly I. Niven[1], Dr Jana W. E. Jeglinski[1,2], Dr Geert Aarts[3], Dr Ewan D. Wakefield[4], Professor Jason Matthiopoulos[1]

[1]University of Glasgow. [2]University of Aarhus. [3]Wageningen University and Research. [4]University of Durham

Abstract

Colonial central-place foragers are particularly vulnerable to localised disturbances. To assess such impacts, robust and unbiased home range (HR) estimates are needed. However, species within this group, such as pelagic seabirds, are difficult to observe and their HRs are shaped by intra- and inter-colony competition. Traditional HR estimation techniques (e.g., utilisation distribution estimation via kernel smoothing or species distribution models) are difficult to correct for such complicating factors and therefore potentially biased. We improve on biological realism of HR estimation by modelling the flux of animal usage through space. Our mechanistic model can be parameterised via tracking data from a small subset of colonies within a wider colony network and then predict HRs for all network colonies simply from their sizes and locations. Using the example of northern gannets, we show that techniques conventionally used in risk assessment bias estimates of exposure to offshore wind farms compared to our method.

Enforcement Activities and Profiling Techniques of Wildlife Rangers in Nigeria's Lowland Forest Reserves: A Mixed-Methods Study on Wildlife Law Transgressions

Dr Norris Igbinosa Erhabor

University of Benin

Abstract

This mixed-methods study investigates the enforcement activities and profiling techniques employed by wildlife rangers in Nigeria's lowland forest reserves to address wildlife law transgressions. The research integrates enforcement strategies, socio-economic factors, community involvement, and governance structures to evaluate the effectiveness of ranger activities. Data collection was conducted in the Omo Biosphere Reserve, Gele Gele Forest Reserve, and Okomu National Park, utilizing both primary and secondary sources, including interviews. Key findings reveal that unauthorized entry, possession of specific tools, and suspicious behaviors are primary indicators used by rangers to identify potential law violators. Poaching activities predominantly occur at night, with armed poachers posing significant challenges. Despite increased patrols and arrests, the study highlights the need for a more holistic approach, including community engagement, strengthened judicial systems, and technological integration, to enhance the effectiveness of conservation efforts. These findings underscore the importance improving enforcement strategies for sustainable management.

Making Space for Water: Nature-based Solutions with Beavers

Dr Alan Puttock[1], Dr Holly Barclay[2], Dr Matt Holden[2], Prof Richard Brazier[1], Peter Burgess[2]

[1]University of Exeter. [2]Devon Wildlife Trust

Abstract

We face intense pressures from climate extremes, land use change, declining biodiversity and increased demand for water resources. It is proposed that by working with natural processes, Nature-based Solutions (NbS) can increase resilience, providing multiple environmental and societal benefits.

Beavers are ecosystem engineers. Research has shown the return of the beaver can provide multiple benefits including for biodiversity and water resource management.

The Making Space for Water Programme aims to support land managers to build a network of nature rich wetlands across SouthWest England. This project led by Devon Wildlife Trust, in partnership with the University of Exeter and local landowners works with wild beavers to deliver natural solutions to address societal challenges. Case studies will be presented discussing how we can make catchments 'beaver ready', target financial support and enable NbS benefits. It is hoped that this project can contribute towards the mainstreaming of nature-led NbS approaches.

Nurturing nature engagement and understanding through Augmented Wildlife Experiences

Dr Phillipa Gillingham, Dr Anastasia Vayona, Professor Anita Diaz, Professor Amanda Korstjens

Bournemouth University

Abstract

Engaging with nature is well-known to enhance human wellbeing and fosters pro-environmental behaviours. However, currently engagement is limited from many socio-economically disadvantaged communities. Augmented Wildlife Experiences (AWE) supports people, especially children, to engage with nature. Many struggle to connect during nature walks since wildlife does not appear as they might expect from watching nature documentaries or other media. We have harnessed digital technology to create an immersive experience, revealing secrets of the living world surrounding participants. We have developed three AWE trails with QR codes at wildlife information hubs. These unlock online multimedia content, including wildlife videos and sounds, fun facts, and educational information. Visitors are encouraged to submit their own photos to cocreate wildlife maps along the trails, extending engagement. Initial interactions have provided positive feedback, with participants appearing to have higher engagement than with traditional nature walks, providing proof-of-concept to build on in future.

The impact of UNESCO Biosphere Reserves on communities in Kenya

Ms Anita Hashmi[1], Professor Richard F Preziosi[2], Dr Samuel T Partey[3]

[1]Manchester Metropolitan University. [2]University of Plymouth. [3]UNESCO

Abstract

The conservation of biodiversity takes many forms, from community projects to protected areas. The success of these initiatives has been assessed repeatedly in terms of biodiversity, but rarely has the impact of conservation action on people been considered, especially given the neo-colonial history of much conservation initiatives. UNESCO Biosphere Reserves are protected areas that involve local communities in designation, management and governance. However, the impact of these more inclusive protected areas is also understudied with regards to their impact on people's lives. In this study, we assess the impact of proximity to a Biosphere Reserve on socio-economic and demographic factors, such as access to education and healthcare, within local communities in Kenya. Despite additional sociological factors, proximity to a Kenyan Biosphere Reserve had positive impacts on household finance, access to education, and women's rights.

Exploring the mental well-being effects of nature sounds: Insights from acoustic monitoring

Dr Melissa Marselle[1], Dr Konrad Uebel[1], Dr Julie Koch Sheard[2]

[1]University of Surrey. [2]University of Marburg

Abstract

Land-use change and human disturbance harm nature and human well-being by causing biodiversity loss. Acoustic monitoring is increasingly used to assess natural habitats. While psychological studies show that nature sounds benefit mental well-being, the effects of different habitat types are unexplored. Here, we assess the mental well-being effects of listening to nature sounds from different habitat types.

Using sound samples from acoustic monitoring of forest and grassland habitats with varying human disturbance, we employed a repeated measures within-subjects design. Fifty-three participants listened to seven, one-minute, sound samples in a random order, rating their momentary mental well-being after listening to each soundscape.

Results show no significant differences between listening to forest and grassland sounds, but a significant difference between nature and city sounds, suggesting that all nature contact benefits mental well-being. This study highlights a novel use of acoustic monitoring data to explore the relational value of nature.

Mapping wetland water extent created by nature-based solutions using novel drone imagery

Miss Kirsty R Frith, Dr Alan Puttock, Dr Pia Benaud, Prof Richard Brazier

University of Exeter

Abstract

From the increasing risk of the hydrological extremes of flooding and drought, to the decline in biodiversity our landscapes face critical pressure from climate change and current land management. Therefore, there has been a move to use more nature-based solutions (NbS) within the management and restoration of waterways opposed to more heavily engineered infrastructure. These more natural methods can provide cost effective solutions to flooding, whilst also providing drought management by storing and slowing water, maintaining baseflows as well as creating wetland habitat refuges providing biodiversity enhancement and resilience co-benefits. The application and monitoring of these NbS is still in its infancy. It is therefore important to create accessible, yet robust monitoring methods that yield quality results over varying wetland landscapes. Here we look to explore developing new approaches using drone imagery to map and monitor wetland creation across a spectrum of beaver and human created wetland interventions.

Regional comparison of the structure of human well-being related to ecosystem services in five coastal areas: possible effect of anxiety unique to the ria coast of Japan

Dr. Jun Shoji

Fukui Prefectural University

Abstract

The structure of satisfaction for five components of human well-being ('Security', 'Basic material for a good life', 'Good social relations', 'Health', and 'Freedom of choice and action') derived from ecosystem services and anxiety about natural disasters (e.g. tsunami) and future loss of the ecosystem services were compared among five ria coasts in the temperate area of Japan (Wakasa, Sanriku, Shima, Ehime, and Miyazaki). Structural equation modeling using the results from questionnaire surveys showed a site-specific difference in the intensity of interactions among the five components; the effect of satisfaction for 'Security' on 'Freedom of choice and action' was greatest at Wakasa, while that was not detected in Sanriku and Miyazaki. We propose a method that quantitatively evaluates both positive (satisfaction) and negative (anxiety) aspects of respondents' subjective assessment as a useful tool for understanding the diversity of human-nature interactions caused by the region-specific natural and social backgrounds of coastal areas.

The benefits of blue spaces: a global systematic review of cultural ecosystem services provided by wetlands

Dr Kevin A. Wood[1], Ms Lucy L. Jupe[1], Prof. Francisca C. Aguiar[2], Dr Alexandra M. Collins[3], Dr Scott J. Davidson[4,5], Dr Will Freeman[1], Dr Liam Kirkpatrick[3], Prof. Tatiana Lobato-de Magalhães[6,7], Dr Emma McKinley[8], Dr Ana Nuno[9,10], Dr Jordi F. Pagès[11], Dr Antonella Petruzzella[12], Mr Dave Pritchard[13,14], Dr Jonathan P. Reeves[1], Prof. Sidinei Magela Thomaz[15], Dr Sara A. Thornton[1], Prof. Hiromi Yamashita[16], Dr Julia L. Newth[1,10]

[1]Wildfowl & Wetlands Trust. [2]Universidade de Lisboa. [3]Imperial College London. [4]University of Plymouth. [5]University of Waterloo. [6]Universidad Autónoma de Querétaro. [7]Mississippi State University. [8]Cardiff University. [9]NOVA University Lisbon. [10]University of Exeter. [11]Centre d'Estudis Avançats de Blanes (CEAB-CSIC). [12]Rhodes University. [13]Charles Sturt University. [14]Ramsar Culture Network. [15]Universidade Estadual de Maringá. [16]Ritsumeikan Asia Pacific University

Abstract

Wetlands underpin global biodiversity and provide critical ecosystem services. Yet, our understanding of wetland Cultural Ecosystem Services (CES), e.g. aesthetic, inspirational, educational, recreational and spiritual values, remains limited. We conducted a global systematic review of 861 papers written in 17 languages, yielding evidence of CES provided by wetlands in 175 countries/territories, illustrating that wetlands are globally important for human culture. Yet, we also found substantial geographic biases (typically towards the Global North) in study effort, research practices, and availability of CES information to practitioners/policy-makers. Recreation/tourism was the most frequently reported CES (40%), with cultural identity/heritage (16%) and education/learning/knowledge (13%) also well-represented. Our study demonstrates the links between wetlands and human culture, highlighting the need for wetland conservation to be a priority, not just for decision-makers charged with water and environmental management, but also those responsible for cultural heritage, education, recreation, tourism, and Indigenous affairs.

Implementing and evaluating evidence-based insect conservation interventions with and for city neighborhoods

Monika Egerer, David Schoo

Technical University of Munich

Abstract

The ecological transformation of the city requires evidence-based interventions to support biodiversity, as well as coordinated efforts among relevant city actors. In our project 'BioDivHubs' in Munich, Germany, we collaborate with gardeners, neighborhood residents, organizations, and government agencies to develop, implement and evaluate insect conservation interventions. Urban community gardens and their surrounding neighborhoods are our "living laboratory" to co-create, test and collectively implement these biodiversity conservation strategies with gardeners and residents. In this talk, we will present on our current activities including a citizen science balcony greening project, a mobile educational demonstration garden, and neighborhood bioblitzes that are implemented in different gardening and neighborhood contexts. These various activities represent different interventions for biodiversity conservation, but also different ways in which people and ecological research interact. We will discuss some opportunities, challenges and successes in our transdisciplinary urban social-ecological engagement.

What makes a “quality” natural space?

Dr Michaela Roberts, Dr Hebe Nicholson, Miss Chloe Thompson, Dr Katherine N Irvine

James Hutton Institute

Abstract

We are in a time of multiple crises, with declining biodiversity, a changing climate, and increasing economic divides. As such, our natural spaces are required to not only support biodiversity, but also our communities and economies. Managing and investing in natural spaces has cross-sectoral policy significance, with quality of space identified as of more importance than quantity. However, measures of “quality” are highly variable. The purpose of this study is to understand the metrics used to explore multifunctional natural space quality, using Scotland as a case study. Through a triangulated methodology, including a scoping literature review, a survey, and workshops, we identify the most important quality indicators for natural spaces. We apply the “Four Capital” framework to explore how these indicators measure benefits accounting for the multiple functions that natural spaces must support. We additionally highlight those indicators that are deemed of high importance, but are not yet widely applied.

The Role of the Cholanaykkan Tribal Community and Their Culture in Nature Conservation

1st author Husna CV Lubaba, Second author Farsana KK

University of Calicut

Abstract

The Cholanaykkan tribal community, one of the most primitive tribes in Asia, plays a crucial role in protecting and conserving the forests in the Nilambur Nedunkayam region of Malappuram, Kerala, India. A study, conducted through surveys and interviews by the first PhD student from the Cholanaykkan community along with a tribal officer, explored their culture and activities.

The findings revealed that the community's diet, which consists entirely of natural foods contributes to their good health. Their cultural practices, including marriage and daily living, revolve around dividing and conserving trees, which they regard as their wealth. All of their actions are undertaken with reverence to nature, always seeking its permission .

In conclusion, although the Cholanaykkan tribe has lived in the forest for generations, they remain relatively isolated from the broader public. Despite their small population, they uphold strict protocols that contribute significantly to the conservation of nature.

Mammal biodiversity responses to infrastructure expansion in the Heart of Borneo, Brunei Darussalam

Miss Natasha LM Mannion[1], Dr Rachel Gaulton[1], Prof Marion Pfeifer[1], Prof Johan WF Slik[2], Prof Stephen G Willis[3]

[1]Newcastle University. [2]Universiti Brunei Darussalam. [3]Durham University

Abstract

Infrastructure expansion in tropical forest landscapes alters biodiversity while benefiting rural development. Here we investigate the effects of infrastructure expansion in densely forested Temburong, Brunei Darussalam, and its interaction with hunting by local communities, to quantify and predict mammal biodiversity impacts. We deployed camera traps (n = 70) in areas varying in distance to nearest road and hunting pressure, investigating mammal richness, relative abundance, and community composition. Key insights from community interviews informed analyses, using generalised linear models to quantify mammal responses to environmental covariates, suggesting distance to roads significantly impacts mammal communities. These results suggest roads may facilitate hunters' access to forests, driving change in Temburong's mammal biodiversity. We model future development scenarios in areas which will become more accessible through newly constructed roads. Effective conservation solutions to mitigate biodiversity impacts from roads should include considerations of local hunting behaviour, to preserve Brunei's relatively untouched forests and their biodiversity.

Impact of Land Use Cover on Honeybee Foraging - Nutritional Landscape and Value of Communication

Dr RAJBIR KAUR[1], Mr Yongqiang Wu[1,2], Dr Christoph Grueter[1]

[1]University of Bristol, UK. [2]University of Mainz, Germany

Abstract

Anthropogenic alterations to landscapes and increasingly extreme weather patterns are disrupting ecosystems and threatening biodiversity. Honeybees face nutritional stress from reduced food availability due to deforestation, and climate change, impacting their health and susceptibility to diseases. Our research investigated the impact of land use on honeybee nutrition, health, and communication. We collected data on nutritional diversity, pesticide exposure levels, and the role of dance communication in foraging success, from 54 hives, over two years, across an urban-to-agricultural gradient in southwest UK. My presentation will focus on two key aspects of our study: 1) Bee nutritional diversity, assessed through nectar quality and quantity, along with pollen metabarcoding analysis. 2) The value of dance communication in relation to foraging success. Our findings highlight the intricate link between land use, foraging success, and colony health, providing crucial insights for sustainable land management practices.

Wild Meat Consumption in Changing Rural Landscapes of Indonesian Borneo

Dr Katie L Spencer[1,2], Dr Daniel J Ingram[1], Dr Namrata B Anirudh[3], Mr Ardiantiono Ardiantiono[1], Dr Susan M Cheyne[4], Dr Leejiah J Dorward[5], Mr Abdul Kadir[6], Dr Michaela G.Y Lo[1], Dr Courtney L Morgans[1], Dr Jatna Supriatna[3], Dr Nurul L Winarni[3], Dr Freya A.V St.John[5], Dr Matthew J Struebig[1]

[1]University of Kent. [2]Chester Zoo. [3]University of Indonesia. [4]Oxford Brookes University. [5]Bangor University. [6]Yayasan Tambuhak Sinta

Abstract

Wild meat plays a crucial role in the food security and cultural identity of many people living near tropical forests, but socio-ecological changes are affecting the patterns and sustainability of its consumption. To understand the prevalence and drivers of wild meat in changing rural landscapes, we conducted structured surveys with 632 male household heads across 28 villages in Central Kalimantan. The frequency of wild meat consumption was low – typically less than once every six months - attributed to declining wildlife and increased difficulty in accessing wild meat. However, respondents with higher well-being were able to consume it more frequently, highlighting disparities in access. Our findings reveal multiple environmental and anthropogenic stressors affecting both terrestrial and aquatic animal populations, with implications for diets and livelihoods. We also identified regional differences in the frequency, diversity, and types of species consumed. Finally, we provide recommendations to work towards sustainable wild meat consumption.

A Citizen Science and Engagement Approach for a Plastic Free Mersey

Mr Aidan J Hubbard[1,2], Mr Luca Marazzi[1], Mr John Sanders[2], Mr Chris Coode[1]

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Abstract

Plastic pollution is a highly concerning global problem. The Plastic Free Mersey project is a highly collaborative initiative bringing together environmental NGOs and plastic industry partners to stem plastic pollution within the Mersey catchment in NW England. Since November 2021 over 20 trained citizen scientists have helped quantify the amount and types of plastic and other litter items on riverbanks and at estuary sites in the Mersey catchment. Plastic food packaging, cigarette butts, plastic bags, sanitary items (e.g. wet wipes), and paper were the five most prevalent litter categories. On average, plastic litter accounted for >80% of the total litter found, with more litter items observed at survey sites without bins than at sites with bins. Using citizen science data, we will test the effects of some interventions (such as more or different bins and creative signage) on litter abundance and inform local, regional, and national policy.

Addressing inequities within the Sustainable Development Goals: ensuring “no-one is left behind”

Chen Ly, Dr Caroline Howe

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Abstract

The world faces planetary crises: climate change, pollution, and biodiversity loss. These are rooted in social and economic inequity, and any solution must address this intersectionality to ensure both environmental and human prosperity. The United Nations' 2030 Agenda for Sustainable Development, with its 17 Sustainable Development Goals (SDGs), provides a framework to address these challenges. Alongside the SDGs, agreements like the UNFCCC and CBD have been established to tackle specific crises. However, global progress remains insufficient, especially on SDGs 5 and 10, which focus on gender equality and reducing inequity. Women, particularly those in the global south, are disproportionately affected by climate change yet remain underrepresented in decision-making. This project explores how the UN incorporates these goals within nature-based solutions (NbS) programs, examining synergies and trade-offs. By doing so, it highlights where women stand in UN discourse and improve NbS initiatives to advance both environmental and gender justice.

Just add water: The effects of urban blue spaces on bird communities and abundance

Matthew C. Morgan, Prof. Rodney Forster, Dr. Charlotte R. Hopkins, Dr. Africa Gómez

University of Hull

Abstract

Urban blue spaces are highly valuable to people and nature, but they have been less studied than green spaces. Blue spaces provide key ecosystem services such as flood alleviation, pollution absorption, microclimate regulation, and health and wellbeing benefits. Critically, they support urban biodiversity, including threatened species, and despite their often small size, they may have disproportionate effects on the surrounding environment, acting as keystone habitats. Currently, research exploring the influences of water within the contexts of urban ecology is limited. This study assessed bird communities and abundance across green and blue spaces in the city of Hull, to quantify the added effects of water presence. We surveyed birds across 22 one km paired transects using visual and acoustic surveys, carried out over the winter and breeding seasons. Preliminary results suggest that the presence of nearby water bodies increases bird species richness but does not affect their total abundance.

Trail tails: Large Mammal Detections Reveal Contrasting Responses to Recreation Along a Visitation Gradient in Quebec National Parks

Mrs. Jessica Bao[1], Dr. Marc-André Villard[2], Professor Martin-Hugues St-Laurent[1]

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Abstract

Recreational disturbances can elicit anti-predator responses in large mammals, altering their spatio-temporal distribution. This study investigates the effects of recreational activities on large mammal distribution across four national parks varying in area, visitation rate, and vegetation. Using 779 camera traps, we analyzed the presence and intensity of use of large ungulates and carnivores in relation to human visitation, recreational activity, and proximity to trails while accounting for environmental covariates. For example, in Mont-Orford national park, hurdle models revealed that distance to trails and water had a negative effect on deer detections, whereas moose and coyote presence had a positive effect on deer detections. These results suggest that deer are attracted to trails and water bodies and tend to coexist with moose and coyotes, sharing similar habitat. Our findings will help harmonize recreation and large mammal conservation in Quebec's national parks.

Artificial Nest Experiment Reveals Low Survival Rates for Ground-Nesting Birds in Israel's Negev Desert

Mrs Ophir Gidron, Prof. Ofer Ovadia, Dr. Eyal Shochat

Ben Gurion University of the Negev

Abstract

Ground-nesting bird populations are declining globally, with significant losses in Israel's Negev Desert due to ecological changes and increasing human disturbances, such as expanding settlements and tourism. These factors elevate the risk from invasive and synanthropic predators. Over two years, we conducted a nest-predation experiment in the western Negev using artificial nests, revealing an average nest survival rate of just 30%. Cox regression analysis showed significant differences in survival rates across years and sites, linked to site-specific human disturbances. These disturbances result in higher predation rates in more affected areas, potentially contributing to the decline in ground-nesting bird populations. Our findings offer critical insights for population modeling and suggest using the conditioned food aversion (CFA) technique for predator management and designating protected nature reserves to safeguard nesting zones. These strategies are vital for preserving habitats essential to the reproductive success of ground-nesting birds in the Negev.

From birds as hat ornaments to interspecies justice – What does the feather trade story from the turn of the 20th century tell us about how people value birds?

Dr Jakub Kronenberg

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Abstract

People's relations with birds changed at the turn of the 20th century. Before, people had been acculturated to exploitative use as a general way of interacting with nature. One example, the use of bird feathers in fashion became a particularly hot topic, vividly debated in the media, streets, shopping environments, and on many other occasions. It was essential for the creation of the RSPB, and an important issue for other conservation organisations of the time. The (R)SPB campaign and the broader debate on feather fashions serves as a prime example of the different attempts to change people's relationship with birds, and illustrates how clashing values led to a broader transformative change. It shows that conservation is not a linear story of continuous improvement or refinement of ideas but rather a cyclical one, with the same arguments reappearing in new contexts, fitting into the broader system of socio-economic priorities.

Characteristics of wolf attacks on humans in India from 1970–2020.

Mr. Prashant Mahajan

Wildlife Institute of India

Abstract

Wolf attacks on humans though often rare, have been a significant cause of human-wolf conflicts, leading to retaliatory killings that have posed a serious conservation threat to wolves since historic times. In India, wolves are often termed "child-lifters". There is sporadic information on wolf attacks on humans in India, but this topic remains poorly documented. In the present study, reported wolf attacks on humans over a span of 50 years in India were analyzed. Victims mostly comprised of children in the age group 0-15 years (62%). Wolf attacks were more common during the evening (51%) and night (30%) hours. Children are more prone to be attacked by wolves in the evening hours near villages with poor socio-economic status. Garnering the local support of people and regularly monitoring wolf attacks are recommended in areas where such attacks are more frequent to ensure the long-term acceptance and persistence of wolves in India.

Taking action for nature: how organisations can maximise their potential for positive ecological impact.

Sarah Papworth[1,2], Aimee Clarke[2], Sarah Jordan[2], Ben Siggery[2,3], Mike Waite[2], Viki Webster[2]

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Abstract

Many organisations in the UK and beyond encourage people to take action to support biodiversity conservation. We generated a longlist of 338 possible actions with positive ecological impacts from The Wildlife Trusts (TWT) websites, TWT staff suggestions and two previous studies of pro-nature behaviour. Having so many options could make people feel overwhelmed and lead to inaction. Therefore we used a series of surveys and workshops to evaluate 1) the potential ecological impact of these behaviours and 2) the likelihood of adoption by members of the UK public. A nationally representative sample quantified 3) the prevalence of selected behaviours. Information on these three factors was combined to rank behaviours and a create shortlist of priority behaviours which have the greatest potential for impact in the UK. This information can be used to guide individuals and organisations towards more effective behaviours which maximise their positive ecological impact.

A quantitative content analysis of the persuasive behavioural content of citizen science biodiversity recording apps in the UK.

Ms Emma Squire, Dr Rebecca Lovell, Prof Kevin Gaston, Dr Lewis Elliott

University of Exeter

Abstract

Citizen science significantly contributes to biodiversity data in the UK, but limitations exist in the quantity and biases of data collected, particularly when and where it is collected, and types of species recorded. A popular way of generating citizen science data is through biodiversity recording apps, but little is known about how the content of these apps might best persuade people to undertake recording.

Consequently, this study aims to analyse the communication methods used by biodiversity recording apps through a quantitative content analysis of 29 apps. The goal is to identify how these apps persuade users to record biodiversity and to uncover strategies that are potentially overlooked and could be effective at addressing determinants of biodiversity recording behaviour.

The findings are expected to inform further experimental studies to test directed messaging designed to improve participation of people using biodiversity recording apps, ultimately improving biodiversity data for future policy and planning.

Ecological boundary conditions for dunes as coastal protection solutions across Europe

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[1]Ghent University. [2]Université de Bordeaux

Abstract

Millions of people live in sandy coastal regions that may become increasingly vulnerable to storm surges and flooding under climate change and coastal erosion. There is currently interest in moving from traditional coastal defense based on purely “grey” hard infrastructure towards nature-based solutions using dunes or dune-hybrid systems. However, as systems driven by sand-vegetation interactions, installing and/or maintaining biodiverse dunes as sustainable coastal protection tools is fundamentally constrained by whether local conditions are suitable for dune-building species. Within the European project DuneFront, we use open data and Species Distribution Models to predict the general ecological suitability of the European coastline for key dune plant species at a kilometric scale. We aim to predict plant occurrence not only based on climatic and physical conditions, but also based on anthropogenic pressure, especially urbanization. We will present our general approach as well as first results pertaining to a few major dune species.

Moose preference between two Birch species in young forest stands in Sweden

Sarah L Gore, Dr Laura Saggiomo, Dr Fredrik Widemo

SLU

Abstract

Moose browsing on Birch species is different with most research stating that Silver Birch is preferred over Downy Birch, However, much research has been done in southern Sweden where there is a higher frequency of Silver birch stems available for browsing. Whereas, in northern Sweden the effect is reversed. In this study we looked at stands in North and South Sweden and recorded stem number of both Birches if present and the damage severity found in each plot in 5 categories, 0, ≤ 10, 11-25, 26-50, 51-75, 76-100 (percent of browsed shoots over the whole plot per species). It was found that preference of moose can be different between North and South. The models did not explain all variation, possibly due to the multiple factors effecting moose preference in wild populations over Sweden. We cannot say that Silver Birch is preferred in every instance over Downy Birch.

The relationship between Agricultural Production and Nature Loss: a cross-country analysis

Mr Michael Reda[1], Mr Marco Franzoi[1,2], Ms Megan Willson-Rymer[1], Mr Joe Mitchell[1], Dr Ralph Blaney[1]

[1]Department for Environment, Food and Rural Affairs. [2]University of York

Abstract

This econometric study investigates the relationship between mean annual agricultural production in tonnes during the period 1995 – 2019 and mean annual natural habitat loss over the same period using a measure constructed from the HILDA+ data.

It also investigates the relationship between the mean annual growth rate of the Biodiversity Intactness Index (BII) and the Species Habitat Index (SHI) and mean annual growth rate of agricultural production.

Our results show that, across all regression models, higher mean agricultural output over the period is associated with higher natural land loss. Specifically, a 1% increase in mean annual agricultural output in tonnes is associated with a 0.31 – 0.36% increase in the mean annual amount of gross natural habitat loss.

Higher growth in agricultural production is also associated with a more negative growth rate of the BII. There is a negative relationship with the SHI, but we are more cautious about this conclusion.

Creation of a sustainability monitoring framework for the assessment of a community-based agroecological farming system.

Imogen Hockenhull[1], Prof Julian Park[1], Gavin Shelton[2], Prof Paul Burgess[3], Dr Sofia Kourmpetli[3], Dr Alice Mauchline[1]

[1]School of Agriculture, Policy and Development, University of Reading. [2]CoFarm. [3]Cranfield University

Abstract

The simultaneous consideration of economic, environmental, and social sustainability indicators within monitoring frameworks for community-based farming systems remains limited. In response, this research employs stakeholder engagement and participatory techniques to develop a sustainability monitoring framework within community-based farms. The research bridges the gap between existing monitoring frameworks and the specific goals of community-based farming systems.

A systematic literature review was undertaken to catalogue a broad spectrum of sustainability indicators. A refinement process then considered the applicability and efficacy of the extracted indicators to form the preliminary foundation of the monitoring framework. This research will provide a framework that can flexibly adapt to varying contexts to bridge the gap between existing monitoring frameworks and the specific goals of community-based farming systems. This presentation will describe the framework and the approach taken to balance the need for generality and applicability within the bespoke nature of these farming systems.

Spatial distribution of forests covered with ferns and vines in Logged-over Bornean tropical lowland rainforests

Ryuichi Takeshige[1], Kotaro Komatsu[2], Sandy Tsen Tze Lui[3], Reuben Nilus[3], Bibian Diway[4], Ling Chea Yiing[4], Kanehiro Kitayama[2], Yayoi Takeuchi[1], Ryota Aoyagi[2]

[1]National Institute for Environmental Studies. [2]Kyoto University. [3]Sabah Forestry Department. [4]Forest Department Sarawak

Abstract

Human-disturbed tropical forests are expected to play key roles in carbon sequestration and biodiversity conservation due to their potential for high recovery rates after disturbances. However, our previous studies in Borneo reveal that not all forests recover quickly. High-intensity logging leaves some areas dominated by ferns and vines, with low biomass even decades later. Understanding the spatial distribution of these vegetation is essential to elucidate the variation of resilience within landscape. We created vegetation maps across five Forest Management Units (FMUs) in Sabah and Sarawak, Malaysian Borneo, using drone data captured over a thousand hectares as sample points for satellite imagery. Machine-learning models trained on this data achieved over 80% classification accuracy, revealing that 20-40% of the areas are covered with ferns and vines, varying with management history. These findings suggest that ecosystem services provided by human-disturbed forests may be overestimated if forests with reduced recoverability are overlooked.

Cultural Tapestry: Den-Site Selection of Indian Gray Wolves in Tribal Landscapes

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[1]Department of Wildlife Sciences, Aligarh Muslim University, Uttar Pradesh, India.. [2]Indian Forest Service, Divisional Forest Officer, Chatra South, Jharkhand, India.

Abstract

The Indian Gray Wolf (*Canis lupus pallipes*) faces significant challenges in finding safe denning sites amidst India's human-dominated landscapes. As one of the oldest wolf lineages, they have evolved separately and adapted to the semi-arid landscapes of India. This study investigates den-site selection within a 64 km² area of the Mahuadanr Wolf Sanctuary, Jharkhand, India. Between 2022 and 2024, 18 active dens were identified and analysed against 40 random locations to assess the importance of habitat and anthropogenic variables in den-site selection. Results showed that dens are preferred near water sources, human settlements, and within dense Sal (*Shorea robusta*) cover. Interviews with 346 villagers revealed that the Sarna people's cultural association with Sal trees helps reduce disturbances, unintentionally benefiting wolf habitat. This study highlights the importance of understanding ecological needs and integrating traditional cultural practices in wildlife management to conserve the Indian Gray Wolf.

A framework for understanding the experience of nature through cognitive mapping

Nitzan Dan-Rakedzon[1], Whitney Fleming[2], Prof. Nurit Lissovsky[1], Prof. Susan Clayton[3], Prof. Assaf Shwartz[1]

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Abstract

Building a connection to nature is essential for inspiring care and action in biodiversity conservation. Yet, as modernization progresses, the experience of nature—central to this connection—is diminishing globally. Despite its importance for conservation, the concept of 'nature experience' remains poorly defined and understudied. This study aimed to clarify what constitutes a nature experience using a multistage conceptual content cognitive map process with 106 participants from the US, Switzerland, and Israel. The study identified three key dimensions of nature experience: interactions, encountered circumstances, and internal responses, comprising 33 components. Frequently mentioned components include observing wildlife, landscapes, relaxing, and awe for nature. Conversely, fear and home-based nature experiences were rarely noted. These results reveal that nature experience is a subjective perception shaped by three interconnected dimensions. The emphasized components underscore the significance of providing access to extensive, natural spaces which can foster a profound nature experience, promoting care for nature.

Cultural landscape values and aesthetics of beaver-modified landscapes

Miss Stephanie K Webb, Dr Flurina M Wartmann

University of Aberdeen

Abstract

Rewilding efforts in Britain are proliferating, with beavers as a keystone species contributing to such efforts. Beavers as ecosystem engineers can drastically change landscapes. While research on ecosystem services such as water quality and biodiversity improvements linked to beaver-modified habitats is increasing, there is still a lack of research on the cultural services (e.g. education, recreation) and disservices (e.g. negative aesthetics) linked to beaver-modified landscapes, even though these services are very likely linked to public acceptance or rejection of co-existence with beavers. This research uses social science approaches to investigate a suite of cultural ecosystem services and disservices of beaver-modified landscapes in England and Scotland. A survey among over 150 visitors to beaver landscapes suggests positive perceptions of cultural services such as recreation but also some disservices related to landscape aesthetics. This research will provide evidence for policy making and planning for beaver expansion and management in Britain.

Tree Equity score reveals disparity in nature access but opportunities for people and wildlife to benefit

Dr R Early[1], Dr Ben Wheeler[1], Dr Mark Ferguson[1], Ms Alice Drysdale[1], Dr Shari Mang[1], Ms Sally Bavin[2], Adam Cormack[2], Beth Collier[3]

[1]University of Exeter, Penryn Campus. [2]Woodland Trust. [3]Wild In The City

Abstract

Living amongst trees improves our health, wellbeing, safety from flooding, shelter from heatwaves. The most important trees may be in our towns and cities: 84% of people live in urban areas and most nature experiences are within two miles of home. But UK urban tree cover varies wildly, from 3% to 45%, and the communities that could most benefit are losing out. Experiencing biodiversity crucially inspires people to engage with conservation, and inequitable access may be excluding the voices of large swathes of society.

The Woodland Trust's Tree Equity score pioneers the synthesis of biodiversity and human wellbeing priorities. We provide the first analysis of the role that ethnicity, age, health, and socioeconomic status plays in access to UK trees, finding startling discrepancies. We calculate co-benefits for people and nature that could be achieved by improving tree equity – the habitat connectivity and ecosystem services of future urban woodland.

Listening to Marine life - Recording, in-situ processing and near real-time satellite transmission of acoustic data from a low-cost marine drifter buoy

Mr Tom J Knowles, Dr Matthew J Witt

University of Exeter

Abstract

Anthropogenic noise pervades marine soundscapes, disrupting the physiology and behaviour of marine species, and has become an emerging conservation issue. Acoustic research in the offshore environment has largely been hindered by limitations in data transmission and cost; many instruments also need to be physically retrieved to access recorded data. This study introduces a novel low-cost acoustic drifter buoy, with capabilities to record, process, and transmit *in-situ* summaries of acoustic data in near real-time, via the Iridium satellite system.

A field-based test provided 22 h of archived acoustic data (~1 GB) sampled at 5 Hz - 10 kHz. The satellite system repatriated third octave summaries of the acoustic environment sampled over sequential 15-minute periods. This technology could lead to improvements in marine soundscape research, by providing access to a wider scientific community and by fostering greater inclusivity in marine acoustics, which is of relevance to conservation efforts globally.

Evaluation of the e-Surveyor mobile app for undertaking plant surveys and determining habitat type

Dr Lucy E Ridding[1], Morag McCracken[1], Zephyr Orsler[1], Emily Upcott[1], Nadine Mitschunas[1], Karolis Kazlauskis[2], Zeke Marshall[1], Grace Skinner[1], Richard Pywell[1], Tom August[1]

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Abstract

Mobile applications have become a popular way to collect biodiversity data and engage with citizen scientists. However, evaluating the accuracy of data collected using such apps is limited. We assess the mobile app, e-Surveyor, which allows users to undertake a plant survey using AI technology to assist with species identification, to help users determine the broad habitat type. We undertake validation trials to compare plant survey data generated by participants using the app, with data recorded by expert botanists within the same plots, in three different habitat types. On average, app participants recorded nearly half of all the species present within a given plot. Of the species recorded, over 70% were identified correctly at the species level. Furthermore, over 75% of participants identified the correct habitat type from their generated plant survey list. This demonstrates the benefit of using such apps to educate and support wildlife recording.

A Potential of Introducing Game Engine-Powered 3D Visualization for NbS Social Implementation

Dr. Kazuaki Ohtsuki[1], Atsushi Makino[1], Dr. Re Itsukushima[2], Dr. Masakazu Hashimoto[3], Dr. Keigo Nakamura[4], Takahiro Sato[5], Dr. Takanori Kono[6], Dr. Jun Nishihiro[7]

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Abstract

The digital twin is advancing across various fields, driven by the widespread use of 3D data. In construction, it has mainly focused on solid structures. However, landscape restoration using Nature-based Solutions (NbS) requires the representation of complex natural objects, landforms that change over time, moving flow in streams, and landmarks in both the far and near field. In addition, the generated 3D space should allow models to not only be seen, but also provide experience in the field. A game engine-powered 3D visual space can meet these needs for social implementation and trigger a change in citizen mindset that will make people have a positive attitude towards NbS and evoke positive involvement and action. In our presentation, we will demonstrate the effectiveness of introducing high quality game engine-powered 3D for NbS in the case of flood management based on several case studies in Japanese rivers with Nature-based Flood Management.

Urban biodiversity is affected by human-designed features of public squares

Andrew J. Fairbairn[1], Sebastian T. Meyer[1], Maximilian Mühlbauer[1,2], Kirsten Jung[3], Beate Apfelbeck[1,4], Katherine Berthon[5,6], Andrew Frank[1], Lea Guthmann[1], Jana Jokisch[1], Kristel Kerler[1,7], Nina Müller[8], Christina Obster[1], Michaela Unterbichler[1], Johanna Webersberger[1], Juliane Matejka[1], Paul Depner[1], Wolfgang W. Weisser[1]

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Abstract

Cities are primarily designed for people, but also provide habitats for other species. As urban biodiversity's importance for humans becomes clearer, understanding the drivers of urban biodiversity is crucial. Our understanding of how urban vegetation and other features allow different species to occur is still limited. We analysed 103 public squares in Munich, Germany, to see how their features affect seven taxa. Using linear models, we found that diversity, abundance and activity of most groups increased with the proportion of vegetation. Using random forests, we determined which features were most important for each taxonomic group. Our results showed that groups differed in effects of features. Thus, while the amount of green on a square is important, the features that make up that green strongly influence the diversity and abundance of each taxonomic group. We recommend a multifaceted approach when designing biodiverse urban spaces, considering features important to different taxonomic groups.

Proper Places for Plants, Pollinators, and People

Dr Sarah C Goslee

USDA Agricultural Research Service, University Park, PA, USA

Abstract

Balancing multiple land uses and management practices to benefit plants, pollinators, and people can be a challenge, especially given increasing climatic and environmental pressures. Combining multiple data sources, statistical models, and simulation models at appropriate spatial, temporal, and thematic resolutions can improve the knowledge available to guide land managers. The Beescape decision support tool integrates climate, plants, and pollinators across agricultural and natural land covers to provide information on environmental suitability and economic impact of pollinators. Current and future work to will increase spatial resolution and add seasonal forecasting capability.

Non-monetary valuation with a US federal agency: The case of coral reef ecosystems

Dr Rachelle K Gould[1], Nathan Smith[2,3], Dr. Mary Allen[4], Dr. Lou Nadeau[5], Dr. Polina Dineva[6], Harriet Nash[7], Charles Goodhue[5], Hannah Stroud[5]

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Abstract

This presentation will report on an ongoing research-policy collaboration that aims to advance non-monetary valuation in conservation policy. The United States NOAA (National Oceanic and Atmospheric Administration) is implementing its periodic Valuation of US Coral Reef Ecosystems. These valuations inform policy and management decisions for 10+-year periods. The current effort adds a new nonmonetary dimension to the traditional monetary valuation. The nonmonetary dimension was added in direct response to stakeholder feedback that monetary valuation alone insufficiently represents coral reefs' importance—yet research is still working to illuminate the path to effective plural valuation in a policy context. The transdisciplinary team conducting this valuation is trialing various nonmonetary valuation approaches that the IPBES Values Assessment recommended. The team aims to not only create a meaningful valuation of coral reef ecosystems in the US but to also inform diverse efforts to conduct rigorous, policy-and-management relevant plural valuation.

Relationship between vegetation change and availability of thatch use in a wetland.

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[1]Graduate School of Agricultural and Life Sciences, University of Tokyo. [2]Center for Climate Change Adaptation, National Institute for Environmental Studies

Abstract

Anthropogenic environmental changes can affect not only the change of biological communities but also the sustainability of the cultures that utilize them. Lake Kasumigaura in Japan, which has a thatch field, has experienced long-term water level alteration for water usage, which is reported to have caused the change in the species composition of its lakeshore grasslands. To clarify the long-term changes in thatch quantity and quality, we analyzed the vegetation data from 1981 to 2021 using criteria of the usefulness of each species, which was determined from interviews with thatchers. Although species richness and diversity showed no significant changes, the coverage of species valuable as thatch (e.g., *Ischaemum aristatum* var. *glaucum*) has decreased since the 1990s. In contrast, species that reduce thatch quality, such as *Isachne globosa* and *Carex dispalata*, have increased. The evaluation based on use criteria and long-term data revealed that vegetation changes have affected thatch use.

Rights-of-nature laws: An interdisciplinary perspective on workable and scientifically grounded legal-scientific concepts

Dr Maximilian Nawrath, Dr Eléonore Maitre-Ekern, Bård Hobæk

Norwegian Institute for Water Research

Abstract

Despite an ever-growing body of environmental laws, biodiversity loss and climate breakdown persist globally. Strengthening these laws is seen as critical to reversing these trends. Rights-of-nature laws, increasingly adopted worldwide, aim to improve the legal system's ability to protect the environment by granting ecosystems legal rights. However, the lack of clarity in the legal-scientific concepts embedded within these laws hampers their effective implementation. We examined these concepts within ten rights-of-nature laws across five continents, using content analysis of data from 23 semi-structured interdisciplinary expert interviews. We identified 21 key concepts, with the right to "exist," "restoration," and "evolutionary processes" most frequently employed. Our findings highlight that concepts are often interpreted in multiple, contrasting, and conflicting ways across disciplines, while those referring to ecological functions were understood most consistently. We propose clearer, scientifically grounded legal-scientific language to ensure rights-of-nature laws can be upheld effectively and achieve their intended impact in courts.

Steps towards ecological understanding and management of harmful algal blooms in the Mediterranean Sea: environmental factors and interannual trend over a 26-year time series.

Giorgia Ravera[1], Fabio Ricci[2], Federica Grilli[3], Samuela Capellacci[2], Christian Ferrarin[4], Silvia Casabianca[2], Monica Cangini[5], Sonia Dall'Ara[5], Giuseppe Prioli[6], Mauro Marini[3], Antonella Penna[2]

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Abstract

Dinophysis spp. is a harmful marine dinoflagellate, lipophilic-toxins producer. These accumulate in shellfish tissues so monitoring is required to ensure safe human consumption. This study aimed to provide a basis for future ecological modelling of harmful algal blooms (HABs) in the Adriatic subregion of the Mediterranean Sea. *Dinophysis* spp. monitoring data from 1998 to 2023 were merged and analysed with meteorological and oceanographic data. Univariate and multivariate analyses showed that *Dinophysis* was most abundant in late spring and early summer, while toxicity events were mostly recorded in autumn and winter. In this area, *Dinophys*is correlated positively with temperature and salinity and negatively with chlorophyll-*a* and DIN. Moreover, interannual trends indicated a decrease in abundance and toxicity of *Dinophysis* spp. in relation to changing environmental parameters in the Mediterranean and, consequently, water use in the basins. Furthermore, a circulation model helped to visualize *Dinophysis* development, providing useful information for shellfish management.

Can beavers clean British streams? A study from three agricultural catchments in south-west England

Mr Gareth Bradbury[1], Dr Alan Puttock[1], Dr Gemma Coxon[2], Dr Stewart Clarke[3], Prof Richard E Brazier[1]

[1]University of Exeter. [2]University of Bristol. [3]National Trust

Abstract

After an absence of 400 years, Eurasian beavers *Castor fiber* are returning to agricultural landscapes across Britain, through re-introduction or subsequent natural colonisation. Beaver ponds, created by damming of smaller tributaries, have the potential to improve river water quality through the settling of solids and uptake and cycling of nutrients. By contrast there are periodic releases of solids and nutrients due to burrow and canal excavations, dam breaches and nutrient inputs from the beavers themselves and the diverse fauna and flora supported in their wetlands.

To examine the dynamic effects of beavers on the transfer of sediments and nutrients in catchments, we undertook water and sediment sampling at three beaver re-introduction sites in South-West England over two years.

The beaver wetlands were shown to reduce nutrient pollution where inflow loads were high. The mixed temporal and spatial dimensions of this monitoring help resolve differences in results between previously published studies.

SITE VISITS TO FLOODPLAIN MEADOWS: A MEANS OF INTEGRATING OUTREACH AND RESEARCH TO ACHIEVE IMPACT

Dr Irina Tatarenko, Emma Rothero, Dr David Gowing

Open University, UK

Abstract

Exchanging knowledge with stakeholders has been a long-standing challenge for ecologists. Even when focussing on a single habitat, like floodplain meadows, multiple interests are involved (Rothero, 2020). Site visits are a useful channel for communication between academics and practitioners. Since the Floodplain Meadow Partnership formed in 2006, 220 established sites and 320 restoration sites have been visited. Meeting practitioners on their own turf creates an important social component to knowledge exchange, facilitating trust.

Where land managers are directly involved in data collection, it enhances their confidence in the results. It is important to share analysed data directly with them, perhaps via a site report, whilst also pooling the data with those from other sites for use in fundamental research.

Face-to-face meetings are the simplest, yet most powerful, way to build confidence in recommendations based on research, thus promoting their implementation and ultimately a positive impact.

Unleashed: walking dogs off the lead greatly increases habitat disturbance in UK lowland heathlands

Dr Rebecca L Thomas[1], Dr Sarah K Papworth[1], Professor Mark D.E. Fellowes[1,2]

[1]Royal Holloway University of London. [2]University of Reading

Abstract

Dogs (*Canis familiaris*) are globally the dominant companion animal. As urban areas extend, dogs are exercised in green space close to housing. In southern England these areas include lowland heath, a habitat of high conservation value. To quantify disturbance caused by dog walking, we used GPS units to track the movement of people and their dogs across four lowland heath sites, mapping potential areas of disturbance. The walks of 162 owners and their 185 dogs were recorded. Mean (±SE) walk distance was 3.75±1.68 km and dogs were a median distance of 20m from the owner during walks. Most dogs were walked off the lead. This resulted in up to a 21% increase in reserve area disturbed. In one reserve, >90% of the area was disturbed by dogs, greatly eroding its conservation value. This highlights the importance of considering how dog ownership can exacerbate levels of disturbance in sensitive habitats.

A death trap in the nest. Anthropogenic nest material entanglement causes significant mortality in a terrestrial bird

Ursula M. Heinze[1], Dr Marta Acácio[2], Dr Aldina M. A. Franco[1], Dr Inês Catry[3]

[1]University of East Anglia. [2]University of Tel Aviv. [3]University of Porto

Abstract

Plastic and synthetic fibers are widespread and impact wildlife globally. While seabird entanglement is well-documented, effects on terrestrial birds are less studied.

We investigated the impact of entanglement on a long-lived terrestrial species. Over four years, we photographed 568 White Stork (Ciconia ciconia) nests, assessing nest contents and nestling survival. Weekly surveys of 93 nests were conducted to determine entanglement materials and mortality.

We found that 91% of nests contained anthropogenic materials. Nearly a third showed nestling entanglements, with 12% of nestlings entangled, primarily in polypropylene ropes linked to agricultural activities. These entanglements, mostly occurring in the first weeks after hatching, caused severe injuries and mortality. This study highlights high rates of nestling entanglement, which without frequent monitoring, could have been mistaken for natural mortality. Urgent policies are needed to remove polypropylene ropes from the environment to protect the survival and welfare of terrestrial birds.

Exploring biocultural diversity of three rural German landscapes through oral histories

Dr Emmeline Topp[1,2], Professor Tobias Plieninger[1,2]

[1]University of Kassel. [2]University of Göttingen

Abstract

People shape landscapes and are in turn, shaped by landscapes. The Biodiversity Exploratories is a flagship biodiversity monitoring program taking place in three distinct regions of rural Germany: Schorfheide-Chorin, Hainich-Dün, and Swäbische Alb. In these regions, rural communities are tightly coupled to the grasslands and forests in their immediate surroundings. These interlinkages may be understood as biocultural diversity. Through oral history interviews with people over the age of 70 who have long lived in these landscapes, we explore people's perception of landscape change over time, and how people express their relationship with these ecosystems through regional linguistic style. We highlight differences among the three regions, and pinpoint how grassland and forest biodiversity contribute to cultural heritage and attachment to place.

How to integrate the flood risk control and biodiversity conservation ? Importance of integrating traditional flood control system with modern river engineering.

Dr Rei Itsukushima[1], Dr Kazuaki Ohtsuki[2], Dr Tatsuro Sato[3]

[1]Kyushu Institute of Technology. [2]University of Yamanashi. [3]Kyushu University

Abstract

Flood control and biodiversity conservation as climate change adaptation are urgent issues for the sustainable existence of human. However, engineering-based flood management and land use change, especially urbanization, have a significant negative impact on biodiversity. Although conventional river-engineering structures have been installed in many countries to prevent flood damage, these measures are vulnerable to the large-scale floods that exceed the design level of the infrastructure. In contrast, traditional strategies and flood-control technology that has been used since ancient times allow inundation and instead strive to minimize flood damage in floodplains. In addition, flood control measures that allow inundation are highly compatible with the conservation of floodplain ecosystems that are currently in danger of disappearing. This presentation will introduce ideas for biodiversity conservation and restoration through the integration of traditional Japanese flood management, which allows for some inundation, and modern engineering methods.

Identifying the optimal landscape configuration for landscape multifunctionality

Dr Andrea Larissa Boesing[1], Dr Valentin H. Klaus[2,3], Dr Margot Neyret[4], Dr Gaëtane Le Provost[5], Dr Sophie Peter[6], Dr Markus Fischer[7], Dr Peter Manning[8]

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Abstract

Previous research into the drivers of landscape multifunctionality have focused on land use composition changes, but the spatial configuration of different land use types also drives ecosystem services (ES) supply. Here we present the *net-balance spatial interactions hypothesis*. This posits that the strength and direction of local and surrounding landscape influences on the local supply of an individual ES will drive its optimal landscape configuration. Accordingly, the net balance of these influences across multiple prioritized ES will determine the optimal configuration for landscape multifunctionality. Using empirical data from four high-prioritized grassland ES in three regions in Germany, we show that different ES benefit from different landscape management strategies. When these patterns are combined with stakeholders' prioritization, we predict that all stakeholder groups would benefit from the same strategy. Our framework is applicable to land-use planning scenarios that aim to maximize multiple ES.

Residents' Perceptions and Experiences of Urban Nature on the Implementation of Nature-based Sustainable Solutions in Ouagadougou

Mr. Youmanli Enok Ferdinand Combary, Prof. Bernard T. Atchrimi

Regional Center of Excellence on Sustainable Cities in Africa (CERViDA-DOUNEDON), University of Lome, Lome 01BP 1515, Togo

Abstract

With rapid urban growth posing major environmental and social challenges, nature-based solutions (NbS) are at the heart of urban strategies for sustainability and resilience. To be best planned and implemented, they need to consider geographical and socio-cultural contexts, including the local perceptions and experiences of residents. This study aimed to explore how socio-demographic factors influence perceptions and experiences of urban nature, and to identify implications for urban planning and the implementation of NbS. We conducted questionnaire surveys among 401 people, with different socio-demographic profiles and different places of residence. We then conducted group interviews with 20 people and triangulated the collected data to understand the different interactions between the residents and urban nature. The main results show that, overall, residents perceive urban nature positively. Perceptions and experiences of nature vary considerably according to respondents' socio-demographic profiles and proximity to green spaces.

Developing a Conservation Tool for Combating the Illegal Turtle Trade

Dr. Jack Hopkins[1], Dr. Matthew Chatfield[2], Dr. Cheryl Frederick[1], Mr. Derek Yorks[3]

[1]Center for Wildlife Studies. [2]University of Maine. [3]Maine Department of Inland Fisheries and Wildlife

Abstract

As one of the most endangered vertebrate groups on Earth, turtles have suffered from overcollection to meet the demands of a growing illegal pet trade. To circumvent prosecution, poachers often 'launder' turtles to hide their origins, passing poached turtles off as legally captive-bred. Unfortunately, law enforcement authorities often lack objective scientific evidence that confiscated turtles were poached from the wild or raised in captivity. In this study, we built a predictive model used to classify Blanding's (n=47), spotted (n=134), and wood (n=259) turtles in the Northeast United States as wild-caught or captive-bred. We found that our model had nearly perfect predictive accuracy (96%; 2 misclassifications) in classifying wild turtles (n=327) as wild and captive turtles (n=113) as captive based on the chemical composition of their claw tips. We plan to expand our efforts globally and develop models to identify the geographic origins of confiscated turtles to aid in repatriation efforts.

Socio-economic drivers of spatial distribution of potential ecological traps for semiaquatic insects caused by polarised light in urban landscapes using deep learning.

Dr. Giovanna Villalobos-Jiménez[1], Dr. Juan M. López-Téllez[2], Dr. Héctor De-la-Torre-Gutiérrez[3], Dr. Léon F. Dozal-García[1]

[1]Centro de Investigación en Ciencias de Información Geoespacial, sede Aguascalientes. [2]Centro de Investigaciones en Óptica, A.C., sede Aguascalientes. [3]Centro de Investigación en Matemáticas, A.C., sede Aguascalientes

Abstract

Semiaquatic insects, such as mayflies and dragonflies, use polarised light to detect suitable habitats for reproduction. However, a wide range of surfaces strongly reflect polarised light, such as cars, solar panels, gravestones, asphalt, among others. Thus, the insects oviposit on these surfaces and the eggs laid do not survive, leading to an ecological trap. The impacts of polarised light pollution (PLP) are well documented on a local scale, but little is known about the spatial patterns or socio-economic drivers of PLP in urban landscapes, where these surfaces can be abundant. Here, we implement convolutional neural networks (CNN) to remotely detect sources of PLP in the urban landscape, particularly cars and solar panels, using satellite imagery. We then analyse the spatial patterns of PLP in the urban landscape and its association with socio-economic drivers (population density, marginalisation levels) to understand how human activity shapes the distribution of PLP sources in cities.

Integrating Social Innovations to Enhance Community Engagement in Ecological Restoration on the Tibetan Plateau

Dr Li Li[1], Ms Huxuan Dai[1], Prof. Mark Riley[2]

[1]Department of Health and Environmental Sciences, School of Science, Xi'an Jiaotong-Liverpool University. [2]School of Environmental Sciences, University of Liverpool

Abstract

One of the world's largest ecological restoration initiatives is currently underway on the Tibetan grasslands. The active engagement of local communities is pivotal for ensuring both social equity and the long-term efficacy of the restoration. However, the scientific explanation of degradation, along with the restoration techniques and tools employed, are novel to the local communities, and their cultural implications remain ambiguous. This study investigates the attitudes and perceptions among local Tibetan herders toward grassland restoration. We discovered that environmental baseline conditions profoundly influence local perceptions, with the most unstable areas perceived the restoration as least urgent ($p<0.001$) but having the highest expectations for positive outcomes ($p<0.001$). Moreover, local elites' innovative narratives about restoration's cultural significance serve as a crucial mechanism to foster incentives for local engagement. Our findings highlight the importance of integrating the social innovations of local communities as an effective means to mobilize community adaptation to ecological challenges.

Taxonomic description patterns of major lineages are related to author numbers, body size, distribution, and public interest

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Abstract

Taxonomic description patterns illustrate how the rate of new descriptions within taxonomic groups changes over time. This study combines description dates, phylogenetic information, and author numbers for all eukaryotic life on Earth from LifeGate, alongside occurrences from GBIF, public interest data from the Biodiversity in Literature project, and habitat preferences and body size data from Wikipedia. We fitted curves to the description patterns and estimated maximum description pace, the time to reach 10% of current diversity, expected total diversity, and variance between the empirical and fitted data. We created a structural equation model linking these variables, revealing strong support for the influence of body size and public interest, mediated by the number of authors, and to a lesser extent, other variables. Our results provide evidence for the effects of traits, distribution, and public interest on description patterns across all major lineages of eukaryotic life on Earth.

Impacts of road verge floral composition and adjacent road traffic on European pollinators

Chris Wyver[1], Andrijana Andrić[2], Maja Arok[2], Carolin Biegerl[3], Sofia Blomqvist[4], Christophe Dominik[5], Noah Feldmann[5], William Fiordaliso[6], Mike Garratt[1], Andrea Holzschuh[3], Hanna Honchar[5], Reet Karise[7], Hanno Korten[3], Sarah Lescot[6], Egle Liiskmann[7], John MacArthur[1], Marika Mänd[7], Denis Michez[6], Erik Öckinger[8], Oliver Schweiger[5], Tea Skendžić[2], Henrik G Smith[4], Ingolf Steffan-Dewenter[3], Louise Truslove[1], Sanja Veselić[2], Dušanka Vujanović[6], Deepa Senapathi[1], Simon G Potts[1]

[1]University of Reading. [2]University of Novi Sad. [3]Julius-Maximilians-Universität Würzburg. [4]Lund University. [5]Helmholtz Centre for Environmental Research - UFZ. [6]University of Mons. [7]Estonian University of Life Sciences. [8]Swedish University of Agricultural Sciences

Abstract

Roads are vital to human society, spanning over 5 million kilometres in Europe. For insect pollinators however, they pose large risks, such as vehicle collisions, air quality issues, noise and light pollution, and habitat fragmentation. Nevertheless, unpaved road verges, if managed well, have the potential to provide valuable resources for pollinators. It is currently unclear how road traffic and road verges impact insect pollinators.

Across five countries, we measured pollinator abundance and diversity in road verges in relation to floral abundance, traffic speed and density, and surrounding land use. Insect mortality from traffic collisions was also assessed using car-mounted sticky traps. We find that increased floral abundance supports more pollinators, and more diverse verges support a higher diversity of pollinators. Pollinator abundance also decreased at higher traffic speeds. This suggests that well-managed verges can benefit pollinators, with the largest benefit seen alongside lower-speed roads.

Understanding primate distribution, behaviour and human-primate interactionsthrough group interviews inside and outside protected areas in southern Guinea-Bissau

Miss Chloe Chesney[1,2], Dr Elena Bersacola[2], Dr Kimberley Hockings[2], Prof Tânia Minhós[1], Prof Amélia Frazão-Moreira[1]

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Abstract

With wildlife populations plummeting, investigating local ecological knowledge and its incorporation into conservation is increasingly vital. Research outside protected areas (PAs) is important because the majority of primates inhabit these areas including over 80% of Critically Endangered western chimpanzees (*Pan troglodytes verus*). This is the first project, to our knowledge, to investigate primate distribution through focus-group interviews and to compare data from the same locations over an 18-year period inside and outside PAs in southern Guinea-Bissau. Semi-structured, focus-group interviews with photo-elicitation exercises were conducted in more than 160 villages. The data from 2006-2009 and 2022-2024 show changes to the presence, distribution, behaviour and interactions with humans of ten primate species. Spatial data were mapped using GIS. Results include higher reported diversity of primates and more 'negative' human-primate interactions inside PAs than outside, highlighting the need to address these interactions within PAs and develop culturally appropriate community-led conservation initiatives outside PAs.

Investigation of the nature and extent of seal-fishery interactions in UK waters to inform mitigation measures.

Beatrice McWilliams, Dr Katrina Davis, Jonathan Rutter

University of Oxford

Abstract

Populations of Grey and Harbour Seals in UK waters have significantly increased from low levels in the early 1900s, and are often cited as a conservation success. But with greater numbers of these apex predators comes reports of growing conflict with fisheries, both directly through depredation and gear damage, and indirectly through competition for resources utilised by both fisheries and seals. However, to address these issues, there must be understanding of the nature and extent of seal-fishery interactions, which currently is limited. This study uses population counts and GPS tracking data of UK seals to assess the overlap between seal foraging and fishing in UK waters, as well as individual vessel tracks to determine whether fishing effort predicts seal behaviour. This study will help guide fisheries mitigation measures to achieve positive ecological, economic, and social outcomes.

Effect of urban road noise pollution on free-ranging wildlife: A Phantom Road experiment

PhD candidate Héloïse Courtines[1], Dr Angeliki Savvantoglou[2], Dr Paul Lintott[1]

[1]University of the West of England. [2]Bear Bones Non Profit Civil Society

Abstract

Since the Industrial Revolution, many landscapes have been increasingly characterized by their anthropogenic soundscapes, which can negatively impact ecological communities. The rapid transition to electric vehicles over the next decade will dramatically change our soundscapes and lead to adaptations in wildlife behavior and movement. Using a Before-After-Control-Impact Phantom Road experimental design in the Voras Mountains, North Greece, we investigated how wildlife responds to both electric and petrol vehicle noise traveling at 50km/h. This poster will outline the initial findings including the impact on terrestrial mammals (ranging from bears to martens), bat foraging and feeding behavior, and bird activity. We will discuss how anthropogenic environmental change results from urban road traffic noise, alongside predicting how the transition towards a soundscape dominated by electric vehicles will impact wildlife in the future.

Edge Artificial Intelligence reveals detailed patterns and drivers of urban wildlife activity

Ella Browning[1], Kate E Jones[2], Wendi Li[2], Duncan Wilson[2]

[1]University of Oxford. [2]University College London

Abstract

Nature-friendly cities can significantly contribute to human wellbeing, biodiversity targets, and climate action, but progress is hindered by a lack of data-driven insights of how urban design can benefit both people and nature. Using a network of edge AI acoustic devices deployed around a mixed-use urban landscape (Queen Elizabeth Olympic Park, (QEOP) London), we continuously monitored bat activity from 2017 to 2023, to investigate the fine-scale effects of human activities and environmental variables, recording over eight-billion observations. Despite QEOP being designed to promote biodiversity, pipistrelles, a common synanthropic taxa, dominated the observations (95%). We found significant negative impacts of large stadium events on bat activity patterns and increases in activity during the hibernation period over eight years, suggesting the influence of climate change. These results emphasise the need for a data-driven approach enabled by new technologies to address gaps in delivering urban spaces for sustainable coexistence between people and nature.

Using stable isotope analysis by IRMS to understand the changing diet of Reading (UK's) urban hedgehogs (*Erinaceus europaeus*).

Mrs Lea Jayne Grayston-Smith

University of Reading

Abstract

The Western European hedgehog (*Erinaceus europaeus*) is in decline within the UK and has a natural diet consisting of a rich and varied selection of invertebrate species, which change with seasonal fluctuations. The provision of anthropogenic "hedgehog feeds" is said to help the success of the species by providing a constant and consistent source of food. Using Isotope ratio mass spectrometry (IRMS) dietary analysis was conducted on 61 deceased individuals to assess the importance of these novel anthropogenic foods in an urban hedgehog's diet. Spine tips all showed ratio patterns consistent with eating anthropogenic foods. The ratios of ẟ13C to ẟ15N indicate little variation in food source across the length of the spine and an enrichment of ẟ15N in their diet, reflecting a diet with little variation and consumption of tertiary species, inconsistent of what would be expected from an insectivorous species.

Monitoring loss of woody vegetation during an active armed conflict in Tigray (Ethiopia)

Dr Henrike Schulte to Bühne[1], Dr Eoghan Darbyshire[2], Dr Teklehaymanot G. Weldemichel[3], Professor Jan Nyssen[4], Mr Doug Weir[2,5]

[1]Zoological Society of London. [2]Conflict and Environment Observatory. [3]Norwegian University of Science and Technology. [4]Ghent University. [5]King's College London

Abstract

Armed conflicts often cause environmental degradation, and identifying areas where this occurs is important for designing effective post-conflict recovery strategies. We illustrate how open-source satellite data can be used to support the identification of woody vegetation loss during armed conflicts when ground-based assessments are difficult or impossible, using Tigray, Ethiopia, as a case study. Potential woody vegetation loss extended across 930 km^2 and was mostly concentrated along major roads; however, vegetation recovery has continued during the war across a significantly larger area (ca. 2,600 km^2). Woody vegetation loss appears to be unrelated to observed drought conditions or large-scale wildfires. We suggest that conflict-driven deforestation, caused by increases in fuel wood demands, is instead driving the observed losses in some areas of Tigray. Eventual recovery efforts will have to include woody vegetation restoration in areas where it was lost to ensure both food security and livelihoods of local communities.

Self-cleaning slipways: harnessing species interactions for sustainable management of coastal infrastructure

Miss Sally I Henderson[1], Dr Louise Firth[2], Dr Matthew Perkins[3], Dr John Griffin[1]

[1]Swansea University. [2]University College Cork. [3]University of Plymouth

Abstract

Enhancing grazer-algae interactions on coastal infrastructure could provide a sustainable, nature-based solution to hazardous algae management. Boat slipways must be periodically cleaned to prevent algal growth and meet safety standards. Current maintenance solutions are short-term, using chemicals and power-washers which are expensive and environmentally damaging. Intertidal molluscan grazers, such as the common limpet (*Patella vulgata*), naturally drive shifts between algae dominated and bare substrate. Ecologically engineering slipway surfaces to encourage targeted limpet grazing could sustainably shift slipways to safer bare-substrate states. Two experiments are currently in action investigating the effects of added surface features and surface roughness on limpet movement and grazing efficiency. Preliminary results show limpets clearly exhibiting diurnal movement cycles and comfortably preventing algal growth after 10 months. Scaled-up and species diversity experiments are now planned to determine optimal engineering solutions facilitating limpets, and potentially other grazers, to prevent algal growth at a scale relevant for slipway use.

Nature Benefits to Human Wellbeing: Evidence from Eastern and Central Madagascar

Dr Jan Petzold[1], Dr Sasha Kosanic[2], Dr Mialy Razanajatovo[3]

[1]Ludwig-Maximilians-University of Munich. [2]Liverpool John Moores University. [3]University of Hohenheim

Abstract

Recent climate change is impacting our ecosystems and their benefits. Marginalised communities in the Global South are at particular risk. In this research, we look at the perception of climate change impacts by local communities on nature's benefits (i.e., Nature's Contributions to People (NCP) framework) and their livelihoods. We were interested in seeing how these changes affect the well-being of rural communities in four sites in Madagascar. Our study sites were in Eastern and Central Madagascar.

Both nature's material and non-material benefits are affected by climate change through rising sea levels, coastal erosion, biodiversity loss, droughts, precipitation, and temperature variability. Those drastic changes were also expressed by 'ecological grief' within local communities.

Findings showed that climate change and related ecosystem degradation have impacts on NCP and the well-being of local communities in Madagascar. The outcome of our research provides evidence-based information to local policymakers, conservation practitioners, and climate change agencies.

Scenario planning for an uncertain world

Professor Lindsey Gillson[1,2], Professor Pen Holland[3], Dr Inês Martins[1], Mr Pattrawut Pusingha[4], Dr Smriti Safaya[5]

[1]Leverhulme Centre for Anthropocene Biodiversity, University of York. [2]Plant Conservation Unit, University of Cape Town. [3]Department of Biology, University of York. [4]Department of Environment and Geography, University of York. [5]Department of Education, University of York

Abstract

Scenario planning is an important tool in exploring possible futures under conditions of high uncertainty and / or disagreement. While conventional modelling approaches utilise agreed scenarios (e.g. Representative Concentration Pathways), there are issues of scale, and social dimensions, that are often difficult to capture using conventional scenario planning approaches. Scenario planning therefore needs to blend ecological and environmental data with social, economic and cultural perspectives. Furthermore, agreement on a particular desired scenario (and how to work towards it) requires changes in behaviour at individual, community and policy levels. We propose a scaled approach to scenario planning that considers agreement, certainty and temporal scale in an integrated framework to facilitate change at local to global change.

A comparison of insect biodiversity in three nature reserves in Preston with differing cutting regimes.

Miss Lauren Fairfax[1,2], Dr Frankie J Kerridge[1]

[1]Myerscough University Centre. [2]Bowland Ecology Ltd.

Abstract

Insect biodiversity in grassland habitats has been declining for decades. Reserve managers are faced with trying to halt these declines while maintaining sites as public spaces. Studies of grassland management comparing grazing to cutting and removal have shown contradictory results for different invertebrate orders thus managers currently use a range of techniques. Three nature reserves with different management techniques were compared to explore the impact on insect diversity in six target orders. Pitfall trapping was conducted along ten metre transects combined with sweep netting and visual surveys of the wildflower meadows. One site had a much lower Shannon diversity index than the other two which was linked to the use of heavy machinery causing soil compaction. The higher diversity sites showed similar levels of diversity despite different management practices. Further studies are recommended to expand the number of orders monitored and confirm the trends at alternative sites.

Food, Fear, and Forests: Modelling Cervid Foraging Behaviour and Human Disturbance in Sweden

Dr. Laura Saggiomo, Sarah L Gore, Dr. Fredrik Widemo

Department of Wildlife, Fish, and Environmental Studies Swedish University of Agricultural Sciences

Abstract

In Sweden, four wild cervid species -moose, red deer, roe deer, and fallow deer- coexist alongside semi-domesticated reindeer. Cervids significantly affect their habitats through foraging, with browsing and grazing often leading to damage in forests and crops. Simultaneously, human activities and infrastructure disturb these free-ranging herbivores, forcing them to trade-off between foraging in preferred habitats and avoiding perceived predation risks. The balance between these factors, along with the services and disservices provided by these large mammals, is a common focus of research and scientific scrutiny.

In this study, we combined data from nationwide field surveys, statistical modelling, and spatial analysis to examine how food availability, resource composition, landscape features, deer species composition, and human activities influence the spatial and foraging decisions of these species. Additionally, we developed a risk map to guide more effective and sustainable management strategies, mitigate human-wildlife conflicts, and promote biodiversity conservation in a forestry-dominated country.

Extreme weather events and vector-borne disease ecology in Madagascar

Estelle Raobson[1,2], C. Jessica E. Metcalf[3], Benjamin L. Rice[3]

[1]Mention Zoologie et Biodiversité Animale, University of Antananarivo; Antananarivo, Madagascar. [2]Association Vahatra; Antananarivo, Madagascar. [3]Department of Ecology and Evolutionary Biology, Princeton University; Princeton, NJ, USA

Abstract

Climate change is driving increases in the intensity of extreme weather events, but few data are available on how this modulates the ecology of vector-borne diseases such as malaria. Tropical cyclones result in heavy rainfall and flooding, conditions that can damage landscapes and infrastructure with downstream effects on disease control efforts. In this study, we focus on malaria in the district of Mananjary, southeastern Madagascar. Following major tropical cyclones in 2022 and 2023, we observed a rapid increase in malaria infection with 13.5% to 49.1% of children infected in the two months following these cyclones. These findings highlight the value of long-term disease data in climate-vulnerable geographies and the vulnerability of pathogen systems to climate variability. We emphasize the importance of resilient public health strategies to minimize the impacts of extreme weather on the disease.

Livestock grazing of salt marshes affects the abundance and diets of fish

Hannah Charan-Dixon[1], Ann-Christin Ziebell[1], Nino van Hees[1], Alenya Merz[1], Tamás Fülep[1], Senyo Kwami[1], Patricia Lamker[1], Annika Arvin-Blaauw[1], Angélique Meyer[1], Nadia Hijner[1], Ingrid Tulp[2], Britas K Eriksson[1]

[1]Rijksuniversiteit Groningen, Groningen Institute for Evolutionary Life Sciences.
[2]Wageningen Marine Research, Wageningen University and Research

Abstract

Livestock grazing is a common method to control salt marsh vegetation, but the effects on fish are often not considered when setting management objectives. We tested how different intensities of livestock grazing (ungrazed, extensively grazed or intensively grazed) influenced the abundance and diets of fish in Dutch Wadden Sea salt marshes. Gobies and seabass were more abundant in ungrazed creeks relative to grazed areas. Goby diets in ungrazed creeks predominantly consisted of the mysid, *Neomysis integer*, which differed from diets in grazed creeks which were dominated by *Corophium volutator*. The proportion of gobies with empty stomachs and reproductive organs was affected by grazing intensity. There were no effects of grazing treatment on the diet composition of seabass, herring, and flounder, though the body condition of post-larval flounder was highest in ungrazed creeks. Our results highlight livestock grazing affects fish, and this needs to be considered when establishing marsh management goals.

Past Paths and Plant Patterns: Preserving Grassland Biodiversity

Professor Sara A. O. Cousins

Stockholm University

Abstract

Landscape history shapes today's vegetation patterns, and understanding the timeline and magnitude of past habitat loss is key for effective conservation and restoration of threatened habitats. While historical geodata like maps and aerial photographs help analyse these changes in grasslands, they miss how people and livestock moved through landscapes. These movements play a significant role in connecting biodiversity in grasslands far apart. For example, 214 people cutting species-rich hay meadows in Sweden carried over 20,000 seeds from 500+ species on their clothing in one day, while a single cow can transport thousands of seeds between grasslands during the growing season.

To better understand these processes, we need to work across disciplines like history and archaeology, and use practical experiments. This broader approach will help us uncover how historical land use shaped species-rich grasslands and inform conservation strategies, allowing us to mimic these dispersal processes to support and restore grassland biodiversity.

Country, calypso or carimbó? The role of cultural value shifts in advancing deforestation frontiers.

Mr Jordan O Lafayette[1,2,3], Dr Luke Parry[1], Dr Chris Ives[2], Dr Jeffrey Hoelle[4], Dr Carlos Valerio Gomes[3]

[1]Lancaster University. [2]University of Nottingham. [3]Universidade Federal do Pará (UFPA). [4]University of California Santa Barbara

Abstract

Deforestation is a major driver of biodiversity loss. Few regions have been more historically affected and at greater risk of continued intensive deforestation than the Brazilian Amazon. Past efforts to curb deforestation have proven ineffective, indicating that purely economic conservation strategies may lack the nuance needed for lasting impact. Interestingly, recent ethnographic work reveals a cultural shift that occurs as cattle ranching, the leading driver of deforestation in Amazonia, intensifies.

We collect large-scale cultural data about popular music genres across Amazonian municipalities (n=335). We explore how popular culture varies across stages of deforestation intensity and find interesting relationships between the popularity of sertanejo (Brazilian country music), and land-use patterns at cattle-led deforestation frontiers. This study is the first to empirically analyse cultural output by geographic location in comparison with environmental characteristics to the authors knowledge, combining the fields of anthropology, sociology, and environmental geography to do so.

"Nesting Dynamics on the Essex Coast: Evaluating Human Impact and Predation Rates."

Mr NILESH KARIPAL KALLAMBALLI, PROFESSOR THOMAS CAMERON

UNIVERSITY OF ESSEX

Abstract

The study explored the nesting success of Ringed Plovers and Oystercatchers, focusing on the impacts of environmental and human factors. Predation, primarily by Carrion Crows on Ringed Plovers and foxes on Oystercatchers, led to high nest failure rates. Human disturbances, such as recreational activities, further disrupted nesting. An experiment involving fencing aimed to reduce these impacts, but results were inconclusive, raising doubts about the effectiveness of such conservation measures. Interestingly, unusual behaviors in Ringed Plovers suggested a possible mutualistic relationship with Pied Wagtails. The study highlighted the urgent need for reform in conservation policies, emphasizing the importance of species-specific strategies and enhanced public awareness. The complexity of avian nesting success, influenced by various unidentified factors, calls for further research to better understand and protect these bird species. Conservation efforts must be re-evaluated to develop more effective solutions for avian protection.

Evaluating the current status and potential of involving farmers in citizen science

Miss Morag E McCracken, Dr Joanna T Staley, Dr Michael O Pocock

UK Centre for Ecology and Hydrology

Abstract

Monitoring on farmland is important to assess the state of the environment including the need to evaluate the impact of agri-environmental interventions, growing interest in sustainable and regenerative agriculture, and diversification of farm income from carbon and biodiversity accounting.

The aim of this project was to understand existing farmland-based citizen science initiatives, with a focus on those involving farmers and farmland in environmental data collection, and to identify gaps and opportunities.

Farmer involvement in schemes ranged from collecting data themselves to allowing volunteers access to land. Few existing citizen science schemes currently focus on agriculture or farmland. However, many survey farmland when reporting national trends, and the continuation of this access permission was seen as a priority. Adding value to existing schemes and broader sharing of data currently held at a farm scale were identified as opportunities. Links between farmer motivations for involvement and changes to land management were explored.

Strengthening capacity for community-led forest rehabilitation and restoration in Sumatra, Indonesia

Dr Lindsay F Banin[1], Ms Emmy Primadona[2], Dr Kristin Olsen[3], Dr Joseph Hutabarat[4], Mr Radinal Radinal[4], Dr Beth Raine[1], Dr Matthew J Struebig[5], Dr Sugeng Budiharta[6], Dr Nicholas Berry[7]

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Abstract

Tropical forest restoration is considered a major route to mediating the biodiversity and climate crises whilst also supporting the livelihoods and well-being of local communities. In Indonesia, an estimated 48.8 million people are considered forest-dependent, but there have been high rates of deforestation historically. Social forestry, or community-led forest management, is a scheme designed to alleviate poverty in rural communities - in 2018 social forestry covered c.2Mha (about 2% of Indonesia's forest estate) with recent plans to expand to over 12Mha. Our project explored a model for community-led forest rehabilitation in mixed-land-use areas in Sumatra, Indonesia to support climate mitigation and adaptation, biodiversity conservation and support local livelihoods and well-being. We facilitated the full pathway, from i) spatial prioritisation, ii) restoration interventions, iii) efficient restoration monitoring and iv) a route to economic benefits. Here, we report opportunities and potential barriers to multi-dimensional restoration outcomes from two case study areas.

Embedding environmental quality into nature-based interventions for health

Dr Sarah J Knight[1], Dr Laura Harrison[2], Dr Trish Darcy[2], Dr Catherine Cowie[2], Mrs Rachel Dexter[1], Professor Peter Coventry[2], Professor Piran White[2], Mr Anthony Hurd[3]

[1]University of Salford. [2]University of York. [3]HEY Smile Foundation

Abstract

Nature-Based Interventions (NBIs) aim to improve the physical and mental health of participants through engagement with nature and can provide co-benefits for the environment, for example, by increasing biodiversity. The quality of green/blue space is important to NBI providers, however, evaluations of NBIs rarely consider the impacts of environmental quality for health.

To understand the perceptions of environmental quality (e.g. biodiversity, aesthetics) of NBIs, we conducted interviews with NBIs in urban, peri-urban and rural settings across Greater Manchester and Yorkshire and the Humber, UK. These captured how factors such as biodiversity shaped their work and the outcomes for participants.

The majority of organisations emphasised the importance of improving green/blue space quality and could describe how their activities did this. However, most NBIs did not measure or evaluate biodiversity and environmental quality. Future work is needed to support NBIs in translating the importance of environmental quality for human health.

Exploring local foundations for global climate solutions in Scotland's peatlands

Dr Lydia E.S. Cole, Dr Cornelia Helmcke, Mr Ewan Jenkins

University of St Andrews

Abstract

Atmospheric carbon needs to be managed at a global scale, but solutions to mitigate emissions need to be designed with the local context - where the physical exchange of CO2 occurs – in mind. The voluntary carbon market (VCM) exemplifies a one-size-fits-all approach that is currently failing to solve climate change. Designing effective nature-based solutions, such as peatland restoration programmes, relies on understanding both the ecosystem, and social-ecological systems present in each place. We sought to explore the social-ecological systems present in communities that are currently under pressure to restore their surrounding peatland ecosystems. We interviewed various crofting communities across the island of Lewis, in the Outer Hebrides of Scotland, to learn about the local relationships people have with peatlands and how these are changing over time. Results from this study will help to inform the design of solutions, such as the VCM, for reducing emissions from the Nation's peatlands.

Palaeoecology

Mid-Holocene Ecological Dynamics at the Eerste River Valley Bottom, Jonkershoek- South Africa

Ms Glory Nicholas Oden[1,2], Prof Lindsey Gillson[1,3], Prof Timm Hoffman[1]

[1]University of Cape Town, South Africa. [2]University of Calabar, Nigeria. [3]University of York, United Kingdom

Abstract

Since the last century, Jonkershoek, a biodiversity hotspot in the Cape Floristic Region of South Africa has provided a research base for environmental monitoring. The last 90 years of rainfall, stream flow, and non-native tree species impacts are documented, but lacking a longer-term context for these transformations. This study presents an ~8000-year paleoenvironmental record from the Erste River Valley bottom, applying fossil pollen, diatoms, coprophilous spores, charcoal and geochemistry to capture events from the mid-Holocene to the present. Overall, the landscape depicts a vegetation type that has evolved to a much wetter fynbos alongside intensified fires, fluctuations in humidity, elevated electrolyte content and an increasingly eutrophic wetland recently. This result provides suitable reference conditions for comparing pre- and post-colonial occupation land management practices and a context for interpreting decadal scale and present-day assemblages. It also provides insights into future possible trajectories of change that can inform fire and wetland management

Palaeontology as a tool for determining the arrival and dispersal of non-native species: the example of Himalayan Balsam along the River Soar, Leicestershire, UK

Miss Amy L Wrisdale, Dr Juan Carlos Berrio, Prof. Mark Williams

University of Leicester

Abstract

Impatiens glandulifera (Himalayan balsam) is a plant species native to South Asia. Its earliest record of being naturalised in the UK is from 1855 and it is now a common species on the banks of many waterways where it is considered invasive. It is challenging to determine, at a local level, when a species such as *I. glandulifera* first colonised. Observational records are useful in this regard, but rely strongly on constant, long-term monitoring. Here, we show how the palynological record from a well-dated sediment core at Aylestone Meadows, River Soar, Leicestershire, demonstrates the history of arrival and proliferation of this plant, and its effects on other plant species. Our approach provides an important additional tier of data for understanding the long-term impact of an invasive plant on the local flora, with a methodology that can be translated to many other contexts.

Steetley Quarry writes the story of a Neolithic lynx from Nottinghamshire, UK

Dr Carlo Meloro[1], Mr Liam Echevarria[2], Mr Talha Ebrahim[2], Dr Angharad Jones[3], Dr Angela Lamb[4]

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Abstract

Although the Eurasian lynx (*Lynx lynx*) was present in Britain from the Pleistocene until medieval times, very few descriptions of its fossils exist. We provide novel insights on British lynx based on two hemi-mandibles currently stored in Creswell Crags Museum collection. The fossils were collected at Steetley Quarry (Nottinghamshire) in 1976 and preliminary radiocarbon dates support their Neolithic attribution (ca. 3100 calibrated Before Current Era). Morphometric analyses of these specimens confirm their attribution to a single individual similar in size and shape to large extant *Lynx lynx*. Preliminary results based on $\delta^{13}C$ and $\delta^{15}N$ of coeval faunal remains support the hypothesis that the lynx from Steetley Quarry was a predator possibly specialised on medium sized ungulates. Ancient DNA will allow us to elucidate the role of lynx in British ecosystems of the past and the future.

Decoding the fossil pollen record: a study of modern pollen rain within the hyper-diverse forests of the Yasuní National Park, western Amazon

Molly R Spater[1], Froilán Macanilla[2], Carmen X Luzuriaga[3], Rommel Montúfar[4], María del Carmen Trapote[5], Núria Cañellas Boltà[5], Gonzalo Rivas-Torres[2], Rachel Jeffreys[1], Rachel Smedley[1], George Wolff[1], Robert Marchant[6], Encarni Montoya[5]

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Abstract

Within hyper-diverse regions like Amazonia, the limited availability of modern pollen datasets hinders our ability to accurately interpret fossil pollen records to study long-term ecological change and processes. We analysed pollen from 44 surface soil samples from the Yasuní National Park (Ecuador) to characterise modern pollen rain, examine patterns of diversity across different forest types, and assess how this information can be used to improve interpretations of fossil datasets from the western Amazon. Over 250 morphotypes were recorded, with the dominance of generalist taxa and the highest diversity observed in samples from unflooded forests, consistent with modern vegetation studies. Results from principal components analysis suggested that the pollen signal captures variation in plant community composition in response to changes in the hydroperiod at local scales. We further explored taxa indicative of distinct forest types and factors complicating the accurate classification of fossil pollen assemblages within this highly diverse region.

How can Norwegian mountain peatbogs represent useful archives to understand the effect of precipitation on peatlands carbon budget?

Christian Zagaceta[1], Anne Bjune[1], Alistair Seddon[1], Hanna Lee[2]

[1]University of Bergen. [2]Norwegian University of Science and Technology

Abstract

There is extensive literature on temporal carbon accumulation changes in arctic and boreal peatlands in Europe, but little has been done in comparing mountain peatlands carbon sinks capacities in wet regions such as Norway. Projections in Norway show a rise in temperature and annual rainfall with more intense seasonal events in western, eastern, and northern parts. In this context, this study hypothesizes that temporal variability of temperature and precipitation during the Holocene led to weaker and stronger evapotranspiration and moisture signals affecting local and regional vegetation in peatland ecosystems, water-table changes, and carbon accumulation capacity. This study aims in disentangling the responses of the carbon budget at different hydrological gradients. Methods involve a multiproxy approach to reconstruct the peat composition rate, organic matter, water table, and local vegetation and to investigate the relationship between the proxies and carbon accumulation rate over the Holocene.

Fine spatio-temporal palaeoecological baseline for wetland restoration in The Great Fen, East Anglia

Dr Matthew Adesanya Adeleye

University of Cambridge

Abstract

The Great Fen is one of the largest peatland areas in the United Kingdom and hosts some of the region's rarest wildlife. However, approximately 99% of the peatland has been drained for peat farming in recent centuries. Previous studies in the area have provided insights into the fen's history, to assist in ongoing habitat restoration efforts. However, there is still insufficient knowledge about the amount of carbon still locked in ancient peat in different parts of the ~9,000-acre fenland, and the role of people in shaping the fen's development remains unclear. In collaboration with the Wildlife Trust BCN, this project aims to use various lines of palaeoecological evidence to investigate long-term changes in peatland floral diversity, carbon, fire and land use, as well as links between these in different parts of the Great Fen. This talk will present the initial findings from this project so far and their implications.

A multimillennial record of woodland resilience in a lowland British context

Hannah Sellers, Mark Williams, Juan Carlos Berrio, Stef De Sabbata, Richard Jones, Anghard Evans

University of Leicester

Abstract

Woodlands in the British landscape have been mostly reduced to fragments and continue to decline in species diversity. Here we integrate a multimillennial pollen record with diverse evidence including that from placenames to identify patterns of woodland resilience at multiple sites across Leicestershire, UK. Our methodology aims to identify regions that have maintained long-term, stable woodland cover and to elucidate how ecosystems have changed and recovered after natural or anthropogenic disturbances over the past 10,000 years. Environmental change including deforestation and reforestation events have been identified with further details about the anthropogenic influence being provided by placename and archaeological evidence. Our analysis is targeted at developing a replicable, spatiotemporal framework to identify resilient woodland ecosystems in a time of Anthropocene environmental change, and to inform local policy and conservation efforts in the design of future sustainable woodlands.

Nature of the Beast? Resolving drivers of prey choice, competition and ecological resilience in the wolf (*Canis lupus* L., 1758)

Professor Danielle Schreve[1], Dr Angela Lamb[2], Dr Amanda Burtt[1], Dr Fabienne Pigiere[1], Dr Neil Adams[3,4]

[1]School of Geographical Sciences, University of Bristol. [2]British Geological Survey. [3]Natural History Museum London. [4]School of Geography, Geology and the Environment, University of Leicester

Abstract

The wolf (*Canis lupus* L. 1758) is a prime candidate for exploring past carnivore community and herbivore interactions, having persisted through multiple climatic cycles during the Quaternary. Here, we present variation in British and continental European modern and fossil wolf diets to assess the impact of forcing factors such as changes in climate, environment, prey community and carnivore competition on feeding behaviour and the rates of change at which these occur. A multiproxy and multiscalar approach is adopted, combining morphological variation in the cranio-dental complex, alongside direct measurement of wolf palaeodiet through Carbon and Nitrogen stable isotope analysis and, for the first time in Britain, dental microwear texture analysis. Information from fossil wolves highlights their ecological resilience to changing climatic and environmental conditions over a longer period of time than can be obtained through modern observations alone, and provides insights into their future responses to global climate warming.

Competitive exclusion prevented megatheropod dinosaur sympatry after the Cretaceous Thermal Maximum and altered predatory theropod guild structures that established tyrannosaurs as apex predators.

Mr Cassius Morrison[1], Mr James Gregory[2], Dr Christopher Jackson[2], Dr Jordan Bestwick[3], Dr Katlin Schroeder[4], Dr Samuel Gascoigne[5], Dr Paul Bills[2], Dr Laura Porro[6], Dr Paul Barrett[7]

[1]University College London and Natural History Museum. [2]University of Huddersfield. [3]University of Zurich. [4]Yale University. [5]University of Aberdeen. [6]University College London. [7]Natural History Museum

Abstract

The sympatry of up to four predatory megatheropod dinosaur taxa lasted from the Middle Jurassic until the Cretaceous thermal maximum (CTM), whereas subsequent food webs were dominated by a single megatheropod group such as tyrannosaurs. The potential for competitive exclusion in these food webs has yet to be explicitly tested. Dental microwear texture analysis was used to constrain megatheropod diets, in comparison to extant crocodylians and varanids. Preliminary results suggest faunivorous theropods pre-CTM exhibited more diverse diets and smaller degrees of ontogenetic dietary differences than theropods post-CTM. This increased interspecific dietary separation in food webs prior to the CTM likely lead to less pronounced interspecific competition, but increased intraspecific competition. The statistically significant ontogenetic shifts in tyrannosaurid diets suggests these taxa performed several ecological roles during their lives that might have prevented the sympatry of other large-bodied theropods through competitive exclusion.

Impacts of Holocene land use and climate change upon Brazil's iconic *Araucaria* Forests

Charlie A Davies[1], Joy S Singarayer[1], Oliver J Wilson[2], Rafael Corteletti[3], José J Iriarte[4], Francis E Mayle[1]

[1]University of Reading. [2]University of York. [3]Federal University of Pelotas. [4]University of Exeter

Abstract

Southern Brazil's highland *Araucaria* Forests, home to indigenous 'southern Jê' cultures, are a heavily threatened part of the Atlantic Forest, a global biodiversity hotspot. >80% of their natural vegetation has been lost, with climate change a growing concern.

Conserving their biodiversity and ecosystem functioning in the future demands an understanding of their relationships with humans and climate through time. Palaeoecological evidence shows some *Araucaria* Forest areas expanded rapidly around 1000 years ago, but the drivers – whether indigenous peoples or climatic shifts – are debated.

Using novel integrations of new palaeoecological data, agent-based modelling, and existing archaeological data, I will assess how pre-Columbian indigenous peoples, climate change, and fire interacted and shaped these landscapes throughout the last 12,000 years. My results should provide important insights into likely responses of these globally important ecosystems to current and future anthropogenic and climatic changes, helping inform conservation strategies for these iconic forests.

Is restoration creating a peatland future without a paleoenvironmental past?

Dr Althea L Davies[1], Ms Kayleigh Letherbarrow[1], Ms Sarah H Watts[2,3], Prof Rob Wilson[1]

[1]University of St Andrews. [2]University of Stirling. [3]Corrour Estate

Abstract

Peatland restoration can support multiple ecosystem services, but not all are equally likely to be achieved and some services may be traded-off in favour of others. This is a concern for palaeoecology since restoration activities routinely involve moving peat to reprofile eroding peats, create pools and block gullies: this destroys the stratigraphic integrity which is fundamental to the value of the palaeoenvironmental archive. There is a gap in current guidance and practice between recognising palaeoecological values and taking appropriate action to minimise or prevent damage to this archive. We examine the impacts of restoration on palaeoenvironmental research at post-restoration and pre-restoration sites at Corrour, Highland Scotland, and use this experience to present a protocol for the inclusion of palaeoenvironmental potential and evidence as part of the restoration planning and design process that is required to meet current UK standards, including the Peatland Code.

Parasites Pathogens or Wildlife Disease

Understanding tripartite interactions between colony genetic diversity, pesticide interference, and parasite pressure in commercial honey bee colonies.

Dr Lewis J. Bartlett

University of Georgia

Abstract

American agriculture remains some of the most intensified on earth, demanding abundant inputs including supplemental pollination from commercial beekeeping operations, who see substantial annual losses of bee colonies to combinations of well-understood pressures. This talk will discuss a series of new publications examining how pesticide exposure via crop foraging can either both improve or damage honey bee colony health, depending on its interaction with the damaging ectoparasitic varroa mite, and how colony genetic diversity and inter-individual heterogeneity can either directly or indirectly mitigate some of these stressors. Of import, we show that parasite pressures are significantly more damaging than pesticide exposure, and that some pesticides principally damage honey bee colonies through immune suppression and therefore exacerbation of parasites, while others offer some marginal parasite control. We additionally show that hyperpolyandrous queens, heading diverse colonies, are better able to suppress parasites, indirectly mitigating pesticide pressures, but show no enhanced pesticide detoxification.

Killing arthropods on arthropods: a meta-analysis addressing challenges and prospects in treating the globally invasive *Varroa destructor* pathogen on honey bees

Dr Darren P O'Connell[1], Dr Kevin Healy[2], Mr Jack Wilton[1], Dr Cristina Botías[3], Dr Julia C Jones[1]

[1]University College Dublin. [2]University of Galway. [3]University of Alcalá

Abstract

The parasitic mite *Varroa destructor* represents the most significant threat to the western honey bee *Apis mellifera*. Honey bees are a critical component of global environmental, economic, and social systems and so the threat posed by this globally invasive ectoparasitic mite is significant. Treatments for *Varroa* can be broadly categorised as biological, chemical, or physical. There is no best treatment method despite years of research, though chemical treatments have predominated. In this first of its kind meta-analysis, data from 138 studies covering five continents were analysed to evaluate the different methods used to treat *Varroa* and their impacts on bee health. This highlighted that while synthetic chemical treatments were highly effective for *Varroa* management, they exhibited the greatest negative effects on bees. In contrast, biological treatments appear very promising, as although they were not as effective at killing *Varroa* as synthetic chemicals, they were more effective at improving bee health.

Grey squirrels *Sciurus carolinensis*: how does an invasive species influence the *Borrelia burgdorferi* ecology in the UK?

Dr Katherine August[1], Dr Daniel Bray[1], Dr Sarah Beatham[2], Prof Richard J Birtles[3], Dr Holly A Broadhurst[3], Dr Simon Croft[2], Dr Harry Marshall[4], Prof Giovanna Massei[5], Prof Steven R Belmain[1]

[1]University of Greenwich. [2]Animal and Plant Health Agency. [3]University of Salford. [4]Forest Research. [5]University of York

Abstract

Grey squirrels *Sciurus carolinensis* are an invasive species in the UK, and efforts to control their populations are ongoing. A key concern is their role as reservoir hosts for *Borrelia burgdorferi*, the agent of Lyme disease. Juvenile squirrels, being more mobile, may disproportionately contribute to disease spread. This study aimed to quantify the grey squirrels' role in spreading Lyme disease and assess different control methods' impacts. In Cumbrian woodlands, squirrel and tick densities were measured before and after three different treatments: no culling, full cull, and simulated fertility control by culling juveniles only. Ticks were tested for *B. burgdorferi*. Results showed that reducing squirrel density led to lower tick density and *B. burgdorferi* prevalence. The simulated fertility treatment had a similar impact to full culling, suggesting that oral contraceptives could be a more cost-effective and efficient method of reducing both grey squirrel populations and their impact on human health risk.

Environmental risk factors for Anaplasma phagocytophilum in Scotland

Prof Lucy Gilbert[1], William McLellan[1], Dr Sara Gandy[1], Prof Jaboury Ghazoul[2], Dr Fanny Olsthoorn[2], Dr Mara Rocchi[3], Dr Jessica Hall[4], Grace Plahe[5], Prof Richard Birtles[5], Hein Sprong[6]

[1]University of Glasgow. [2]ETH Zurich. [3]Moredun Research Institute. [4]University of Edinburgh. [5]University of Salford. [6]RIVM, Netherlands

Abstract

Anaplasma phagocytophylum (*AP*) is an ecologically complex group of tick-borne pathogens that vary in their pathogenicity and transmission hosts. There are still fundamental gaps in knowledge of the ecological determinants of *AP* hazard in the environment. Here we test the hypothesis that higher prevalence and hazard of *AP* Ecotypes I and II increase with higher densities of transmission hosts (deer and sheep), while hosts that do not transmit *AP* (rodents and birds) can reduce pathogen prevalence. We found that *AP* prevalence in questing *Ixodes ricinus* ticks in Scotland is spatially patchy, with most areas having very low prevalences, except the north. *AP*-positive tick samples comprised 86% Ecotype I and 14% Ecotype II. As predicted, *AP* prevalence and hazard increased with higher deer densities, and negatively with bird densities, suggesting that birds are dilution hosts. Managing land to enhance bird abundance while controlling deer densities could be a potential mitigation strategy

Physiological and Environmental Factors Jointly Determine Rat-Protozoa Infection Patterns.

Mr. Talpaz Itamar[1], Mr. Matan Markfeld[1], Dr. Georgia Titcomb[2], Prof. Charles Nunn[3,4], Dr. Shai Pilosof[1]

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Abstract

Emerging infectious diseases (EID) pose significant risks, particularly in developing regions like rural Madagascar, where zoonotic pathogens transmitted by wildlife, such as *Rattus rattus*, are prevalent. Disease transmission is characterized by heterogeneity at the individual level, yet the specific host features that influence infection patterns in rat populations remain unclear. We investigated how physiological and environmental factors affect the protozoan infection patterns of *R. rattus*. We analyzed data from 540 rats across various land cover types in Madagascar, applying a Stochastic Block Model (SBM) to identify infection profiles, which classified rats into four distinct groups. A machine learning approach (XGBoost) accurately classified rats to infection profiles, with body mass, microbiome richness, and vegetation as the most important features. These findings provide the first quantification of the relative importance of physiological and environmental factors in determining infection heterogeneity, offering valuable insights into the key determinants of pathogen transmission.

Cold snaps lead to a 5-fold increase or a 3-fold decrease in disease proliferation depending on the baseline temperature.

Ms Niamh McCartan[1], Dr Jeremy Piggott[1], Ms Sadie DiCarlo[1,2], Dr Pepijn Luijckx[1]

[1]Trinity College Dublin, Ireland. [2]Carleton College, USA

Abstract

Climate change is driving increased extreme weather events, impacting ecology by moderating host-pathogen interactions. Few studies have explored how cold snaps affect disease prevalence and proliferation. Using the *Daphnia magna – Ordospora colligata* host-parasite system, we manipulated the amplitude and duration of cold snaps at four baseline temperatures 10-days post-infection, recording *O. colligata* fitness at the individual level. Cold snaps induced a 5-fold increase or a 3-fold decrease in parasite burden relative to baseline temperature, with complex, varied outcomes depending on treatment combinations. Both amplitude and duration interacted with baseline temperature, highlighting the complexity of cold snaps. Moreover, parasite fitness—prevalence and burden—were simultaneously altered in opposite directions in the same cold snap treatment. Thus, cold snaps can yield complicated outcomes that are unique from other temperature variations, such as heatwaves. These results illustrate the challenges in predicting how climate and extreme weather may alter disease dynamics under global change.

How does dung burial by Coprophagous beetles modify infectious strongyle nematode larvae? An experimental test in the Serengeti Ecosystem

Ms. Mecklina Michael Mbundi[1,2], Prof. Grant C. Hopcraft[1], Dr. Gareth P. Hempson[1], Dr. Jason E. Donaldson[3], Dr. Thomas A. Morrison[1]

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Abstract

Gastrointestinal nematodes pose significant health risks to livestock, wildlife, and humans, especially in regions with limited access to deworming treatments. Dung beetles can help regulate these parasites by burying faeces containing nematode larvae deep in the soil, preventing the emergence of infectious larvae on pasture. However, shallow burial may enhance parasite survival by creating suitable microclimate for larvae. This study examined the impact of burying dung at depths of 0, 5, 10, and 15cm on the emergence of strongyle larvae (L3) onto pastures. Results showed that burial at 10 cm depth significantly increased larval emergence ($p < 0.05$), while deeper burial at 15 cm reduced larval availability, suggesting that deeper burial by beetles can suppress parasite emergence, whereas shallow burial could incubate/protect larvae from harsh microclimates, e.g., heat/desiccation, that occur at soil surface. These findings underscore the role of dung beetles in modifying parasite transmission risk in grazing ecosystems.

Scorched earth and blackened eyes: High Pathogenicity Avian Influenza in the European metapopulation of Northern Gannets

Prof Jason Matthiopoulos[1], Ms Holly Niven[1], Prof Emma Cunningham[2], Prof Sarah Wanless[3], Prof Stephen Votier[4], Dr Jude Lane[5], Dr Jana Jeglinski[1]

[1]University of Glasgow. [2]Edinburgh University. [3]Centre of Ecology and Hydrology. [4]Heriot Watt University. [5]Royal Society for the Protection of Birds

Abstract

The 2021-22 High Pathogenicity Avian Influenza (HPAI H5N1) outbreak inflicted severe reductions in adult survival and breeding success for the majority of wildfowl worldwide, particularly affecting charismatic seabirds, such as Northern gannets (*Morus bassanus*), where the majority (75%) of colonies became infected with considerable loss of life. Using expansive and diverse data (carcass detections, demographic observations, movement patterns) and state-of-the-art modelling, we piece together the spatial contagion mechanisms that may have led to the rapid burn-through of the disease across this continent-spanning metapopulation. Incorporating the mortality events into realistic metapopulation and spatial models, we investigate the long-term consequences for the metapopulation's recovery and implications for space use. Northern gannets had been previously considered one of the most robust seabird systems. We discuss whether HPAI has aggravated the situation of the species in relation to other threats such as climate change and anthropogenic marine disturbance.

Marginal habitats drive rapid expansion of vampire bat rabies in the Peruvian Andes

Emilia Johnson

University of Glasgow

Abstract

In Latin America, vampire bat rabies is a lethal zoonosis that poses a major burden to livelihood and public health. Spatial patterns of outbreaks show rabies to be an emerging disease with wave-like invasions into uninfected regions. Considerable geographic variation in wavefront velocities remains unexplained. Here, using national surveillance data and satellite-derived remote sensing datasets, we identify five wave-like expansions of rabies in distinct valleys in Peru. Distance-time linear regression highlights that invasions occur at predictable yet independent rates in different valley systems and spread more rapidly in landscapes with more ecological constraints. We hypothesize that such areas, with less prominent hydrology, sparse bat roost availability and high human disturbance, necessitate longer range movements between roost and foraging sites, increasing viral invasion speeds. Identifying environmental or anthropogenic drivers of epizootic advancement can directly inform proactive vaccination campaigns in high-risk zones and provides powerful opportunities to predict and mitigate infection frontiers.

Disentangling trophic and transport effects on parasite infection dynamics in a multihost community

Mr Houssein Samwel Kimaro[1,2], Dr Jeniffer Mclntyre[1], Prof Vanessa Ezenwa[3], Prof Ricardo Holdo[4], Dr Jason Donaldson[4], Prof J. Grant C. Hopcraft[1], Dr Thomas Morrison[1]

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Abstract

Quantifying the direct and indirect ways that mobile hosts influence the infection dynamics of other host species remains a considerable challenge. We experimentally tested the effect of grazing intensity, duration and host density on the availability of infectious gastrointestinal nematode (GIN) parasites. We found that: (1) simulated grazing reduced GIN larvae availability by 2.5 times compared to ungrazed plots (2) high dung addition increased GIN larvae availability 2 times as much as plots with low dung addition, (3) a longer duration of grazing reduced larvae availability 3 times as much as a single bout of grazing. Our second experiment showed that microclimatic conditions in the grass layer mediates parasite development and/or survival. Our results provide evidence of the role of grazing duration and host density on parasite dissemination within the ecosystem.

Resistance is futile: cost of resisting infection is excessive for some Daphnia genotypes

Viktoria Rozmann[1], Patrick Chen[2], Dr Jeremy J Piggott[1], Dr Pepijn Luijckx[1]

[1]Trinity College Dublin. [2]University of Toronto

Abstract

Costs of resistance against disease or parasites can influence how diseases coevolve and interact with their hosts. The upregulation of the immune system can be energetically expensive or immune action may cause collateral damage to host tissues. We investigated resistance and its costs in seven genotypes of the aquatic invertebrate *Daphnia magna*, a keystone species, when infected with the microsporidium parasite *Ordospora colligata*. In a controlled laboratory experiment, we recorded infection rates, parasite burden, host mortality, and fecundity at multiple timepoints. Within some host genotypes, individuals that resist infection had lower fitness compared to those that became infected, suggesting that the costs of resisting infection can exceed that of becoming sick. Since *O. colligata* is usually benign, tolerating it might be more beneficial than resistance. Our findings underscore the complex interplay between host and parasite genotypes, indicating that in certain scenarios, tolerating infection could be more advantageous than fighting it.

Interactions between microsporidian parasites and temperature modify the outcome of multiple infection in *Daphnia magna*.

Dr. Floriane E O'Keeffe, Viktoria Rozmann, Prof. Celia V Holland, Prof. Pepijn Luijckx

Trinity College Dublin

Abstract

Human-induced global change, including rising temperatures and more frequent extreme weather events, is altering disease dynamics. While most research has focused on single infections, the impact of global change on co-infections — responsible for up to 80% of infections in nature — remains understudied. This study examines how temperature affects the interaction between two microsporidian parasites, *Hamiltosporidium tvaerminnensis* and *Ordospora colligata*, in the freshwater invertebrate *Daphnia magna*. We conducted two experiments with five constant temperatures (10.5–24.5°C and 21–29°C) and a heatwave treatment. Both experiments show that despite *H. tvaerminnensis*' higher thermal tolerance, co-exposure to *O. colligata* reduces *H. tvaerminnensis* spore production. Additionally, at higher temperatures, *O. colligata* spore production decreases when co-infected with *H. tvaerminnensis*. Thus, as global temperatures change, the outcomes of multiple infections could shift, with potential consequences for biodiversity and ecosystem functioning.

High temperature preference as a response to disease: a potential behavioural response in *Caenorhabditis* nematodes to *Leucobacter* infection

Serena Johnson[1], Dr. Tobias Hector[2], Professor Kayla King[1,2]

[1]University of British Columbia. [2]University of Oxford

Abstract

Under global change, animal species are increasingly experiencing heat stress, as well as the emergence of new infectious diseases. It is therefore crucial to understand how host species respond to the combined effects of heat stress and infection. Exposure of ectotherm hosts to pathogens has been shown to increase preference for higher temperatures which promote infection clearance. We will explore whether this behaviour pattern is exhibited among a range of *Caenorhabditis tropicalis* nematode isotypes collected across an altitudinal range when exposed to a natural *Leucobacter* pathogen. Further, we will investigate how local adaptation to altitude and associated climate impacts inclusive host fitness when exposed to simultaneous heat and infection stresses.

Disentangling complex disease ecology networks: Scotland exhibits strong direct pathways linking deer to ticks and Lyme disease pathogen, but weak indirect pathways via vegetation and rodents

Dr Sara L Gandy[1], Fernanda Sanchez[1], William McLellan[1], Dr Paul Johnson[1], Dr Fanny Olsthoorn[2], Dr Marianne James[3], Dr Roman Biek[1], Dr Hein Sprong[4], Manoj Fonville[4], Dr Caroline Millins[1], Dr Ken Forbes[3], Dr Alan Bowman[3], Dr Jaboury Ghazoul[2], Dr Lucy Gilbert[1]

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Abstract

Quantifying inter-species interactions in complex ecological networks is challenging, but statistical tools such as structural equation modelling (SEM) can help understand the strength and direction of these interactions. We applied SEM to the Lyme disease system to investigate how deer influence tick density, pathogen prevalence and Lyme disease hazard both directly and indirectly, through cascading effects on ground vegetation and rodent (pathogen transmission host) abundance. Using a meta-analysis of 39 Scottish sites, we found that deer strongly increased tick density and, less strongly, reduced pathogen prevalence, which resulted in an overall positive effect on Lyme disease hazard. The SEM teased apart the relative strengths of the various pathways causing these patterns, and showed that they were primarily driven by direct mechanisms; although deer negatively affected rodent abundance, the hypothesised indirect pathways from deer to ticks and pathogens acting through vegetation and/or rodents were relatively weak.

Impact of mangrove forests on malaria prevalence in coastal Africa: a spatial analysis of ecosystem health and disease dynamics

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Abstract

Mangrove forests provide essential ecosystem services to coastal communities in tropical and subtropical regions, yet they have historically been linked to increased infectious disease risk. The actual influence of mangrove forests on disease prevalence remains unclear. This study examines the relationship between mangrove cover, ecosystem health, and malaria prevalence across coastal Africa from 1996 to 2020 using a spatial analysis. By integrating data on mangrove cover, vegetation health, climate, and socio-economic factors into a structural equation model, we assessed direct and indirect effects on malaria prevalence alongside African coastlines. Our results show a weak positive association between mangrove cover and malaria prevalence, but a negative association between mangrove health (i.e. vegetation index as a proxy variable) and malaria. Temperature anomalies, agricultural expansion, and urbanisation are key drivers. In conclusion, while mangroves moderately influence malaria prevalence in coastal Africa, healthy mangrove ecosystems may help mitigate these effects.

Human disturbance expands vampire bat movement.

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Abstract

In Latin America, the common vampire bat is the primary reservoir of rabies. Controlling vampire bat rabies is challenging due to the virus spatial dynamics, driven by bat movement. Recent research suggested that culling bats for rabies control, may inadvertently increase viral spread by enhancing bat dispersal. However, the details of bat responses to disturbance have not been measured directly. Using sparse GPS tracking data from 55 vampire bats captured in the complex landscape of the Peruvian Andes, we examined how individual variation, landscape features and human disturbance influence bat movement. Our Bayesian model of distance and departure time, accounting for observation error and overdispersion, highlights that vampire bats can travel large distances, especially when disturbed after capture. This suggests that culling at roosts may have unpredictable effects on rabies control. Our model can be applied to any situation where maximum travel distances are biologically important but difficult to observe.

Using wild deer as sentinels to explore the diversity of Non-tuberculous Mycobacteria in Scotland

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Abstract

Wildlife can play an important role in the epidemiology of pathogens by acting as reservoirs or vectors for infection. Non-tuberculous mycobacteria (NTM) are opportunistic pathogens of livestock and humans and are ubiquitous in the environment. Using wild deer as sentinels, we used molecular approaches to explore the diversity of NTM in two deer species and different environments, and compare that to livestock found in the same environment. DNA was extracted from deer and sheep faecal samples and next generation sequencing was conducted based on the hsp65 gene, a biomarker for NTM. Results have shown distinct spatial structuring to the diversity of NTM found in deer between different geographical regions of northeast Scotland. At a finer spatial scale, NTM diversity differs between deer species, suggesting that the ecology of the two species may be important drivers in determining their NTM diversity within the same area.

Gut feelings: Gastrointestinal parasite sharing in co-existing wild and domestic ungulates in Kenya

Miss Kim van de Wiel[1], Mr Ben Karani[2], Dr Amy Sweeney[3], Dr Fiona Kenyon[4], Dr Phil Toye[2], Prof Andy Fenton[1], Dr Jakob Bro-Jorgensen[1]

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Abstract

Gastrointestinal parasites are critical due to their role in livestock production losses and potential impact on natural ecological processes in wildlife. Prevalence, infection intensity, and community composition of gastrointestinal nematodes were evaluated in co-grazing wild and domestic herbivores in the Maasai Mara ecosystem, Kenya. 973 faecal samples were collected from 14 sympatric herbivore species across mixed livestock-wildlife and single-occupancy pastures. Nematode eggs were quantified using the Mini-FLOTAC technique, and species identification was achieved via DNA metabarcoding. Results show that wildlife-livestock coexistence does not affect nematode prevalence but does increase infection intensity in animals on mixed pastures. We will also present nematode diversity observed amongst the 14 co-existing host species and highlight the impact of host traits and phylogenetic relationships on the nematode communities within the sampled animal hosts. Our findings highlight the complex dynamics of parasite transmission at the wildlife-livestock interface and its implications for animal health in this region.

Can humans shape their own tick-borne pathogen risk?

William McLellan[1,2], Dr Sara Gandy[1], Dr Mara Rocchi[2], Dr Jude Eze[3], Dr Hein Sprong[4], Anne Wattimena[4], Professor Lucy Gilbert[1]

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Abstract

A “landscape of fear” occurs when a predator inspires a perceived risk of predation in prey, thus changing prey’s spatiotemporal behaviour and distribution, causing cascading ecological effects through the ecosystem. However, how a landscape of fear can shape pathogen abundance is rarely studied. This study, therefore, aims to test whether humans, as “super-predators”, shape their own Lyme disease risk through a landscape of fear by shifting deer space-use with cascading effects on ticks, vegetation, and pathogen prevalence. We surveyed for ticks, vegetation and deer dung at increasing distances (0m – 80m) from 15 high-use and 9 low-use rural trails in Scotland and applied structural equation modelling. Deer space-use and tick density were higher with increasing distance from high-use trails, supporting the hypothesis that humans shape environmental hazard through a landscape of fear. This study has identified a major driver of vector distribution and has implications for risk mitigation.

Impact of genetic diversity and population density on disease susceptibility to novel bacterial pathogen in Caenorhabditis elegans

Mr Dominik Vinopal, Professor Kayla C King

University of British Columbia

Abstract

Habitat degradation from human activity is reducing genetic diversity and also alters the population distribution often causing an increase in population densities. Both loss of genetic diversity and increase in density can independently impact pathogen transmission and disease outcomes in host populations. However, their interaction remains untested despite major implications for the persistence of at-risk species in the face of emerging pathogens. By exposing a diverse panel of wild *Caenorhabditis elegans* nematode isolates to a novel bacterial pathogen, we examined the effect of genetic diversity and population density on host susceptibility to infection. We found that higher population density significantly increased host mortality during infection as well as the pathogen load. However, the strength of this effect varied across the host genotypes. Our results highlight the strong role of ecological stress and genetic diversity on shaping patterns of disease in disturbed habitats.

From Tradition to Transition: Adaptations in Pastoralist Cattle Habitat Use Amidst Malignant Catarrhal Fever Vaccination and Land-Use Changes

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Abstract

Malignant Catarrhal Fever (MCF) is a fatal cattle disease transmitted by wildebeest, severely affecting pastoralist livelihoods through direct mortality and indirect costs. Using 79 GPS-collars on cattle from two at-risk Tanzanian villages and 46 wildebeest collars, we analyzed cattle movement patterns before and after large-scale MCF vaccination, and compared unvaccinated and vaccinated herds post-vaccination through a cross-sectional design. We hypothesized five key factors influencing habitat selection and daily movement: 1) MCF vaccination, 2) proximity to wildebeest, 3) indirect MCF risks, 4) socio-economic status, and 5) land-use changes. Longitudinally, cattle avoided wildebeest areas, but vaccination reduced this avoidance. Wealthier households' larger herds showed greater wildebeest sensitivity, indicating socio-economic disparities. Experience with MCF mortality increased sensitivity to MCF risk. Post-vaccination, cattle shifted their habitat preferences, reducing wildebeest sensitivity, seeking better grazing quality, and increasing daily movement. In the cross-sectional design, vaccinated herds accessed superior grazing and moved more than unvaccinated herds.

Parasite size and sex influence the population dynamics of European mistletoe

Oliver G Spacey[1], Dr Owen R Jones[2], Dr Sydne Record[3], Alice Rosen[1], Arya Yue[4], Prof Mick Crawley[5], Dr Chris J Thorogood[1], Dr Rob Salguero-Gómez[1]

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Abstract

Not all parasites are equal, even within the same population. Individual parasites contribute to population dynamics in different ways, *e.g.*, larger parasites, typically with more resources, tend to produce more offspring. However demographic studies usually ignore parasite population structure, and we do not know how this crude treatment may affect model predictions. To address this knowledge gap, we collected demographic data on European mistletoe parasites (*Viscum album*) in Silwood Park, UK, for 10 years and parameterised an integral projection model (IPM). We found that parasite size and sex are predictors of mistletoe survival, growth and reproduction. We combined relationships between parasite traits and vital rates into an IPM and quantified the relative contribution of parasite traits to parasite population dynamics via elasticity analysis. Given the importance to overall dynamics of parasite heterogeneity, we suggest that this variability should be accounted for in models used to predict parasite spread and impact.

Exploring how plant-pollinator network structure shapes the virome of bee communities

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Abstract

Survival of wild bees is threatened by many factors, of which diseases have received increasing attention. Many pathogens are shared between managed and wild bee species, with flowers as the most likely route of interspecific transmission. An increased density of managed honeybees, the assumed reservoir hosts of many viruses, in the landscape may therefore aggravate pathogen spillover among bee communities. To explore this possibility, we manipulated the density of honeybee colonies across 32 agricultural sites differing in floral abundance, recorded plant-pollinator interactions, screened managed and wild bee species for common pollinator viruses and estimated the contribution of each bee species to viral R_0. We found that the density of virus-positive honeybees, network connectance and network niche overlap were important predictors of viral presence in wild bees. Our study provides insights into the viral transmission dynamics in bee communities which can inform management decisions to reduce disease threat to wild bees.

A One Health ecosystem approach for understanding and mitigating spill-over of tick-borne diseases to humans in India's degraded forests

Dr Sarah J Burthe[1], Stefanie M Schäfer[1], Dr Abi T Vanak[2], Dr Mohammed M Chanda[3], Dr Natrajan Balakrishnan[3], Dr Bhimanagoud Kumbar[3], Dr Darshan Narayanaswamy[4], Mujeeb Rahman[2], Santoshkumar Potadar[5], Dr Festus A Asaaga[1], Dr Meera Oommen[2], Dr Juliette C Young[6], Dr Prashanth N Srinivas[7], Dr Tanya Seshadri[2], Ishwarya Lakshmi[2], Dr Shivani K Kiran[4], Dr France Gerard[1], Abhishek Samrat[2], Dr Manoj V Murhekar[8], Dr Subhash L Hoti[9], Dr Bethan V Purse[10]

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Abstract

Zoonoses disproportionately affect tropical communities and are associated with human landscape-modification and use. Kyasanur Forest Disease (KFD), a tick-transmitted viral zoonosis endemic to southern India, affects resource-poor communities with livelihoods reliant on degraded forest ecosystems. Transmission is complex, involving multiple tick and host species, and the contributions of ecological dynamics and human behaviour to disease risk are poorly understood, hampering effective disease management. A One Health co-production approach was used to identify critical knowledge gaps and needs of local communities and disease managers. Empirical data on vectors and hosts was collected across multiple habitats (~40 sites) in fragmented landscapes in conjunction with household surveys, to quantify habitat associations and seasonal abundance of vectors and hosts, and understand why, how, and when habitats were used by the local communities. We demonstrate how empirical knowledge was used to co-produce guidance and risk maps to empower local communities to avoid KFD risk.

Heather nectar as preventative medicine for bumblebees

Dr Lachlan C Jones[1], Dr Xuan Feng[2], Professor Phillip C Stevenson[2,3], Professor Mark JF Brown[1]

[1]Royal Holloway University of London. [2]Royal Botanic Gardens Kew. [3]University of Greenwich

Abstract

Diseases and parasites threaten health and pollination services of wild bumblebees. Although parasites are natural components of healthy ecosystems, their impacts on bees may be exacerbated by commercial bumblebee production. Another aggravating factor in the UK is the loss of lowland heath. This valuable food source for bees is dominated by heather (*Calluna vulgaris*), which also produces a nectar metabolite, callunene, which is active against the gut parasite *Crithidia bombi* when tested on individual bees. To test for colony scale effects, we reared *Bombus terrestris* colonies and infected 10 workers with *Crithidia.* A week after infection, colonies were provisioned with sugar water alone or spiked with ecologically relevant concentrations of heather honey extract or semi-purified callunene and infection rates within the colonies were sampled in worker faeces for 10 weeks. Heather extract effectively reduced *Crithidia* infection rates, and more so than callunene alone, suggesting multiple compounds may be responsible.

Immunology and Inflammation: Faecal Biomarkers of Gut Health in Wild and Domestic Ruminants

Alice M Burton, Prof Kathryn J Else, Jessica Irving, Andrew M Halls, Dr Catherine Walton, Katharine Coyte, Prof Susanne Shultz

University of Manchester

Abstract

Faecal biomarkers allow animal health monitoring without invasive sampling, and gastrointestinal health is an important target for development. We tested the validity of three biomarkers: two immunological (immunoglobulin (Ig) A and IgG) and one inflammatory (lactoferrin), to detect infectious gastrointestinal pathologies in cattle. IgA and lactoferrin were significantly higher in cattle with infectious pathologies compared to healthy controls, and lactoferrin distinguished between active and inactive disease. Furthermore, we applied these markers to co-grazing wildlife and livestock in Kenya. Lactoferrin and IgG positively correlated with nematode faecal egg counts in bovid livestock, but not wildlife, suggesting wildlife have an alternative immune strategy with increased tolerance to nematodes. In equids, the opposite trend was found, with negative correlations in livestock. Ongoing work includes exploring co-infections. These biomarkers could be used for a range of veterinary and ecoimmunological applications, including health monitoring for conservation, and testing hypotheses of disease ecology in non-model organisms.

The impact of high pathogenicity avian influenza on UK bird populations in 2021/22 and 2022/23

Prof James W Pearce-Higgins[1,2], Dr Daniel T Johnston[1], Dr Callum J Macgregor[1], Prof Phil W Atkinson[1]

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Abstract

In 2021/22 a novel high pathogenicity avian influenza (HPAI) strain started to cause an unprecedented number of infections in wild birds across Europe. The virus has subsequently circulated around the world, posing challenges to conservationists. During this time, wild bird populations in the UK have experienced unprecedented levels of mortality, significantly impacting certain species. Drawing on a range of different wild bird monitoring schemes from the Wetland Bird Survey and Breeding Bird Survey to bird ringing, we summarise the impact this outbreak on wild bird populations in the UK, identifying the factors associated with the greatest vulnerability and assess potential conservation responses.

Coinfecting parasites in a warming world: temperature dependent virulence and microbial competition in nematode hosts

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[1]University of Oxford. [2]University of British Columbia

Abstract

Different parasite species often coinfect individual hosts in nature, altering disease outcomes in ways not predicted by one-host one-parasite paradigms. Simultaneously, climate change subjects organisms to thermal stresses, which can modify pathogenicity and resistance. We performed laboratory experiments to test how these two major factors, coinfection and thermal stress, can shape disease together. We leveraged a model system using nematodes (*Caenorhabditis elegans*) singly or co- infected by two *Leucobacter* bacteria species, which naturally coinfect *Caenorhabditis*. Hosts were infected across a range of temperatures that (i) spanned the host thermal optimum to past its reproductive viability and (ii) reflected the natural climate of these *Leucobacter* species. We found temperature controlled which parasite species was the primary driver of virulence, but that across temperatures, coinfection protected hosts from peak single-infection virulence. Our results contribute to exploring the "thermal mismatch hypothesis", which relates fitness outcomes to relative host-parasite(s) performance at different temperatures.

Warming mediates the genomic evolution of a tropical parasite (*Leucobacter*) after experimental introduction to a novel temperate nematode host.

Dr Tobias E Hector[1], Dr Julia M Kreiner[2], Dr Kim L Hoang[3], James C Forward[4], Dr Emily J Stevens[5], Serena Johnson[6], Dr Jingdi Li[4], Professor Kayla C King[1,4,6]

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Abstract

Changes in climate patterns are provoking the poleward range expansions of parasites, increasing the risk of host jumps. It is unclear whether warmer thermal environments will favour the spread of more virulent variants in these novel host species. We experimentally passaged a wild parasitic bacterium, across the thermal range (20-30°C) and extremes (35°C) of Cape Verde – the site of field collection – in a novel, temperate animal species with a mismatched, lower thermal optimum. We found that virulence and genetic diversity escalated at the likely optimum temperature for the parasite. At hotter temperatures phenotypic and genomic evolution were generally constrained, but molecular change was more predictable. Our findings reveal the potential for phenotypic and molecular evolution of parasites emerging into new, warming areas.

Relative humidity during the aquatic life stages can shape the temperature dependence of maximal population growth rate in the malaria vector, *Anopheles stephensi*

Paul Huxley[1,2], Joel J Brown[3], Brandyce St Laurent[3], Britny L Johnson[3], Brandon Hollingsworth[3], Leah J Johnson[1], Courtney C Murdock[3]

[1]Virginia Tech. [2]Imperial College London. [3]Cornell University

Abstract

Arthropods account for a large proportion of earth's animal biomass. Understanding how these organisms respond to environmental change is central to coping with many of humanity's challenges in public health, biodiversity conservation, and food security. For many arthropod species, a complex set of abiotic and biotic factors can influence their abundance and distribution patterns by introducing stage-specific variation in fitness-related life-history trait responses. Temperature, rainfall, inter- and intra-specific competition, and habitat quality have all been considered in previous attempts to understand how different environmental factors can interact and vary in their relative influence on a population's maximal growth rate, r_m. However, the effect of relative humidity on the temperature-dependence of this key metric has largely been ignored. Using laboratory experiments and an analytic r_m model, we show that variation in relative humidity during the aquatic juvenile life stages can shape the temperature-dependence of r_m in the malaria mosquito, *Anopheles stephensi*.

A One Health approach to assessing tick-borne disease risk and impacts in UK upland habitats.

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Abstract

Tick-borne diseases (TBD) are an escalating threat to both humans and livestock globally, with UK upland areas being particularly affected. These diseases significantly impact livestock production and pose growing public health risks, making them a top concern for farmers. Policy-driven changes in upland land management, intended to provide environmental benefits, may unintentionally heighten the risk of tick hazard and the spread of tick-borne pathogens. Therefore, understanding the management, environmental, and ecological factors that contribute to TBD risk is essential for developing future policies and best practices to mitigate disease impacts on both animals and humans.

This study focuses on investigating the management, host, and environmental drivers of tick hazards on upland sheep farms in North Wales. It specifically examines sheep exposure to key tick-borne pathogens, including Louping Ill virus, Anaplasma phagocytophilum, Babesia spp., and Borrelia burgdorferi s.l., to inform better management and intervention strategies.

Exploiting artificial haemolymph (Nutri-blood) to understand the role of nutrition on pathogenic relationships invitro

Dr Awawing A Andongma[1], Dr Annabel Rice[1], Dr Sheena Cotter[2], Prof Ken Wilson[1]

[1]University of Lancaster. [2]University of Lincoln

Abstract

Nutrition plays a critical role in promoting health and fitness. However, it is still unclear how different pathogens responds to varying nutritional environment and the consequences on host fitness. To understand this, we exploited artificial Nutri-bloods, a simple model system which provides a tractable *in vitro* approach to unravel the effect of macronutrients and their metabolites on bacteria population growth and the outcome of infections.

The results showed that, bacteria growth rates were significantly positively associated with the carbohydrate content in Nutri-bloods. In contrast, bacterial growth was negatively correlated with both the absolute and relative amounts of protein in Nutri-bloods. Comparative growth studies revealed that *Klebsiella* grew significantly faster than the other bacteria, regardless of the micronutrient composition of the artificial Nutri blood. These results were reflected in *Spodoptera littoralis* mortality rates following pathogenic infections.

This study lays the foundation for designing effective treatment options following a pathogenic infection.

Connectivity of Plague: Exploring population genetic structure of plague vectors and hosts across varied East African landscapes

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Abstract

Plague is endemic in Madagascar with hundreds of bubonic infections reported per year. The pathogen subsists within a wild reservoir cycle consisting of flea vectors *Xenopsylla cheopis* and *Synopsyllus fonquerniei* and the primary host *Rattus rattus*. Improved understanding of the landscape connectivity of populations of these species is critical for improving epidemiological understanding and informing rodent and vector borne disease control efforts.

We explored patterns of genetic structure in *R. rattus* and *S. fonquerniei* in a heterogenous landscape of agriculture and forest to understand levels of genetic connectivity at small scales (between 5 and 50km). Results indicated higher levels of spatial structure in flea populations than in *R. rattus*. We compare our *R. rattus* population structure results with results from a different, more mountainous landscape in Madagascar and with a rural landscape in Tanzania where *R. rattus* are largely confirmed to houses.

Nanopore PCR-free sequencing of eDNA samples leads to detection of wildlife-related pathogens in La Mandria Regional Park, Italy.

Mr Amir reza Varzandi, Professor Stefania Zanet, Professor Ezio Ferroglio

University of Turin

Abstract

Surveillance of wildlife is crucial for the early detection of emerging pathogens. The One Health Integrated Wildlife Monitoring approach combines information from all biotic components of the ecosystem, disease surveillance on animals (domestic and wild) and wildlife population. Environmental detection of pathogens through environmental Nucleic Acids (eNA) methods is a promising component of such programs. In this study, we analysed eDNA samples derived from water filtered at eight different irrigation channels inside and outside the La Mandria Regional Park's fenced-off area near Turin, Italy. We sequenced these samples with Nanopore's PCR-free native sequencing kit to identify taxonomies that can be informative of candidates for targeted surveillance of invasive species and pathogens. In addition to the detection of Fascioloides magna (which its presence in the park is known), sequencing results detected Batrachochytrium dendrobatidis. The latter was detected months before its first case being reported in animals.

Spatial structure of a host landscape can slow the spread of invading pathogens (such as cassava brown streak virus in sub-Saharan Africa)

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Abstract

To infer the effect that the spatial structure of a host landscape has on an epidemic, we used an analytical approximation for the rate, *r*, at which susceptible hosts become infected at the start of an epidemic. Considering cassava brown streak virus (CBSV) as an example of a crop pathogen and the cassava harvested area in sub-Saharan Africa as an example of a crop landscape, we estimated a potential reduction in the CBSV infection rate that could be achieved by increasing fragmentation of the cassava landscape. We demonstrate that the analytical approach based on an estimate of the rate, *r*, can be used to identify spatial structures that effect deceleration of an invading pathogen.

Superspreaders have lower gut microbial alpha-diversity and distinct gut microbial composition in a natural rodent population

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Abstract

The impact of the gut microbiota on host health is well-established, but its role in superspreading is not fully understood. Superspreaders are individuals with a strongly disproportionate contribution to pathogen transmission, and they come in two forms. Supershedders transmit infection to more individuals because they shed higher levels of a pathogen. Supercontacters transmit infection to more individuals because they have a larger number of social contacts. We explore associations between the gut microbiota and these two forms of superspreading in a natural population of field voles (*Microtus agrestis*), focussing on one of their most common pathogens, *Bartonella* spp. We find evidence that supercontacters have lower gut microbial alpha-diversity than low-contacters. We also show evidence that both supershedders and supercontacters have distinct gut microbial composition, and identify specific taxa which are more abundant in the gut microbiota of these two classes of individuals. We discuss the implications for wildlife disease control.

Ecological correlates of parasitism in red deer

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Abstract

In red deer on the Isle of Rum, high faecal egg counts of strongyle nematodes with a direct life cycle (FEC), are associated with lower juvenile survival and depressed female fecundity. We investigated the ecological factors associated with FEC variation after accounting for seasonal effects and individual variables such as lactation, which is associated with higher FEC. Specifically, using individual home range centroids, spatial variation in local density and spatial variation in NDVImax from satellite imagery, we tested the predictions that high host density should increase FECs through enhanced transmission and that high food availability should reduce FECs through enhanced condition and hence greater investment in resistance. Our findings support these predictions, in that FEC increases with density but decreases with NDVImax and both effects can be fitted in the same model. Our results highlight the twin roles of exposure and susceptibility in determining the realised FEC of an individual.

Moving from the Dilution Effect to Dilution Landscapes: Effects of Natural Vegetation Cover and Fragmentation on Host-parasite Eco-evolutionary Dynamics

Ana Paula Lula Costa[1], Klementyna Gawecka[2], Cecilia Andreazzi[1,3]

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Abstract

The transformation of natural landscapes is a major driver of biodiversity loss and disruption of ecosystem services, including disease regulation. Deforestation and fragmentation increase the risk of zoonotic diseases, especially in areas with reduced vegetation cover. Although evidence links deforestation to disease regulation, the impact of landscape configuration on host-parasite interactions remains unclear. Parasite-host coevolution produces varying interaction strengths shaped by landscape structure. To explore this, we developed a spatially explicit metacommunity and coevolutionary model to answer how vegetation cover and fragmentation affect parasite-host dynamics. Using data from the Atlantic Forest Biome, we modeled 49 mammal species and 102 infectious agents across 12 landscapes with varying levels of fragmentation and cover. Results indicate zoonotic and non-zoonotic interactions increase with higher vegetation and lower fragmentation, while interaction strength diminishes. Landscapes with less vegetation and higher fragmentation amplify zoonotic disease transmission due to fewer host species, increasing their competence.

Does deer habitat use drive the impact of woodland patch size and connectivity on tick density, *Borrelia* prevalence and Lyme Disease hazard?

Saudamini Venkatesan[1], Kayleigh Hansford[2], Sara Gandy[3], Mark Greener[2], Richard Hassall[4], Beth Purse[4], Roman Biek[3], Tom Morrison[3], Lucy Gilbert[3], Jolyon Medlock[2], Caroline Millins[1]

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Abstract

Recent UK woodland expansion policies aimed at enhancing biodiversity and woodland connectivity could increase human exposure to tick-borne diseases by providing suitable habitats for *Ixodes ricinus* ticks and impacting abundance and movement of key tick hosts such as deer. To evaluate future risks, we examined how woodland patch size and connectivity impact tick density, *Borrelia* prevalence, and Lyme disease hazard in 60 woodland patches across two landscapes in the UK. We obtained patch-level deer encounter rates using trail cameras to assess how deer habitat use influences the relationship between landscape structure and Lyme disease hazard. Our findings, based on mixed models and confirmatory path analyses, indicate that the impact of deer habitat use on Lyme disease hazard differs significantly across landscapes and is deer species-specific. This study highlights the potential impact of large-scale woodland management on deer habitat use and subsequently on tick densities and Lyme disease hazard.

SPREAD: SPatio-temporal Rodent Ecology And Disease Database.

Miss Ana Martinez-Checa Guiote[1], Mr Harry Gordon[1], Dr Greg Milne[1], Dr David Redding[1], Dr David Simons[2]

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Abstract

Rodents are reservoirs of zoonotic diseases, posing a significant threat to human health. Understanding rodent ecology and population dynamics is therefore important for mitigating human zoonotic hazards. Trapping studies have improved our understanding of zoonotic epidemiology, however, capturing known reservoirs to the exclusion of other rodent species limits inference on broader eco-epidemiological questions. Detailed information on rodent communities could be used to understand how global changes in habitat suitability and climate influence the dynamic ecosystems from which zoonotic diseases emerge and are maintained. Currently, there is no standard method for reporting rodent trapping data. This project aims to establish a high-resolution rodent community seroprevalence database by collating published data on rodent abundance and pathogen prevalence, and provide a standard for its reporting going forward. These data will facilitate robust inference on the eco-epidemiological predictors of rodent-borne disease, helping to shape our understanding of zoonotic disease risk in a changing world.

Modelling climate-driven *Mastomys natalensis* population dynamics with an application to forecasting Lassa fever outbreaks

Dr. Gregory C Milne[1], Dr. Lauren A Attfield[3], Prof. Christl A Donnelly[2], Prof. Kate E Jones[3], Dr. David W Redding[1]

[1]Natural History Museum. [2]University of Oxford. [3]University College London

Abstract

Rodents are key reservoirs of zoonotic infections, hosting 85 known zoonotic pathogens. While the transmission of rodent-borne zoonoses occurs within a complex and dynamic ecosystem, most research on predicting rodent-borne disease risk overlooks reservoir host ecology. In this study, we model the population dynamics of *Mastomys natalensis*, the reservoir of Lassa virus (LASV), which causes annual Lassa fever outbreaks in West Africa. Using a climate-driven model, we integrate daily climate data, 29 years of capture-mark-recapture data, and arenavirus serosurvey data to estimate *M. natalensis* population and infection dynamics. Bayesian methods reveal climate lags affecting rodent demographics, and our model aligns well with observed annual LASV outbreaks in Nigeria. This study highlights the importance of eco-epidemiological approaches for forecasting rodent-borne disease outbreaks.

Population Ecology

Rainfall, temperature and humidity shape body condition of subtropical feral cattle.

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Abstract

Heat stress alters feeding behaviours and growth in farmed cattle leading to fluctuations in body condition, but impacts in wild subtropical cattle remain largely unknown. Here, we demonstrate the impact of subtropical climate on feral cattle body condition score, an effective and non-invasive method used to evaluate health and fitness of ruminant populations. Over two-years, we used a 9-point scale to assess body condition of 179 adult cattle from 12 herds in Hong Kong, recording 4,336 scores. Males had higher body condition than females. Higher rainfall led to lower body condition scores in the same month, but higher scores in the following month. Higher temperature increased body condition scores, particularly in females. Higher humidity decreased body condition in the subsequent month. Provisioning did not predict body condition but reduced inter-individual body condition variability. These non-linear relationships between climate and body condition suggest subtropical cattle adapt to seasonal fluctuations.

Towards multi-scale models of functional invertebrates: how realistic are current mechanistic and process-based models of earthworms and wild pollinators?

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Abstract

Ecological models are important tools for informing land management decisions, especially when they encode the biological mechanisms and processes that give rise to population dynamics. Yet, model development is constrained by a trade-off between realism and complexity, leading to species-specific models with specific mechanisms or processes, spatiotemporal scales and management scenarios in mind. Agri-environment schemes, however, need to account for diverse functionally important species from agricultural field to landscape scales. We developed and applied a novel approach for quantifying the 'ecological realism' of existing mechanistic and process-based earthworm and wild pollinator population models. We find that these distinct invertebrate groups are represented according to scale-specific mechanisms and processes which are not necessarily suited to the purpose of predicting emergent population responses from field to landscape scales. Progress towards the development of multi-scale models is needed to improve the evidence base of land management interventions that aim to promote biodiversity-based resilience.

Are the peacocks are real problem makers?A case study from Malappuram district, Kerala, India.

First Author Farsana KK

University of Calicut

Abstract

Are the peacocks are real problem makers?

A case study from Malappuram district, Kerala, India.

The Indian peafowl (Pavo cristatus) is a large, ground-dwelling bird species native to the Indian subcontinent. Belonging to the family Phasianidae.In the Pandikkad area(Malappuram district) peacocks have been identified as primary crop damages. To quantify the issue, conducted bird sampling, population density analysis, and surveys among local farmers. Our research revealed a significant correlation between peacock presence and crop damage. Notably, the results showed a higher proportion of male peacocks engaging in crop damage compared to females. This study provides valuable insights for developing targeted mitigation strategies to minimize crop losses and promote coexistence with peacocks. By understanding the dynamics of peacock behavior and population density, we can work towards finding effective solutions for farmers and conserving peacock populations in the area.

European beech (*Fagus sylvatica*) regeneration at risk: The role of rising summer temperatures on masting across species range

Jessie J Foest[1,2], Michał Bogdziewicz[1], Andrew Hacket-Pain[2]

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Abstract

Climate change effects on tree reproduction remain poorly understood, though population resilience depends on sufficient regeneration to offset rising mortality rates. Forest-forming species like European beech often mast, varying seed production year-to-year to enhance pollination and reduce seed predation. Recent observations indicate that climate change can dampen masting, thereby drastically reducing seed crop viability. The extent and conditions under which masting breakdown occurs are unclear. We analysed 50 long-term seed production datasets and found that rising summer temperatures are a key driver of masting breakdown. Specifically, increased site-specific mean maximum June-July temperatures were linked to lower masting. Additionally, crop failures and low-seed years have decreased over the past four decades, indicating altered starvation effects on seed consumers. Lowered masting can reduce viable seed production despite the overall increase in seed count, and our results warn that a covert mechanism is underway that may hinder regeneration and disrupt forest dynamics.

Summer solstice orchestrates the subcontinental-scale synchrony of European beech (*Fagus sylvatica*) mast seeding

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Abstract

Masting i.e., synchronous and highly variable seed production among years is commonly observed reproductive strategy in trees. However, mechanisms facilitating seed production synchrony over the vast geographical areas remain largely unknown. Here, we investigated factors driving masting synchrony in European beech, which extends to the thousands of kilometres throughout its range. We used a moving window analysis to determine how correlations between beech seed production and mean temperatures fluctuate at a fine temporal scale. We found that beech abruptly opens its temperature-sensing window on the summer solstice - the longest day of the year that occurs simultaneously across the whole Northern Hemisphere. Anchoring the weather cue window to the solstice enables even widely separated populations, inhabiting diverse climatic regions, to start responding to weather signals in the same week. In turn, this creates a high precision timing of the Moran effect, leading to the subcontinental-scale synchrony of beech mast seeding.

Butterfly responses to weather anomalies depend on local adaptation and range position

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Abstract

Intra-specific variation in responses to climate change can be linked to adaptation to the local conditions. Likewise, species are expected to be more resilient at the centre of their distribution, but this pattern may not be general. Using long term monitoring data for 34 species across six European bioclimatic regions, we showed that species responses to climatic anomalies vary with local adaptation and position in the distributional range. While climatic anomalies negatively affected all population changes of locally adapted species, populations of non-locally adapted species were affected positively or negatively, depending on their location and the direction of the anomalies. As a result, population trends of locally adapted species showed stable abundances over time at the trailing margin, but steep declines at the leading; while the rest showed a steeper decline at the trailing. Our results urge for contextualised forecasting and management, incorporating information on species adaptations and location.

The Timeline to Collapse suggests terminal decline in Norwegian Atlantic puffins and Black-legged kittiwakes.

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Abstract

The Timeline to Collapse represents a sequence of signals detectible in collapsing populations which improves the prediction of extinction. It achieves this by demonstrating behaviour buffers against morphology change, which in turn buffers against abundance decline. Such a process is documented in experimental systems, but only partial evidence is available for wild populations, resulting in scepticism of the concept. We therefore used decadal flight, weight, survival and count measurements of well-monitored but threatened Atlantic puffin and black-legged kittiwake populations to comprehensively document the sequence of changes across space and time. We show population abundances have been declining since the mid-2000s while other measurements in that period are generally stable. The Timeline to Collapse does emerge in the most extensively monitored population – puffins on the island of Røst – but the lack of change in non-abundance measurements suggests that these populations cannot buffer against further stress and are trending towards extinction.

Trap-dependence in Capture-Recapture studies: what does it tell us about intraspecific variation?

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Abstract

Capture-recapture (CR) models have been used to estimate demographic rates in natural populations. The most frequent deviation from assumptions required in CR studies is the immediate trap-dependence that corresponds to the correlation between successive capture events. We review 570 papers across vertebrate populations where several capture types exist, record possible variation in occurrence of trap-dependence, and discuss its biological meaning. We highlight that the occurrence of trap-dependence varies among populations of a given species and only displays a moderate repeatability. It also varies within a population depending on the sex, age, or type of mark, and reflects strong among-individual variation in personality, in responses to capture, or ecological context. We argue that immediate trap-dependence can be seen as a form of dynamic heterogeneity, reflecting clear among-individual differences. Although trap-dependence is generally considered simply as a noise to account for, it has a clear biological meaning in terms of intraspecific variation.

Pollination does not always translate neatly to plant fitness and population dynamics

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Abstract

Most plants require animal pollination to reproduce, prompting concern that pollinator declines threaten plant biodiversity. However, resource reallocation and reproductive strategies may buffer plant populations against losses in offspring production. To test this, we parameterized Integral Projection Models with four years of experimental field data to understand how decreases and increases in pollination affect population growth rates of five plant species. Species varied in their capacity to buffer against declines under reduced pollination, with neutral and negative effects on population growth. In contrast, increased pollination consistently diverted resources towards seed production and away from growth and/or survival, in one case causing a net decline in population growth. Our results reveal pervasive indirect effects of altered pollination on plant population dynamics that are important for predicting the impact of pollinator declines on plant biodiversity.

The effects of glyphosate on the locomotion and mortality of freshwater snails *Vitta (Neritidae) virginea*

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Abstract

Freshwater ecosystems are subject to anthropogenic stressors, including pesticides like glyphosate which poses an ecological risk. *Vitta virginea* is an amphidromous freshwater snail, essential for maintaining water quality and recycling nutrients. *Neritidae virginea* was exposed to different concentrations of glyphosate to examine the effect of this pollutant on locomotion. Snails were exposed to glyphosate and video recorded for 96 hours. Videos were analyzed through movement software, and statistical analysis was done for mortality and water quality data. Results indicate a difference in the particulate matter water parameter, with higher mortality rates among experimental groups. Locomotion analysis of the snails under different concentration of glyphosate demonstrated no effects on locomotion. Further research on the impact of glyphosate in freshwater snails serves as models for future experimentations and contributes to findings of glyphosate effects in macroinvertebrate organisms which have been poorly studied.

Accurate prediction of population dynamics: a statistical assessment of matrix projection approaches with five herbs

Professor Richard P. Shefferson

University of Tokyo

Abstract

Accurately projecting population size is key to population and conservation ecology, but accurate predictions remain elusive beyond 1-2 years. Matrix projection modeling (MPM) approaches are commonly used, including Leslie and Lefkovitch models, empirical and function-based MPMs, age-by-stage and historical MPMs, with and without density dependence. We used individual-based demographic datasets of five perennial herbs, each covering 20-36 years, to compare the accuracy of these approaches, splitting each dataset into model building and prediction subsets. We developed each model using a simple vs complex life history, with and without climate predictors, characterizing model accuracy against observed population dynamics. Lefkovitch models outperformed Leslie and age-by-stage models. Function-based models (complex IPMs) predicted observed population dynamics more accurately than empirical models. Among stage-based models, historical models predicted most accurately. Density dependence increased accuracy in all cases. We suggest that individual history and density dependence should be more broadly incorporated into studies of population dynamics.

Phylogeography and global distribution of the food and feed-related Tenebrionid Species (T*enebrio molitor* and *Alphitobius diaperinus*)

Dr Inusa J Ajene, Ms Evalyne W Ndotono, Dr Chrysantus M Tanga, Dr Fathiya M Khamis

International Centre of Insect Physiology and Ecology

Abstract

Insect-based products are an indispensable component in efforts to address the increasing demand for alternative protein sources attributed to global population growth. Mealworms are excellent sources of high-quality protein and have been used as a feed source for livestock. Larvae of the mealworms *Tenebrio molitor* and *Alphitobius diaperinus* have been identified as alternatives to conventional protein sources and reported to degrade plastic waste like polystyrene. Therefore, in-depth studies on the diversity and distribution of these species could reveal the genetic and ecological foundations of their exciting abilities. This study evaluated the interspecific genetic and ecological diversity of both species. A moderate interspecific genetic diversity was observed between *T. molitor* and *A. diaperinus* and the predictive model showed marginal to optimal suitability for both species in countries where they have not been reported. This study provides insights necessary for maximizing these species as alternative protein sources and in waste management.

The dynamics and outcomes of fishery-seal interactions

Dr Katrina J Davis

University of Oxford. University of Western Australia

Abstract

Globally, many populations of pinnipeds—such as seals and sea lions—have made important recoveries after a long history of human exploitation. This conservation success brings its own challenges as larger populations of these animals lead to higher interactions with fisheries, and the depredation (removal) of fisheries catch by pinnipeds. I present new research synthesising how big this problem is globally, estimates of the economic impact it can have on fisheries, and mechanistic insight into how seal-depredation behaviours may emerge and the impact they can have in a density dependent fisheries system.

Brown trout (*Salmo trutta*) and European grayling (*Thymallus thymallus*) respond differently to river restoration

Miss Hannah King, Dr Andrew Vowles, Professor Paul Kemp

University of Southampton

Abstract

Brown trout (*Salmo trutta*) and European grayling (*Thymallus thymallus*) provide commercial value for freshwater recreational fisheries. Instream wood addition is an affordable restoration technique increasingly used in fishery management to improve wild salmonid habitat. Yet, evidence of the benefits of wood addition for salmonids is lacking. Here, we conducted electric fishing surveys at two recreational fishery reaches over multiple years to compare brown trout and grayling populations before and after wood addition. Grayling populations declined in both reaches in terms of juvenile and overall abundance. In contrast, brown trout juvenile and overall abundance increased in both reaches. Brown trout are a popular fly-fishing species, so this "light touch" restoration could be considered successful. However, restoration becomes more challenging when attempting to benefit multiple life-stages and species, as does assessing success. We highlight the need to explicitly state river restoration motivations to better guide the development of more robust monitoring.

Seasonal dependent switching of leaf senescence control in Arabidopsis halleri.

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Abstract

Leaves are the central organ of plants, with functions such as storage and production, and are appropriately senesced to optimise production and reproduction. First, when photosynthetic efficiency declines due to leaf age or self-shading, leaves are renewed to maintain photosynthetic efficiency throughout the individual (Chabot & Hicks, 1982). In addition, leaf senescence is synchronously accelerated throughout the individual during reproduction to transport resources to the reproductive organs (Brown & Hudson, 2017). Thus, senescence is triggered by multiple factors, optimising resource allocation and playing an important role in adaptive strategies. Particularly in the field, appropriate senescence pathways must be selected seasonally for production, overwintering and reproduction, but there are few studies on how senescence control is integrated in the field. In conclusion, our results show that there is an important switching control of leaf senescence that optimises photosynthetic production and storage/reproductive translocation in the seasonal schedule of the perennial plant.

Non-stationary environments accentuate the relative resilience of natural populations

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Abstract

Predicting the viability of ecological systems under future global change has inspired decades of research into the ability for these systems to resist and recover following disturbance. However, existing approaches used in quantifying this resilience in natural populations commonly overlook how their vital rates (e.g., survival, reproduction) are routinely exposed to continual changes imposed by directional environmental shifts. Here, we test how robust conventional understanding of demographic resilience is to persistent directional environmental change. Exposing structured population models, sourced from the COMPADRE and COMADRE databases, to directional changes in their underlying vital rates, we illustrate how the subsequent magnitude of change observed across each populations' resilience attributes is proportional to the initial condition of these attributes. Accordingly, directional environmental change will compound existing variation across the relative resilience of differing populations, increasing the vulnerability of already vulnerable populations, and making it harder to displace invasive species.

The trait-specific relationships between phenotypic dissimilarity and diversity effects on population performance in wild *Drosophila*

Dr Takahisa Ueno, Dr Yuma Takahashi

Chiba University

Abstract

Genetic diversity non-linearly enhances ecological performance (e.g., productivity and persistence), a phenomenon known as the diversity effects. The performance of a mixture of dissimilar genotypes exceeds the average of monocultures (non-transgressive) or even the most productive monoculture (transgressive). While phenotypic dissimilarity in certain traits has been identified as a factor responsible for these diversity effects, the features remain poorly understood. Here, we experimentally reared monocultures and pairwise mixtures derived from 12 isofemale lines of *Drosophila immigrans* to assess the relationship between phenotypic dissimilarities across 21 traits and diversity effects on population performance. Additionally, whole-genome sequencing compensated for unmeasured phenotypic dissimilarities and enabled the calculation of genetic dissimilarities within each mixture. We found that both genetic and specific phenotypic dissimilarities contributed to non-transgressive and transgressive diversity effects, indicating that the dissimilarity affected diversity effects. Our results also highlighted the potential to identify the features of traits that significantly influence diversity effects.

Holding their Ground: The Influence of Habitat Composition and Tree Cover on the Home Range Size of GPS Tagged Golden Eagle *Aquila chrysaetos* in Western Scotland

Miss Charlotte Jennifer Chandler[1], Dr Matt Geary[1], Dr Charlotte A Hosie[1], Dr Philip D Whitfield[2], Dr Alan H Fielding[2]

[1]University of Chester. [2]Natural Research Ltd, Aberdeenshire, United Kingdom

Abstract

For two centuries, the Scottish uplands have been maintained as an open landscape of grassland, heather moor and blanket bog. However, land use is changing from predominately management for livestock, deer and grouse, to increased afforestation, tourist recreation and renewable energy schemes. As such, understanding how habitat may influence space use can help us to determine how future changes may impact upland specialists, such as the golden eagle. This study investigated if the home range size (kernel density estimate) of 16 GPS tagged golden eagles differed based on habitat composition (Sentinel-2A satellite imagery). Habitat composition was not a key driver of range size, which suggests that eagles either cannot, or choose not to, expand their ranges to compensate for the loss of open habitat. Therefore, any habitat changes within their range needs to be considered carefully, as the eagles will not move to a more suitable area of habitat.

Heterogeneity in microclimate and weather parameters interfere with effects of landscape structure on intraspecific trait variation

Mr. Santiago J Ordonez[1], Dr. Balázs Deák[2], Dr. Orsolya Valkó[2], Ms. Vivien Szász[1], Dr. Krisztina Verbényiné Neumann[3], Dr. Anna M Csergő[4]

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Abstract

Predicting how changes in climate and land use jointly impact populations in remnant habitat fragments is a pressing task in ecology. Microclimate may play a key role in the local persistence of plant species by modulating the regional weather effects.

Using a spatially and temporally well replicated dataset we showed that responses to a local heat load gradient modulated by temporal weather fluctuations were dominant drivers of intraspecific plant trait variation, and for some traits these effects were superimposed on constraints due to habitat isolation and small area.

We performed repeated measurements of vegetative and reproductive traits of 569 permanently marked individuals of a grassland specialist plant *Salvia nemorosa* L. over three consecutive years. We sampled 13 populations, where individuals were located in microhabitats exposed to different levels of heat load.

We propose that exposure to strong environmental stressors may obscure the real effect of human impact on plant populations.

Using Unmanned Aerial Vehicles to estimate body volume at scale for ecological monitoring

Mr Thomas C Stone, Dr Katrina J Davis

University of Oxford

Abstract

Demographic data are essential to construct mechanistic models to understand how populations change over time and in response to threats like climate change. Existing demographic data are either lacking or insufficient for many species, particularly those challenging to obtain direct measurements from, like marine mammals. We introduce a novel, non-invasive method to estimate the 3D body size (volume) of pinnipeds (seals, sea lions, and walrus) that enables monitoring at high spatial and temporal scales. Our method utilises 3D structure-from-motion photogrammetry with off-the-shelf, multirotor unmanned aerial vehicles (UAVs), and accurately estimates individual body volume of pinnipeds in a time- and cost-effective manner whilst minimising disturbance. Although applied to pinnipeds here, our method could be adapted to further taxa that are otherwise challenging to obtain direct measurements from. Our proposed approach therefore has the potential to fill demographic research gaps, which will improve our ability to conserve these species into the future.

Determinants of body condition of black bears: an analysis of four decades of data collected from maple to spruce-moss forests.

Ms. Sophie Lavoie[1], Dr. Christian Dussault[2], Dr. Claude Samson[3], Prof. Martin-Hugues St-Laurent[1]

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Abstract

Resource availability is known to influence the body condition of the American black bear, with more productive habitats allowing for greater fat accumulation before denning. Recent climate change may have modified the abundance and availability of plant food resources, with potential effects on body condition in bears. Using 40 years of morphometric data collected along a boreal-deciduous forest gradient, we assessed the relative influence of local weather and habitat on the age-adjusted body mass of bears (an index of body condition). While body mass was positively correlated to the proportion of deciduous forests producing hard mast, we also found a small positive effect of the growing season length and a negative effect of the number of early spring frost events. Disentangling the effects of local climatic conditions and habitat composition on indices of bear fitness will improve our ability to anticipate the potential effects of climate change on bear populations.

Populations grow more slowly when founded by offspring of old vs young parents in the tiny, clonally reproducing, aquatic plant *Lemna minor* (common duckweed)

Victoria C. Thwaites, Suzanne L. Chmilar, Amanda C. Luzardo, Abbe Pawluk, Robert A. Laird

University of Lethbridge

Abstract

Advanced parental age can negatively affect offspring quality, leading to reduced offspring lifespan, reproduction, and fitness. In two lab experiments on the clonal macrophyte *Lemna minor*, we tested the hypothesis that these 'parental age effects' result in slower growth of populations founded by offspring of older parents compared to populations founded by offspring of younger parents. In Experiment 1, we founded populations from all 212 offspring of 19 parents of known age, harvesting populations at 2 or 4 weeks. Parental age negatively affected population growth for both growth durations. In Experiment 2, we founded populations from 178 offspring whose parents were either very young (first offspring) or very old (eleventh offspring), harvesting populations after 1-40 days. Parental age again negatively affected population growth across the range of growth durations. Our results link parental age effects with population dynamics and emphasize the importance of parental age for the evolution of senescence.

More social species live longer, have longer generation times and reproductive windows, and buffer better against environmental disturbances

Dr Rob Salguero-Gomez

University of Oxford

Abstract

We lack generality regarding how sociality associates with demographic traits within the Animal Kingdom. Efforts to understand how sociality shapes demography, and *vice versa*, have focused on single species or single taxonomic groups. I introduce a continuum of sociality, from solitary to tightly social, and test whether this continuum correlates with the key demographic properties of 152 species, from jellyfish to humans. I show that the sociality continuum is associated with key life history traits: more social species live longer, postpone maturity, have longer generation time, and greater probability of achieving reproduction than solitary, gregarious, communal, or colonial species. In agreement with the social buffering hypothesis, for a subset of species with long-term data, and using second derivatives of population growth rate, I show that sociality is associated with more buffered populations. This examination of sociality across the demography of 13 taxonomic classes highlights how individual interactions shape animal demography.

Population ecology needs new density-dependent analytical methods: the case of demographic resilience and suggested directions for future research

Dr. Christina M. Hernández[1], Dr. Iain Stott[2], Dr. David Koons[3], Dr. Roberto Salguero-Gomez[1]

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Abstract

Population regulation is a fundamental component of ecological systems: populations do not grow infinitely, due to a combination of competitive and predatory interactions within and between species. Despite wide acceptance of this idea, the vast majority of structured population models (where individuals are structured by age, size, or developmental stage) are density-independent. Here, I present our recent work on demographic resilience to demonstrate that unobserved density dependence alters our predictions of how populations will cope with disturbances. Importantly, we found that the apparent resilience of populations either increases or decreases with population density, depending on whether survival, reproduction, or growth are density dependent. Additionally, density-dependent models have increased recovery times than equivalent density-independent models; this increase is correlated with generation time. Therefore, density-independent models are poor predictors of response to disturbance if the underlying processes are density-dependent. Finally, I outline next steps for building and analysing density-dependent structured population models.

Does the size of a protected area matter? An assessment of leopard density and habitat use in a small protected area of Shiwalik foothills, Himalaya, India

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Abstract

Small protected areas are crucial for conserving wide-ranging, low-density large carnivores, despite often being undervalued compared to large protected areas. But these protected areas need sufficient prey, controlled wildlife crime, and connectivity with other protected areas to be effective. In the Shiwalik foothills, India, the 46.8 km^2 Kalesar National Park (KNP) is a dry deciduous forest. We used camera trap data to estimate leopard density with SECR model and assess habitat use using generalized linear models. The estimated leopard density was 19.31 ± 5.10 individuals/100 km^2. Leopard habitat use was positively associated with sambar and wild boar availability, human disturbance, and distance to road and was negatively associated with chital availability and distance to water. KNP's high leopard density is driven by abundant prey and absence of dominant competitors, despite significant human disturbance and livestock presence. This study provides a key baseline for understanding leopard population dynamics and developing conservation strategies.

LiDAR-based integral projection models calculate the time required by boreal forests to recover from fires

Miss Jessica M McLean[1], Miss Alice Rosen[1], Dr Tommaso Jucker[2], Dr Sean McMahon[3], Dr Roberto Salguero-Gómez[1]

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Abstract

Wildfires are increasingly impacting boreal forest biodiversity. Fire intervals are becoming too short for forests to recover, even amongst fire-adapted, semi-serotinous conifer species. Monitoring forest recovery at scale has been historically limited by the resources required to examine individual trees from ground-level. Here, we develop a novel pipeline to parameterise integral projection models (IPMs) with remotely sensed data at large spatial scales to monitor forest recovery post-fire disturbance. Specifically, we build IPMs for the fire-adapted *Picea mariana* to estimate passage time from 4m to the height where individuals substantially increase reproduction, where self-replacement is more likely. As hypothesised, we found that, once controlling for differences in topography and competition, the longest passage times to the target height was in the not recently burned stands on north-facing slopes (> 40 years). We discuss the challenges and opportunities of LiDAR-based IPMs for the accurate forecasting of natural populations before environmental drivers.

Demographic models predict species level responses to disturbances and nutrients in a distributed grassland experiment.

Dr Rachael H Thornley, Dr James Cant, Dr Christina M Hernández, Dr Roberto Salguero-Gómez

University of Oxford

Abstract

Two main drivers of community change in global grasslands are high levels of physical disturbance and nutrient addition. To create effective conservation programmes, we require data on which species are likely to be the most impacted by these pressures. However, this type of data are often prohibitively time-consuming to collect, resulting in patchy understanding of species dynamics and forecasting of community change. Here, we present a comparative demographic approach to predict changes in species cover estimates within DRAGNet (The Disturbance and Recovery Across Global Grasslands Network). Using two repositories of demographic models (COMPADRE and PADRINO), we calculate population resilience metrics, such as amplification and resistance, as well as life history traits, and successfully use these metrics to predict changes in species abundance following disturbance and nutrient addition events. Our results suggest that demographic models could play a complementary role to species cover data collected by ecologists, in predicting community change.

Populations on the edge: Range dynamics and conservation of great crested newts under global change

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Abstract

Great crested newts (*Triturus cristatus*) have declined across their range from years of habitat degradation, fragmentation, and loss. They now face new challenges under climate change which could further exacerbate declines. Edge of range populations in the Scottish Highlands are genetically distinct and ecologically important due to the unique habitats they occupy (such as more acidic ponds with pH as low as 4.9) as well as the multitude of processes which may shape their range boundaries in future, including increased drought frequency from warming temperatures and land-use changes. The aim of this project is to combine individual process-based modelling with population genomics on data collected across the latitudinal gradient in the UK and Europe. We will use this to investigate how the interaction of multiple stressors could affect the future persistence, adaptation and range expansion of *T. cristatus* and provide a scientific basis for conservation management strategies.

Sperm whales are drawn (back) to the shores of Terceira island in the Azores, the question is why

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Abstract

The waters around Terceira island in the Azores are a hotspot for cetacean diversity, particularly species foraging on deep-sea cephalopods. The largest of these deep-divers is the sperm whale (*Physeter macrocephalus*), capable of reaching lengths up to 19 meters and diving to depths over 2000 meters. Following the cessation of whaling in the 1980's, sperm whales remained less common around Terceira than other Azorean Islands, but sightings have significantly increased in the past 3 years. Moreover, sightings are being made increasingly close inshore (<4km), at relatively shallow depths (< 500m). Here we use over a decade of systematic survey data to investigate what could be driving the return of sperm whales to Terceira's shores. We examine changes in the number of sightings and group composition over time from visual surveys, as well as highlighting recent insights into the distribution and consumption of cephalopod prey by sperm whales in the area.

Effects of recurrent disturbance on the distribution and dynamics of genetic diversity and population persistence

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Abstract

Anthropogenic disturbance is leading to the decline of biodiversity. A key but overlooked biodiversity variable is intraspecific genetic diversity, which has been declining since the 19th century. In particular, land-use change has consistently been shown to have a negative effect on genetic diversity, although the underlying mechanisms are poorly understood. We investigate the effect of heterogeneous landscapes dominated by areas of high anthropogenic activity and recurrent disturbance, e.g. ploughing, on the distribution and dynamics of genetic diversity among virtual species differing in their life-histories.

We use genetically-explicit individual-based modelling to assess how different factors, including disturbance severity, demography and landscape characteristics, influence the distribution of genetic diversity across highly anthropic landscapes. Our results provide insights on the amount of anthropogenic disturbance species can sustain in highly anthropic landscapes before collapsing to levels of genetic diversity sufficiently low that they threaten population persistence.

Effects of habitat amount and fragmentation on red squirrel genetic diversity are strongest at specific spatial and temporal scales

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Abstract

Genetic diversity is important for adaptation and persistence of populations. It is influenced by many scale-dependent factors including demographic history and interactions with surrounding landscape. In this research we assess the spatial and temporal scales at which habitat amount and fragmentation impact genetic diversity in red squirrels (*Sciurus vulgaris*). To do so we deployed over 650 collectors across five 16 x 16 km landscapes in the south of France to gather hair samples, and genotyped 441 individuals at 16 microsatellite loci. We calculated habitat metrics across time periods from 1900-2019 and within distances between 4-18 km and fit models correlating genetic diversity to these metrics. We found evidence that genetic diversity is most closely related to landscape conditions roughly 30-40 generations (30-40 years) ago, and at broad spatial scales. Understanding the scales at which habitat loss and fragmentation impact genetic diversity is important for predicting and mitigating future biodiversity impacts.

Seminatural habitats support both grapevine pests and their parasitoids in Mediterranean organic vineyards

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Abstract

Seminatural habitats in agroecosystems support diverse communities of natural enemies and are expected to promote biological control. However, complex landscapes may also support agricultural pests, with undesirable outcomes for crop production. Here, we monitored populations of leafhopper pests and their egg parasitoids in two habitats: vineyards and seminatural habitats. Our results showed that the composition of the agricultural matrix strongly influences the spatio-temporal dynamics of leafhoppers and their egg parasitoids. Specifically, seminatural habitat cover in the landscape was positively correlated to leafhopper abundance in vineyards, and to parasitoid abundance in both habitats. Vineyard cover influenced leafhopper abundance in seminatural habitats. Our analyses indicate that seminatural habitats might be a greater source of leafhoppers than of their egg parasitoids in Mediterranean agroecosystems, with negative implication for their sustainable control in organic vineyards. Although seminatural habitats support farmland diversity and ecosystem service provision, they might not contribute to mitigate leafhopper impact.

Data integration improves monitoring efficiency for threatened tropical mammals

- Ardiantiono[1], Nicolas J Deere[1], David J.I. Seaman[1], U Mamat Rahmat[2], Eka Ramadiyanta[3], Muhammad I Lubis[3], Ahtu Trihangga[2], Ahmad Yasin[2], Gunawan Alza[4], Dessy P Sari[4], M Daud[5], Ridha Abdullah[6], Rina Mutia[6], Dewi Melvern[3], - Tarmizi[3], Jatna Supriatna[7], Matthew J Struebig[1]

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Abstract

Conservation initiatives strive for reliable and cost-effective species monitoring. However, resource constraints often force management decisions to rely on data from single methodologies, bringing inherent taxonomic or geographic biases. We introduce a data integration framework to identify the most cost-effective approach to monitor threatened mammals, focusing on tigers and prey (sambar deer and wild pigs) in Sumatra's largest tropical forest. We applied integrated community occupancy models to combine biodiversity data obtained from unstructured ranger patrols, systematic sign transects, and camera trap surveys. This integration improved species occupancy precision, reducing uncertainty by up to 42%, while expanding spatial scope to landscape scale. Moreover, utilizing multiple survey techniques reduced overall monitoring costs, demonstrating that a modest US$10,000 budget can achieve high precision tiger-prey occupancy estimates. Our framework addresses resource limitations and common biases in species monitoring, offering a practical solution for timely biodiversity management in tropical regions.

European rabbit in Chile: Towards a population and community approach for its management

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Abstract

The European rabbit causes great damage to several Chilean ecosystems. However, important gaps still need to be addressed to manage rabbits such as triggers of the rabbit population and how they are embedded in local food webs. We employed population models and weather and biotic drivers to understand triggers. Moreover, we built the food webs in several Chilean ecosystems to evaluate the interactions and likely short-term mechanisms after a rabbit extinction simulation. Population increase was best explained by low evaporation in summer, high cumulative winter rainfall, and abundance of eagles from autumn to winter. Besides, the rabbit was the most connected node, showing a possible release of herbivory pressure on plants and release a competition for herbivores after extinction simulations. Some predators could face a reduction in their trophic width and could intensify predation on alternative prey. Considering ecosystem approaches, these results should be useful for managing the rabbit efficiently.

Stress Echoes: Past Environments Shape Population Responses to Fluctuating Stress in *Synechococcus* sp.

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Abstract

In an ever-changing climate, global change factors are rarely consistent and often fluctuate, creating sequential stresses on ecosystems. Under such conditions, does a population's environmental history affect its response to future changes?

This study examines the influence of stress acclimation on the population responses of *Synechococcus* sp., a globally dominant marine cyanobacteria. We selected six strains from different habitats (warm and cold oceans) and experimentally manipulated their environmental histories through short-term exposure to two stressors: temperature and pollution. We then tracked population growth and functional traits across three different stress sequences. Our findings reveal that environmental history significantly shapes future responses: cross-tolerance can develop when environments differ, while repeated exposure to the same stressor may lead to stress build-up. Using generalized additive models, we found that functional traits and density feedback consistently predict population responses, highlighting their potential as key indicators of population dynamics in fluctuating environments.

Disentangling drivers of establishment success in range-expanding plants in mountains

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Abstract

In the face of global change, plant species around the world are shifting their geographical distributions along elevational gradients to track their climatic optima. However, range shifts generally lag behind predictions based on the current pace of climate warming and there is great variation between species' individual responses. In a large field experiment in the Swiss Alps, we investigate potential drivers of range expansion of common low elevation species. To test the effect of dispersal limitation, biotic interactions and temperature limitation on establishment success, we transplanted seeds and seedlings above their current range edge with and without competition, crossed with a warming treatment. Our results show, that while overall survival in the three year study period was high, growth and reproduction was substantially reduced by competition. Together with a collectively low germination rate, competition seems to considerably alter population dynamics and therefore slow down range expansion of our focal species.

Contrasting responses of rural and urban butterfly populations to urbanization and climate shifts

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Abstract

Urbanization and climate change are driving forces behind shifts in biodiversity, yet their impacts can vary significantly depending on the landscape context. Using extensive butterfly monitoring data across Europe, we analysed the impacts of urbanization and climate pressures on rural and urban populations. Butterflies' populations slightly increased over time with increasing urbanization in urban sites but not in rural sites. Warming trends led to greater population declines in urban sites than rural sites, while cooling trends generally increased butterfly numbers. Precipitation benefited rural populations but impacted urban ones, and aridity negatively affected populations in both settings, with a stronger impact in rural areas. Species traits related to trophic specialization, thermal tolerance, mobility and voltinism significantly influenced how butterflies responded to these pressures, with varying effects based on the landscape context. This research highlights the complex interplay between environmental changes, landscape context and species-specific traits in shaping biodiversity outcomes.

Is Bawean deer Axis kuhlii Population under 200 individuals? Comparison between Spatially Explicit Capture Recapture and Random Encounter Model

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Abstract

Estimating population density is crucial for conserving the crititically endangered Bawean deer (Axis kuhlii). This study aimed to (i) estimate deer density using the Random Encounter Model (REM) considering sex and season, (ii) assess REM variance based on daily movement from camera trap data and GPS telemetry, and (iii) compare density estimates from REM and the Spatially Explicit Capture Recapture (SECR) model. Thirty cameras were deployed in 30 grid cells within Bawean Island protected areas from January 29 to October 31, 2023. SECR estimated 2.23±0.16 deer/km^2 , while REM with camera trap data estimated 2.40±0.007 deer/km^2. Using GPS telemetry data, REM estimated a much higher density of 24.50±0.069 deer km^2. Density differences were noted with season and sex variations. Since setting precise criteria can be challenging, comparing results from multiple models is important for accurate density estimation, as results can vary significantly.

Ecological variation among two species of Phoxinus (Leuciscidae) in their natural contact zone, the Sieg drainage (Rhine)

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Abstract

Variation in the ecology of two Eurasian minnow species, *Phoxinus phoxinus* and *Phoxinus csikii* (Leuciscidae), was investigated in a newly discovered species contact zone within their natural distribution in the Sieg drainage (Rhine tributary, Germany). While *P. csikii* inhabits the mountainous streams of the drainage, *P. phoxinus* can be found in the foothill regions. The dispersion of *Phoxinus* in the Sieg drainage might thus represents a case of species sorting in the Sieg fish metacommunity. In species sorting, the local community composition is driven by local environmental conditions and their specific niche preferences. We focused on their dietary and trophic niche ecology, as well as their habitat preferences. We employed stable isotope analysis, stomach content analysis and ecological niche analysis. Preliminary results show evidence for different trophic niches of both species, which supports the species sorting hypothesis.

Dispersal distance and population connectivity in salt marsh species occupying different locations in the tidal range

Prof Paul A Ashton, Dr Jennifer Clayton-Brown

Edge Hill University

Abstract

The ability of plants to disperse is key to their survival under climate change. The dispersal distance and it's influencing factors are unknown for the majority of plants. For habitat specialists dispersal, through pollen, seed or vegetative fragments needsi need to be efficient to reach other suitable habitats. Saltmarsh plants are such specialists utilising a highly stressful, spatially restricted, though predictable environment. *Carex* section *Phacocystis* (Cyperaceae) incorporates a group of wind pollinated long lived clonal species which inhabit salt marshes. Three of the group occupy different niches on Norwegian saltmarshes, characterised by different distance from the low tide. They thus present a suitable suite of species to investigate maritime dispersal extent and population connectivity at various scales while latitudinal range offers an additional, potentially influencing, factor. The relative role of sexual or vegetative spread is also assessed.

Contributions of genetic differentiation and phenotypic plasticity to niche breadth for invasive *Alliaria petiolata*

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Wellesley College

Abstract

Niche evolution versus conservatism for invasive species can be difficult to discern from effects of competition and biotic resistance. We have found that the ecological niche for *Alliaria petiolata* across 16 locations in New England is much less constrained by environmental conditions when competitors are removed. Yet the effect of environmental variables on demographic vital rates is often location-specific, suggesting local niche evolution and/or genetic bottlenecks. We conducted greenhouse experiments to examine genetic differentiation and/or phenotypic plasticity using seeds from the same field locations. Aboveground size and leaf morphology were significantly related to seed source location. We observed plasticity in response to soil moisture variation for leaf morphology (consistent across seed source locations), but not for leaf number versus size. These results indicate that location-specific demographic responses may be driven in part by local adaptation or maternal effects, whereas plasticity may contribute to overall niche breadth across populations.

Larval herring diet analysis for the assessment of stocks with differing successes.

Dr Lauren Aylward, Professor Monika Winder

University of Stockholm

Abstract

Herring (*Clupea harengus*) are a culturally, commercially and environmentally valuable species, particularly in the Baltic sea. Stressed herring populations with distinct spawning windows are currently exhibiting variable recruitment rates and reported larval body condition, particularly lipid content. A potential explanation for this change in body condition is a change in food resource use and availability, potentially arising from forward phenological shifts of spring phytoplankton blooms. We sampled larval herring and performed metabarcoding on their stomach contents to understand what food resources are utilise between populations. We compare the results to historical research on larval herring diet and discuss if these diets are likely to meet the nutritional needs of larval herring. Preliminary results indicate a potential historical over-represendation of arthropods which maintain structure in the stomach, and high signal strengths of lipid-poor prey species.

Waves of synchrony and anti-synchrony in reproduction of mast-seeding trees across the northern hemisphere

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Abstract

Spatial synchrony in the temporally variable patterns of reproduction by populations of perennial plants (i.e., "mast seeding"), is high locally and decays with distance in response to changes in atmospheric temperature. Atmospheric waves generate climate dipoles that ripple around the planet and could lead to synchrony in ecological dynamics between distantly-separated populations. Using tree reproduction time series from 448 populations coupled with near-surface air temperature, we analyzed patterns of synchrony across the northern hemisphere spanning seven decades (1950-2020). We show that spatial-temporal synchrony in tree reproduction manifested as repeated waves of synchronization and anti-synchronization around the northern hemisphere as separation between populations increased by ~50° longitude. This ecological pattern aligns with atmospheric waves in annual summer temperature differences that propagate across and between continents. Future shifts in patterns and variability of global climate could have profound effects on ecological processes central to terrestrial trophic food webs across the planet.

Innovative ecological impact assessment using life-table response experiments and interstage flow matrices: Effects of habitat fragmentation and temporal environmental variation on *Trillium camschatcense.*

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Abstract

By incorporating the concept of interstage flow proposed by Yokomizo et al. (2024) into the life table response experiment (LTRE) method, we enhance the ability to assess ecological impacts beyond merely evaluating population growth rates (PGR). This refined approach breaks down PGR into interstage flows between different developmental stages. In a case study on a perennial plant, *Trillium camschatcense*, found in Hokkaido, Japan, we analyzed the effects of habitat fragmentation and environmental variability on both PGR and developmental transitions. The findings suggest that while habitat fragmentation has a minimal effect on overall PGR, it causes significant changes in interstage flows associated with stage-specific stasis. Seasonal environmental changes, particularly warm springs, significantly influenced PGR by enhancing the stasis of the one-leaf stage. This study illustrates the value of integrating interstage flows into the LTRE method for a more nuanced analysis of ecological impacts, highlighting its importance in understanding complex environmental interactions.

A systematic review and meta-analysis to assess variation in reported coral larvae dispersal distances and pelagic larval durations (PLDs)

Mr Matthew J Morecroft

University of Oxford

Abstract

Coral reefs play a crucial role in underpinning considerable levels of global biodiversity and human activity, but are severely threatened by anthropogenic stressors including climate change, pollution, and overfishing. The connectivity of coral metapopulations, primarily driven by the dispersal of coral larvae, is important for resilience and recovery of coral reefs in response to these stressors. Despite its importance, there is uncertainty in current scientific understanding of coral larval dispersal, with considerable variation in reported values of dispersal distances and pelagic larval durations (PLDs) even within species. I am conducting a systematic review and meta-analysis to assess the extent of variation in dispersal distances and PLDs, identify drivers of this variation, and assess how closely PLD values used in biophysical models of dispersal match empirically-obtained PLD values. This will identify potential methodological biases and evidence gaps, and enhance understanding of the biological drivers of variation in coral larval dispersal.

Population dynamics in complex marine environments – a call for process-based models

Professor Jacob Nabe-Nielsen[1], Dr Caitlin K Frankish[2], Dr Cara A Gallagher[3], Professor Volker Grimm[4]

[1]Aarhus University. [2]Norwegian Polar Institute. [3]University of Potsdam. [4]Helmholtz Center for Environmental Research – UFZ

Abstract

Marine predators increasingly experience conditions that are unlike those they have encountered in the past, with more wind farms and ships, altered prey availability and increasing temperatures. When we attempt to predict how populations will respond to these entirely novel conditions, statistical extrapolations are likely to fail. Instead, process-based models can yield robust predictions of how populations respond to multiple stressors. In such models, the energetic status, movements and fitness of individual animals can be simulated to reflect changes in environmental conditions and prey availability, allowing population dynamics to emerge as it does in nature. Here we demonstrate how a model framework built for the harbour porpoise (*Phocoena phocoena*) can predict the cumulative population impacts of wind farms, ship noise, climate change and fisheries. Additionally, we discuss the steps needed to expand the framework to a wider range of marine predators.

Assessment of *Macrobrachium* Populations in Sonadora Stream, El Yunque National Forest: an Analysis of Population Abundance and Distribution

Coral J Salgado Mendez, Dr. Omar Perez Reyes

University of Puerto Rico, Rio Piedras Campus

Abstract

Macrobrachium shrimp are a delicacy enjoyed by many. Fishing practices in Puerto Rico are a sustainability concern. There needs to be more information about the *Macrobrachium* species population in the Puerto Rico streams. This study aims to observe the population dynamics of *Macrobrachium* shrimp in Sonadora Stream, El Yunque National Forest. By quantifying population distribution, density, and elevation-related variables, we expected to gain a better understanding of the factors influencing shrimp populations and fishing sustainability. Long-term monitoring was carried out using visible implant elastomer (VIE) tags, while capture-mark-recapture analysis was utilized to estimate population number and movement. We anticipated considerable changes in the abundance, distribution, and size of *Macrobrachium* spp. populations in the Sonadora Stream are influenced by elevation. Preliminary evidence reveals a relationship between elevation and pool depth, which influences shrimp abundance. This study helps us better understand *Macrobrachium* ecology and assist conservation efforts.

Understanding the consequences of environmental fluctuations on community dynamics by considering Physiological Time

Dr Christophe F.D. Coste

Swansea University

Abstract

The concept of Physiological Time was developed in the 1970s to simplify analyses of population dynamics where life history stage duration varies with environmental conditions (e.g., insects). Indeed, in this alternative timescale to the chronological one, a stage has a constant duration. However, this concept has mainly been used to simulate stage-structured population abundances in fluctuating environments (via its derivative and using delay differential equations with time-varying delays). Physiological Time is, however, more than just a computational tool; it offers a valuable theoretical framework to decompose the effects of environmental stochasticity on population dynamics by focusing on the varying functional responses of different life history stages to environmental conditions. We demonstrate its potential by examining the dynamics of two competing species in a trendy and noisy environment. We reveal important and unforeseen consequences of a mismatch, between the two species, in the sensitivity of larval stage duration to environmental conditions

Determining the Leaf Litter Preferences of *M. carcinus* and *M. rosenbergii* in El Yunque National Forest

Daned S Morales, Dr. Omar Pérez

University of Puerto Rico, Río Piedras Campus

Abstract

Macrobrachium carcinus and *Macrobrachium rosenbergii* are freshwater prawns valued in aquaculture for their great size and meat quality. The *Macrobrachium* are omnivorous, consuming smaller shrimp, mollusks, small fish, insects, algae, macrophytes, and decomposing leaf litter. However, their specific feeding preferences are mostly unknown. This study aims to determine the feeding preferences of *M. carcinus* and *M. rosenbergii* in El Yunque National Forest through a controlled preference test. Three predominant riparian plant species were selected based on a visual population analysis: *Cecropia schreberiana*, *Piper glabrescens*, and *Spathodea campanulata*. Captured prawns were placed in separate tanks and exposed to leaf cuttings from each plant. Leaf weight changes over 96 hours were measured to determine ingestion rates. Based on previous studies with other shrimp species in this area, the preferred plant species is the *Spathodea campanulata*. Understanding these preferences is crucial for the comprehension of their nutritional needs, which could enhance aquaculture productivity.

Human influence dominates leopard population dynamics over ecological limitations

Mr. Jayanta Kumar Bora, Mr. Ujjwal Kumar, Mr. Qamar Qureshi, Mr. Yadvendradev V. Jhala

Wildlife Institute of India

Abstract

Large carnivores naturally occur at low densities and are susceptible to demographic changes caused by environmental disturbances. To understand how large carnivores are shaped by ecological limitations it's important to evaluate vital demographic rates such as density, growth rate, survival, and recruitment across populations. We studied leopard demography over 14 years in Kanha Tiger Reserve, India, using camera trap mark-recapture (n=262362 trap nights). Our findings (based on 481 adults) indicate that leopards can grow in well-protected, prey-rich habitats, demonstrating healthy demographic rates and fulfilling important ecological and evolutionary roles. Nonetheless, high abundance of top carnivores, like tigers, limit leopard populations. Due to their adaptability leopards also occupy suboptimal habitats, with scarce wild prey and high human pressure. Yet, we found that leopards in such habitats exhibit poorer demographic parameters compared to protected areas with abundant prey, demonstrating human influence is the most critical limiting factor for leopard populations.

Tree species growth dynamics drive forest dynamics

Dr Sean M McMahon

Smithsonian Environmental Research Center. Forest Global Earth Observatory. Smithsonian Tropical Research Institute

Abstract

Tree growth is a vital rate essential to understanding forest community structure and function. Growth patterns among tree species are used to indicate how different parts of the forest community allocate resources both as life-history strategies, but also how disturbance, competition, and climate might impact those strategies. Individuals within species, however, show different growth patterns consistently over time—that is, there is correlation in growth within species. This pattern betrays fundamental ways that trees experience the environment over time. We use inventory data from tropical and temperate forest plots to investigate the persistence of growth across species over time. We find that growth is correlated over individuals over time in both systems. We demonstrate with simulations how this correlation can challenge analyses of functional traits, identification of plant functional types in vegetation models, and can lead to a better conceptualization of life history strategies in forest systems.

Going the Distance: A look at how different populations of a maritime sedge (Carex extensa Gooden) genetically diversify when dispersed along the coast of the Irish Sea.

Madeleine Fyers, Professor Paul Ashton

Edge Hill University

Abstract

Saltmarshes are transitory environments that host several notable species of plants and animals. These environments are key in tackling the climate crisis, however not much is understood about how these ecosystems function on a genetic level. Carex extensa Gooden is a common saltmarsh species in Europe but is also native to the coasts of the UK. Despite its common occurrence, it appears that many of the populations of C. extensa exist in isolated communities. To assess the connectivity between these communities, microsatellites will be utilised to determine whether the isolated populations are dispersing via hydrochory, or via vegetative fragment. Using this method, this study aims to uncover the genetic mystery of C. extensa and how it genetically diversifies along the coast of the Irish Sea. Results and discussion will be presented at the poster conference.

Using Integrated Population Models to understand local environmental drivers of population dynamics in a short-lived avian migrant

Ellen C. Martin[1], Thomas V. Riecke[2], Pierre-Alain Ravussin[3], Daniel Arrigo[4], Michael Schaub[1]

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Abstract

Integrated population models (IPMs) combine demographic data into a unified framework, allowing for incorporation of environmental covariates to test hypotheses about demographic rates and population growth sensitivity. For birds, there is strong evidence that environmental conditions significantly affect demographic rates, particularly for long-distance migrants with short phenological windows. We developed a Bayesian IPM using 40 years of mark-recapture, fecundity, and nest-box occupancy data, incorporating environmental covariates hypothesized to affect two populations of the European pied flycatcher, a fast-lived long-distance migrant. Population growth rates were most sensitive to changes in apparent juvenile survival. Environmental covariates influencing juvenile apparent survival provided the largest contribution to variation in population growth rate, with little contribution from covariates acting on reproductive parameters. Modelling these mechanistic links between environment, demographic rates, and population growth rates increases estimate precision, allows comparisons between demographic rates, and is critical for assessing trends and allocating conservation resources for at-risk species.

Quantifying the impacts of habitat loss on genetic diversity in Danish arthropods

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[1]University of Aberdeen. [2]Aarhus University

Abstract

Genetic diversity is under threat. In addition to global climate change and human pollution, habitat loss is key contributor to the loss in genetic diversity being realized across taxa. However, the cross-taxonomic impacts of habitat loss on genetic diversity are difficult to capture due to the moderating effects of landuse cover and scale (*i.e.*, sampling radius). This gap is especially important for the effective provisioning of habitats (*e.g.*, grasslands *vs*. agriculture) for organisms with broad ecosystem services (*e.g.*, arthropods). To fill this gap in knowledge, we conducted a large-scale study of the genetic diversity of Danish arthropods. Specifically, we sampled species of springtails, beetles and spiders across 50 locations and quantified the genetic diversity of each population using pooled sequencing (50 individuals per population). Following a spatially-explicit analysis pipeline, our results demonstrate local grassland- and agriculture-cover both positively and negatively impact arthropod genetic diversity depending on sampling radius.

Improving understanding of mallard (Anas platyrhynchos) productivity, survival and movement in a changing world

Hannah Coburn[1], Tom Cameron[1], Aldina Franco[2], Matt Ellis[3], Chas Holt[4], Kim Wallis[5,6]

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Abstract

Despite being a ubiquitous feature of UK wetlands, we still have many gaps in our knowledge of mallard ecology. The UK's winter mallard population has declined over the past 30 years and we have a poor understanding of the breeding population status. Drivers of this decline are unclear but could include shifts in migratory behaviour induced by climate change. Contemporary, UK-specific estimates of demographic rates are needed to improve understanding of mallard population dynamics and more work on their movement ecology is required to inform management of this species. We used a combination of ring return data, GPS tracking, traditional survey techniques and citizen science to investigate mallard survival, productivity and movement. I will present my initial estimates of survival rates and duckling mortality, as well as offering insights into mallard movement ecology at a landscape and flyway scale.

Disturbance of tree populations in eastern Libya

Dr Tarek Awad Mukassabi

University of Benghazi

Abstract

The Green Mountain in east Libya is the only wooded region found in the east of North Africa and the only wooded Mediterranean spot located between the sea and the Sahara. Within the last few decades, decreasing annual precipitation and increasing temperature alongside human disturbance have significantly affected these *Pinus* and *Cupressus* woodlands. We have studied these native tree populations in terms of community structure, size, morphology, seed productivity and seedling establishment in five different sites across the Green Mountain over the last seven years. The results show a dramatic decline in tree density within three sites whereas a fourth was completely destroyed by storm Danial last year. The last site, which has the biggest trees, and the highest cone and seed production, is found at the highest elevation site (843 m). This raises many questions as to how these unique and endangered woodlands can be monitored and conserved.

How do weed abundance & diversity vary with cropping practices?

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[1]University of Sheffield. [2]Nottingham Trent University

Abstract

Weeds are a serious problem to farmers and cause great damage to food production while being ecologically important parts of the agro-ecosystem. Therefore, it is essential to measure the impacts of management on weeds. We tested association of weed densities and diversities in major crops using a large scale survey of 7 common weeds across 485 fields in the UK over 3 years. Weed populations were enumerated up to two times each year when both weeds and crops were mature. Ordinal density structured scale was used, in which density states for every species were visually estimated.

The relationship between weed density and diversity with crop types and rotational complexity was assessed by linear mixed models and diversity indices. We show that there are clear impacts of crops and rotation on weeds, however these are species and crop-specific. Our results demonstrate the importance of understanding the ecological impacts of crop management.

Responses to extinction drivers vary among specialist plants in Baltic coastal meadows

PhD Candidate Lukas Rimondini[1,2], Dr Adam Kimberley[3], Dr Jessica Lindgren[1,2], Professor Sara AO Cousins[1,2]

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Abstract

Coastal meadows are unique ecological communities due to their position between land and sea. However, abandonment and environmental change threaten their characteristic flora and fauna.

We recorded abundance of 9 specialist plant species in 72 coastal meadows along 250 km of coastline in central Sweden, reiterating a 60-year-old inventory. We analyzed drivers of changes in population sizes and distribution.

We found that all species have decreased in habitat occupancy, with some now having become regionally extinct. Changes in habitat occupancy depended both on habitat variables, such as habitat size and management, and species traits, such as dispersal and seed bank capabilities. These results give a rare insight into the varying responses of specialist plant species to the joint effects of habitat loss and environmental change. Conservation measures are imperative and must take habitat quality and connectivity into account.

Using stable isotope analyses to identify population-specific moulting regions for two seabird species

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Abstract

Seabirds are threatened by extreme weather events, fisheries bycatch, and renewable energy development throughout the annual cycle. Protection measures generally target breeding populations and identifying breeding colonies of wintering individuals is important in management. However, determining population-specific distributions of seabirds during the non-breeding season is challenging. For species that moult during winter, isotope analyses can identify feather regrowth locations. Traditional approaches use bulk carbon and nitrogen, yet there is also considerable geographic variation in sulphur. We combined marine isoscapes with feather signatures to identify moult locations of common guillemots and razorbills from known breeding populations. Furthermore, we compared locations estimated with and without the addition of sulphur signatures to assess the value of this third element in analyses. We aimed to determine if individuals' breeding population could be identified using wintering feather signatures. This work will help ascertain the provenance of beached, stranded, or bycaught wintering birds, improving population management.

The impact of environmental noise on the population dynamics of hosts and parasitoids.

Dr. Dongbo Li[1], Dr. Christophe F.D. Coste[2], Dr. Marianne Mugabo[1], Mr. Edward Hall[1], Prof. Chenggui Yuan[2], Prof. Mike S. Fowler[2], Dr. Steven M. Sait[1]

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Abstract

Environmental variation can be characterised by the frequency of change. Fluctuations can be rapid in blue environments (with negative temporal autocorrelation), slow in red environments (positive AC), or stochastic in white environments (no AC). However, the ecological impacts of coloured environments on species interactions remain under-studied. We examined how coloured temperature fluctuations affected the dynamics of an insect host, the Indian meal moth *Plodia interpunctella*, and its parasitoid, *Venturia canescens*, when exposed to red, white or blue fluctuations, and one constant temperature. Whereas the host-alone exhibited generation cycles in the constant environment, white noise gradually reduced host cycle amplitude and period, while blue and red environments rapidly eliminated cycles after just 3-4 generations. In stark contrast, parasitoids stabilised host populations by maintaining generation cycles in all coloured environments. We discuss how the impact of coloured temperature variation has important implications for understanding interacting species' responses to future environmental change.

Process-based modelling and citizen science monitoring indicate that some UK *Vipera berus* populations may be limited by anthropogenic disturbance

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Abstract

Predicting biodiversity in disturbed systems is increasingly important as environmental change accelerates. The adder (*Vipera berus*) is particularly vulnerable to disturbance effects due to its low fecundity and dispersal. In the UK, adder populations have declined, with habitat fragmentation and public pressure both cited as potential drivers, but their relative importance is not well understood.

We collaborated with NGOs and volunteer surveyors to build, parameterise and validate a process-based model that simulates adder relative abundance, accounting for habitat fragmentation. Across 257 UK survey sites, we examined where this model over/underpredicts adder abundance and related these residuals to multiple pressure metrics. Our results offer the first quantitative evidence that public pressure may be limiting adder population sizes at some sites. We discuss the challenges involved in quantifying anthropogenic disturbance and the importance of incorporating this into models to support conservation decision-making for adders and other sensitive species.

The role of diet in the body condition of Greenlandic caribou

Dr Mathilde Le Moullec[1], Aurélien Grange[1], Laura Barbero-Palacios[1], Ass. Prof. Glenn Yannic[2], Dr Josephine Nymand[1], Prof Perry Barboza[3], Dr Christine Cuyler[1]

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Abstract

In ecosystems with strong seasonality like in the Arctic, food availability and quality determine body condition of herbivores with implications for survival and reproduction. We examined the relationship between diet (faeces DNA metabarcoding and δ15N) and body condition of caribou from coastal and inland populations. Fecal DNA reflected a diet with a dominance of lichens on coastal moorlands and the prevalence of shrubs and sedges on inland heaths and grasslands. Low fecal δ15N on the coast indicated a lichen diet typically low in protein. Inland caribou were 10 ±1.5kg heavier than coastal caribou. Pregnant females were also 3 ±1.2kg heavier (foetal developmental of 41g/day). Better condition of inland caribou was best explained by a greater proportion of shrubs and graminoids in their diet, after accounting for reproductive state and age. We provide insights into the mechanisms that ultimately drive herbivore's population dynamics in a warming Arctic with shifting vegetation communities.

Soil Ecology and Plant-soil Interactions

Seasonal variations in soil respiration and its components, and the integrated environmental drivers under different disturbance regimes in sal forests of the Western Himalaya, India

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Abstract

Knowledge of how disturbances and related soil microenvironment factors such as temperature (T_s), moisture (M_o), and N available changes impact soil respiration (R_{tot}) and its components (microbial respiration (R_h) and root respiration (R_a)) is crucial for estimating the feedback effect of soil C_{org} pool on future climate change. Using the trench method, we investigated the effects of disturbances and seasonality on R_h, and R_a. Results indicated that R_{tot}, R_h, and R_a depended on changing disturbance regimes and seasons. R_{tot}, R_h, and R_a were significantly higher under high disturbance (HD) stands than other disturbance regimes throughout the seasons in the following order: summer > monsoon > winter. RDA results indicated soil Q_{mic}, N-NO_3^-, M_o, and T_s were the important determinants of changing disturbances and seasonal variability in soil respiration fluxes. This study highlights that moderate disturbance (MD) optimally enhances soil health and reduces CO_2 efflux by strengthening interactions between soil and microbial properties.

Forest age-dependent soil and microbial inoculation effects on *Alnus glutinosa* growth, herbivory, and greenhouse gas fluxes during afforestation

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Leiden University

Abstract

During afforestation, as young plantations mature into forests, soil biotic and abiotic characteristics change and can differentially impact tree growth. This research explores these dynamics through two separate experiments focusing on *Alnus glutinosa*. The first experiment assessed the effects of biotic and abiotic soil characteristics from 10, 15, and 25-year-old forests on tree growth and herbivory. Results indicated age-dependent responses, with higher herbivore susceptibility in younger forest soils and distinct microbial community influences on tree performance. The second experiment examined the impact of inoculation of soil microbial fraction sizes (250, 20, 11, and 3μm) from soils of young and mature forests on the resulting root microbiome of *A. glutinosa* and on greenhouse gas (GHG) fluxes. Inoculating with the largest fraction size decreased plant performance. Although the established root-associated microbiomes varied based on forest age, GHG fluxes were unaffected by forest development stage suggesting possible microbial functional redundancy.

Seasonal dynamics of fine root length in European beech: unveiling unexpected winter peaks and summer declines

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[1]University of Greifswald, Germany. [2]Forest Research Institute, Poland. [3]University of Bayreuth, Germany

Abstract

Belowground biomass plays a crucial role in temperate forest ecosystems, but information on root seasonality is still scarce. Here, we analysed seasonal differences in fine root length of European beech within its north-eastern distribution range. Root length density of mature trees was monitored over two consecutive years using minirhizotrons and an AI-algorithm for the analyses. We expected highest values during summer, when water and nutrient demands are high.

Surprisingly, fine root length was significantly higher at the beginning of winter (+ 40 %) and at the end of winter (+ 50 %) than in mid-summer. Our study indicates that fine root length in temperate forests is seasonally more variable and, so far, less predictable than previously assumed. A reduction of root length during adverse conditions seems to be compensated afterwards during more favourable periods of the year. This high seasonal variability is important for modelling terrestrial biogeochemical processes and global carbon fluxes.

Under Drier conditions, soil microbes mediate exclusion for two plant species in a tropical forest

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Abstract

Global environment changes can alter plant-soil microbe interactions that regulate plant community dynamics. Microbes can influence plant coexistence by stabilizing plant populations and generating competitive differences. For two tree species from Western Ghats, Litsea Floribunda and Symplocos racemosa, we tested how plant responses to soil microbes of their own and competitor species changed with water and light. In high water-low light, microbes allowed coexistence but exclusion of Symplocos was the predominant outcome in low water-high light conditions, where Litsea gained a competitive advantage from microbes. We combined these experimental results with field data on seedling performance to simulate longer-term coexistence. The simulated system tended towards monodominance of Litsea more easily in low water-high light conditions, supporting inferences from experiments. Our findings suggest that warmer, drier conditions as with drought or at edges of human-modified forest, will weaken microbially-mediated coexistence of Litsea and Symplocos.

Identifying edaphic and climatic factors influencing Miscanthus establishment: a multi-scale approach

Dr Donald Scott

University of Lincoln

Abstract

Increased adoption of sustainable bioenergy crops such as the perennial grass *Miscanthus* is a key component of the UK strategy to achieve net zero by 2050. *Miscanthus* requires very low inputs, can be grown on marginal farmland and provides a range of ecosystem services. Given the environmental benefits of *Miscanthus,* understanding factors influencing establishment is crucial to facilitate the upscaling of areas under cultivation.

However, little information is available on the role of edaphic and climatic factors in early growth in the UK. Studies identifying such factors are therefore, needed. Here we present a multi-scale study examining the role of soil type, macronutrients and climate in the establishment of *Miscanthus* across the UK. Initial findings suggest that establishment is influenced by a range of edaphic and climatic factors. The findings will help inform strategies for the required future expansion of the area under cultivation in the UK.

Inconsistent short-term effects of enhanced structural complexity on soil microbial properties across German forests

Rike Schwarz[1,2], Prof Dr Nico Eisenhauer[1,2], Dr Simone Cesarz[1,2]

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Abstract

Production forests are often even-aged, with few canopy gaps and little deadwood, causing loss of biodiversity and ecosystem functions. We study the effects of experimentally enhanced structural complexity on soil across 156 plots (50 x 50m) in eight forests in Germany, where half of the plots underwent normal forest management, and in the other half, canopy gaps and various types of deadwood were created. Results indicate that increased structural complexity increases soil water content but does not affect soil pH or soil C:N ratio. Soil microbial activity, biomass, and responses to different substrates appear to be context-dependent, with effects varying across different forests. Within the first five years following treatment establishment, there was no significant increase in the impact on biotic soil properties. Despite the lack of significant immediate changes in soil functions, promoting structural complexity in production forests holds promise for enhancing long-term biodiversity and ecosystem health.

Belowground carbon transfer across mycorrhizal networks among trees: Facts, not fantasy

Prof. Tamir Klein[1], Dr. Ido Rog[2], Dr. Stav Livne-Luzon[1], Prof. Marcel van der Heijden[2], Prof. Christian Koerner[3]

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Abstract

The mycorrhizal symbiosis between fungi and plants is among the oldest, ubiquitous and most important interactions in terrestrial life on Earth. Carbon (C) transfer across a common mycorrhizal network (CMN) was demonstrated over half a century ago in the lab and later in the field. Recent years have seen ample progress in this research direction, including evidence for ecological significance of carbon transfer. Furthermore, specific cases where the architecture of mycorrhizal networks have been mapped and CMN-C transfer from mature trees to seedlings has been demonstrated have suggested that trees in forests are more connected than once thought. Recently, concerns have been made of over-interpretation and positive citation bias in CMN research. C movement among plants was not questioned, but the importance of CMNs was unclear. Here we argue that while some concerns are justified, factual evidence about belowground C transfer across CMNs is solid and accumulating.

The effects of habitat, soil depth, edaphic factors and bait type on the diversity and composition of entomopathogenic fungi in Lancashire Nature Reserves: implications for bioprospecting.

Dr Christopher D Williams[1], Mr Luis M Quinzo-Ortega[1], Dr Roger Moore[2], Dr Robbie G Rae[1]

[1]Liverpool John Moores University. [2]Forest Research

Abstract

Bioprospecting for entomopathogenic fungi (EPF) as sustainable alternatives to chemical pesticides, often involves collecting soil from natural habitats and baiting with laboratory models such as *Galleria mellonella* or *Tenebrio molitor*. In some cases, a dual baiting technique is used. Despite this widespread practise, there is very little information in the published literature advising on which habitats are the most profitable for obtaining EPF, how deep in the soil EPF reside in various habitats and which baits are the most useful for obtaining a diversity of EPF strains from natural habitats. Not only is diversity (species richness and strain richness) and abundance (number of isolates obtained) important, but differences in composition or beta-diversity is important when assessing the collecting strategy for EPF bioprospecting. In this presentation diversity and composition of EPF are presented with respect to habitat type, depth of sampling and bait type. General conclusions for bioprospecting are presented.

Compound-specific difference in root exudates of three tree species at four climatically varying temperate forest sites

Melissa Wannenmacher, Dr Simon Haberstroh, PD Dr Jürgen Kreuzwieser, Professor Dr Christiane Werner

Ecosystem Physiology, Faculty of Environment and Natural Resources, University of Freiburg, Germany

Abstract

Root exudation is a key process for plants to acquire nutrients and to shape the surrounding microbiome. Therefore, it represents an important part in carbon and nutrient cycling. Nonetheless, quantitative and qualitative data of root exudates from forest trees are scarce. In this study, we conducted a compound-specific analysis of root exudates in *Fagus sylvatica*, *Picea abies* and *Acer pseudoplatanus* at four temperate forest sites with different climatic and geological conditions in two seasons (early summer and autumn 2023), in different soil depths: in the forest floor and in the mineral soil (A-horizon). Root exudates were collected *in situ* using a cuvette-based approach. In addition to differences in total amount of exuded carbon between the tree species, the composition of root exudates was found to vary between species and season. These results give a first indication on how trees influence belowground carbon cycling and acquire nutrients in changing temperate forests.

Synthesizing over 30 years of soil biodiversity data in Germany – trends and drivers

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Abstract

The decline in biodiversity in conjunction with global change poses a threat to human well-being. Soils are home to c. 60 % of species on earth but our knowledge of soil biodiversity change and its drivers is limited. Here, we present analyses of over 30 years of soil biodiversity monitoring in Germany.

We show how earthworm diversity in Germany's c. 350 long-term observational sites, as well as micro-, meso-, and macrofauna, based on a literature synthesis, changed over time from 1985. In addition, we link changes in these soil biodiversity variables to important drivers, such as land-use, soil pH, nutrients, and pollution.

Taken together, we present the first time-series of soil biodiversity change for Germany and make a case for the importance of soil monitoring. We show how our results can inform assessments on the state and change of biodiversity, potentially resulting in policies to protect and restore soil biodiversity.

Cd uptake by camelthorn (*Alhagi maurorum* Medik): a promising approach for phytoremediation of Cd-contaminated soils.

Dr Modhi Obaidan Alotaibi

Princess Nourah bint Abdulrahman University

Abstract

Alhagi maurorum is a desert plant that can withstand a of abiotic challenges. The aims to determine the degree of plant to Cd toxicity and the possibility of using it in the phytoremediation of soils. Alhagi m. was cultivated in soil polluted with Cd at four doses. The growth, nutrient uptake, Cd concentrations, and some biochemical compounds were determined to study the response of plants to Cd stress. Exposure of Alhagi m. to 200 mg kg−1 of Cd inhabited the synthesis of chlorophyll and reduced the concentrations of element. Plants can tolerate up to 11 mg kg−1 of soil Cd, 65 mg kg−1 in the root, and 22 mg kg−1 in the shoot before experiencing Cd toxicity.Plants accumulate Cd in the roots with low root–shoot transfer and are suitable for phytostabilization technology, and this finding is a good tool in the remediation of Cd-contaminated soil.

Coupling of plant and soil activity mediates plant diversity and community history effects on ecosystem multifunctionality

Ana E Bonato Asato[1,2], Anna-Maria Madaj[1], Dr. Makoto Kobayashi[3], Yihan Cai[3], Dr. Thomas Reitz[4], Angelos Amyntas[1], Dr. Christian Wirth[2,1], Dr. Jes Hines[1,2], Dr. Nico Eisenhauer[1,2]

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Abstract

Plant diversity and the coexistence history of plant and soil communities enhance ecosystem multifunctionality. While various mechanisms explain these multivariate relationships, few consider intra-annual temporal variation in multiple ecosystem processes above and below ground. In an Ecotron experiment, we tested if plant diversity and plant-soil history impact multifunctionality through concurrent responses of multiple response variables acting in concert (i.e., coupling of plant and/or soil phenology). Results showed that plant species richness decreased multifunctionality by increasing plant-soil and plant-plant coupling, but not soil-soil coupling, suggesting that plant and soil activity patterns contribute differently to ecosystem multifunctionality. Plant and soil history indirectly affected multifunctionality throughout the experiment but only directly enhanced it in the final stages, further demonstrating the importance of temporal variation in ecosystem dynamics. Our findings emphasize the variability in how plant diversity influences ecosystem functions and the need to consider subsystem dynamics and seasonality in biodiversity-multifunctionality studies.

Changes in soil organic carbon fractions in a semi-arid Mediterranean ecosystem with biocrusts after 15 years of warming and reductions in precipitation

Luna McGill[1], Dr. Pablo García-Palacios[1], Victoria Ochoa[1], Beatriz Gozalo[2], Dr. Joeri Kaal[3], Prof. Dr. Fernando T. Maestre[4], Dr. César Plaza[1]

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Abstract

Drylands represent 45% of the Earth's surface and store about 32% of the global soil organic carbon (SOC) reserves. Current evidence suggests that warming and reductions in precipitation associated with climate change may affect the C cycle in drylands promoting the loss of soil organic C stocks in their particulate form (POC), and also affecting their mineral-associated form (MAOC), despite being relatively protected from microbial decomposition.

Biocrusts are complex communities of microorganisms developing on the soil surface in dryland ecosystems and play a crucial role on its functioning. Previous studies have demonstrated their ability to buffer the effects of climate change on the whole soil organic C and its fractions. Here we evaluated changes in the composition of SOC, POC and MAOC in soils with low (<20%) vs. high (>50%) initial biocrust cover after 15 years of warming, reduced precipitation and their combination in a semi-arid ecosystem in central Spain.

Soil fertility and topography drive large and predictable shifts in canopy structure and dynamics across tropical forest landscapes

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Abstract

Tropical forests can vary enormously in their 3D structure and dynamics even within the same landscape. However, what drivers and processes underpin this local-scale variation in canopy structure and dynamics remains unclear. Here we used repeat airborne laser scanning data acquired across >1500 ha of intact tropical forest in Malaysian Borneo to explore how soil fertility and topography influence rates of gap formation, closure and canopy growth across the landscape. We found that both canopy gains and losses were substantially greater in low-lying, fertile alluvial forests compared to nutrient-depleted heath forests growing on hilltops just a few hundred meter away. Moreover, we found that variation in canopy 3D structure and dynamics were tightly coupled across the landscape, with taller and more structurally heterogeneous canopies also the most dynamic. Our study highlights the key role that soils and topography play in shaping the structural complexity and dynamics of tropical forest canopies.

Germany's Next Topsoil: A Citizen Science Project to Explore and Understand Soils

Dr. Marie Sünnemann

German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig. Leipzig University

Abstract

Over half of all species on Earth live in soil, yet human activities threaten the essential ecosystem functions that these species provide. Despite its importance, soil is often overlooked in school curricula. This citizen science project introduces students to the critical role of soils through hands-on learning, quantifying how human activities degrade soil functioning. Students conduct experiments in areas altered by human activity and natural sites, estimating plant cover, measuring pH, assessing detritivore and predator activity, and determining earthworm abundance. They also collect soil samples for laboratory analysis of microbial activity, biomass, and moisture. The data are used to calculate a soil multifunctionality index, offering students feedback on the soils they explored. This approach helps students understand soils as living environments and learn scientific investigation methods. We also evaluate students' relationships with soils before and after the experiments, while monitoring soil functioning across Germany for broader environmental efforts.

Long-term role of restoration treatments on soil nutrients and floristic diversity in a brownfield site grassland restoration experiment.

Aled R Moore, Dr David Watson

University of Bristol

Abstract

Agricultural intensification has caused considerable habitat and biodiversity loss across global, regional and local scales, leading to the replacement of species-rich hay meadows with less diverse plant communities. While agri-environmental schemes have promoted restoration, many brownfield sites remain underexploited for grassland restoration. Soil nutrient status and physiochemical properties have both been recognised as key constraints to restoration success, yet few studies have explored their long-term influence on species-rich establishment. This study investigates the effects of manipulating ground conditions on soil nutrients, carbon content and floristic diversity in a twenty-year landfill restoration experiment. Using a microwave-assisted aqua regia-method coupled with ICP-OES analysis, significant variations ($p < 0.05$) in soil nutrient concentrations were found between restoration treatments over time. Species diversity and richness also differed significantly ($p < 0.001$) and showed treatment-specific correlations with nutrient concentrations. These findings provide valuable insights into the implications of soil nutrient status on biodiversity restoration in the long-term.

The development of plant–microbe networks following glacier retreat

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Abstract

Glacier retreat is a striking symptom of global warming. All over the world, glaciers are retreating and exposing new areas for colonisation by living organisms, including plants and microorganisms. However, we are lacking knowledge on the impact of glacier retreat on plant–microbe interactions and how networks assemble and develop following glacier retreat.

Here, we assessed how plant and microbe diversity as well as their interaction networks respond to glacier retreat along a 140-years chronosequence. Using field survey and environmental DNA, we assessed the effects of plant succession on soil microbial communities at 3 different levels: patch, rhizosphere, and endosphere. Our results highlight the novel assembly and development of networks influenced by interaction rewiring from patch to rhizosphere and endosphere.

The impacts of nitrogen and phosphorus fertilisation on the symbiosis between ectomycorrhizal fungi and *Pinus sylvestris*

Miss Emma-Lee Peterson, Prof David Johnson, Dr Filipa Cox

University of Manchester

Abstract

Ectomycorrhizal fungi provide boreal trees with access to bioavailable nitrogen in nitrogen-limited forests. Inorganic nitrogen deposition is linked to shifts in the belowground EcM fungal community composition and aboveground plant community composition. The addition of inorganic nitrogen may result in phosphorus limitation, reflected in shifts in the plant community towards species associated with phosphorus limitation. Phosphorus is a key nutrient for plant health and most plant access to phosphorus is facilitated by their symbiotic mycorrhizal fungi. In phosphorus-limited forest systems, there is evidence that distinct phosphorus sources are partitioned between plants depending on their mycorrhizal type. This study aims to discern whether phosphorus partitioning occurs between EcM fungal species in nitrogen-limited forests, whether shifts in the EcM fungal community under nitrogen fertilisation are linked to their ability to access phosphorus and to use these findings to predict how these changes impact nutrient cycling at the ecosystem level.

Grassland plant community composition and traits modulate the impacts of drought intensity on the soil microbial community

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Abstract

The impact of drought on soil microbial communities will have cascading effects on how ecosystems cope with climate change. However, the effects of increasing drought intensity on soil microbes are not well known. In an outdoor grassland mesocosm experiment, we determined how increasing drought intensity affects soil bacterial and fungal communities during and after drought, and investigated how plant strategy, community composition, and functional traits moderated microbial responses. We found that increasing drought intensity markedly shifted bacterial and fungal community composition during and after drought. Moreover, two months post drought, microbial communities that experienced severe drought did not return to their baseline composition, while mildly droughted communities did. Drought intensity effects on microbial communities were shaped by plant functional group abundance, composition, and leaf traits, but not strategy, during and after drought. Our study emphasizes the role of plant-microbe interactions in soil microbial community response to increasingly severe droughts.

Quantifing minirhizotron's internal root prevalence bias. A simple problem, a simple calibration solution - call to action!

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Abstract

Minirhizotrons are the current standard for high frequency, AI supported field observations of root dynamics. However, the output is systematically biased and calls for a revaluation of previous results. The problem is simple: 1) people use varying tube diameters which alters the “true” soil depth position in scanned images; 2) targeted insertion angles are rarely achieved *in-situ* and differ between experiments. Worse even, problem one and two theoretically interact and influence rotational root prevalence bias, false-depth assignment, and root growth directionality. This problem has never been systematically tested, instead relying on an unfounded neglibility assumption. Preliminary results support methodological bias. Here, we want to present the problem, tempt with analytical tools, show preliminary evidence, and finally present the solution: a simple call to action. With this, we hope to motivate the community to contribute in quantifing bias caused by varying methodologies and support high resolution, root depth distribution output.

Effect of multiple stressors on dissolved organic matter composition - implications for soil characteristics and function

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Abstract

Rivers serve as a vector for pollutant transport (e.g. pesticides), as well as a dispersal medium for invasive plant species. Through flooding events, these stressors can be distributed to the riparian zone. We conducted a pot experiment to investigate the effect of pesticides and an invasive plant species (*Impatiens glandulifera*) on dissolved organic matter composition and soil wettability under flooded conditions. Porewater from the root zone of native and invasive species were collected and characterized by measuring aromaticity, degree of humification, and average molecular weight. Additionally, the effect of the dissolved organic matter on the microbial community-level physiological profile was assessed by adding the collected porewater to the soil and measuring respiration under the addition of different carbon sources. Differences in dissolved organic matter composition were observed as a result of exposure to *Impatiens* and pesticides through flooding, although these did not readily translate to significant differences in soil wettability.

The strength of conspecific negative density dependence is regulated by soil phosphorus and mycorrhizal type in a subtropical forest

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Abstract

This study combined observational and experimental evidence in a subtropical forest to test how the direction and strength of conspecific negative density dependence (CNDD) of AM and ECM hosts are regulated by different forms and concentrations of soil phosphorus (P). The results showed that the direction and strength of CNDD of both AM and ECM trees were dependent on soil P forms and concentrations. It showed that ECM fungi alleviated CNDD for host trees under both inorganic P and complex organic P (phytic acid) treatments, whereas the strength of CNDD for AM trees increased across all P additions due to a reduction in root architectural traits when seedling density increased. These findings revealed that ECM trees promoted mycorrhizal associations while AM trees decreased root traits in response to high density, which suggests the two main mycorrhizal types have different resource acquisition strategies that may promote species coexistence in subtropical forests.

Disentangling the biotic and abiotic drivers of deadwood decay in European forests

Miss Emily Bingham, Dr Hannah Griffiths, Dr Tommaso Jucker

University of Bristol

Abstract

Soil organisms underpin key ecosystem functions, such as the decomposition of dead organic material. Research has focused on macroclimate as a dominant control of deadwood decomposition which may mask within-site effects. This study aims to disentangle the relative contribution of macroclimate, microclimate, soil biota and other abiotic conditions on wood decay rates in European forests, necessary to understand global carbon budgets.

Six wood samples of contrasting traits that were accessible or inaccessible to invertebrates were installed in six stations within 50 plots across a latitudinal gradient from Finland to Italy (n=1,800). At each station, a datalogger recorded microclimatic conditions and eDNA was extracted to describe the soil community.

We use variance partitioning to determine the contribution of variables on decay rates. There was high within-site variability in wood decay which was not explained by microclimate. We predict that the soil community will explain a high proportion of the observed variation.

Direct and indirect effects of unregulated deer populations on soil biodiversity

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Abstract

Deer, especially in highly anthropic contexts with no predators such as in Ireland, can deeply change the structure and functions of ecosystems, acting as a powerful engineer. Deer effects on the belowground components, however, are scarcely known. We present results from a field study in Ireland along a gradient of deer use intensity quantified with camera traps in woodlands. We found evidence that deer intensity was positively associated with anthropic fauna such as cats, dogs, foxes and badgers, whereas it was negatively associated with birds, micromammals and mustelids. Such an effect cascaded on soil microarthropod, fungal and bacterial communities, with more opportunistic species linked to higher deer intensity. Our results thus suggest that the long-term monitoring of terrestrial biodiversity and ecosystem functions is crucial to understanding the response of ecosystems to large, scarcely or no top-down controlled fauna populations.

Soil food web organisms are differentially affected by drought and forest management in a Mediterranean pine forest

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Abstract

Management of temperate and Mediterranean forests is essential to maintain their productivity, especially given the increasing vulnerability of forests to climate change. However, few studies have investigated the effects of forest treatments (overstory and understory vegetation removal) on soil biodiversity despite their importance for ecosystem functioning. We investigated how soil biota respond to thinning and understory vegetation removal in a Mediterranean pine forest in southeastern France before and after the summer drought period. Management of overstory and understory vegetation altered soil fertility and microclimatic conditions, with higher soil fertility and lower air and soil temperatures in shrub presence. Only microfauna and macrofauna abundances were affected by forest treatments, with lower values found in intensively thinned plots associated with understory vegetation removal. Summer drought had a greater effect than forest treatment on soil community structure, increasing the microorganism and mesofauna abundances and, by contrast, decreasing the microfauna and macrofauna abundances.

Effects of earthworms (*Amynthas* spp.) on *Quercus serrata* litter decomposition and ^{13}C and ^{15}N transport along the soil profile

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Abstract

The influences of *Amynthas* spp. earthworms on litter decomposition and vertical C and N transport were studied over 70 days using ^{13}C and ^{15}N dual-labeled *Quercus serrata* leaves (961 $\delta^{13}C$‰, 9,815 $\delta^{15}N$‰). We employed 40 cm containers with three treatments: L_{un} (soil+unlabeled litter), L_{la} (soil+labeled litter), and $L_{la}E$ (soil+labeled litter+earthworms). Each container received 6 kg soil, 15-24 g earthworms, and 11 g litter. In $L_{la}E$, the daily C transport was 0.4 mg and 0.1 mg at 10 cm and 20 cm depths, respectively, representing 45.2% and 173.3% increases over those of L_{la}; daily N transport was 0.2 mg and 0.03 mg at 10 cm and 20 cm depths, showing 1,500% increases over L_{la}. $L_{la}E$ also increased CO_2 efflux (2.0 $gCm^{-2}day^{-1}$) by 208% compared to treatments without earthworms and had the lowest total C (2.8 gkg^{-1}). An additional $^{13}CO_2$ analysis is required to quantify earthworm-induced C release.

Does Plant Diversity Safeguard Soil Carbon During Drought in a Large-Scale Biodiversity and Climate Experiment?

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Utrecht University

Abstract

Climate change threatens biodiversity and ecosystem functioning globally. One key consequence of such biodiversity loss is decreased soil organic carbon (SOC). Yet, increasing or maintaining SOC is key to many nature-based climate change mitigation strategies. Understanding how biodiversity loss and changes to the climate, such as an increased incidence of severe drought, alter SOC simultaneously is therefore crucial to understanding the potential for such nature-based climate change mitigation strategies. In a large-scale biodiversity and climate variability experiment, we explore whether increased plant species diversity can buffer against drought-induced SOC loss. We hypothesize that diversity will increase SOC and act as a buffer preventing loss of SOC during severe drought. Gaining insights into how a diverse community of plants adapt and respond to water stress, and the resulting impact on carbon accumulation, will enhance our understanding of ecosystem resilience and the cycling of carbon in the face of changing climatic conditions.

The contribution of soil inoculum to explain wheat and maize crop productivity and resilience under drought conditions

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Abstract

Anticipating the impacts of drought on food security and agricultural sustainability is a key challenge of the twenty-first century, particularly in regions like Southern Europe, where drought severely limits maize and wheat yields. While the soil microbiome is crucial for future crop production, most research has focused on specific microbes under limited conditions. Here, we conducted a greenhouse experiment to evaluate how different microbial inoculums, from Spanish and EU soils, affect wheat and maize production under drought conditions. We found that drought reduced crop biomass in both wheat and maize, especially in maize. Moreover, soil inoculum can regulate the responses of crop growth to drought events. These findings highlight the importance of soil biodiversity in enhancing crop resistance and resilience, offering valuable insights for sustainable agriculture and global food security in the face of climate change.

Testing the addition of arbuscular mycorrhizal fungi and a low-carbon footprint organo-mineral N fertiliser in potato crops

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University of Lincoln

Abstract

With regenerative practices gaining traction, there is an increasing demand to find alternatives to mineral N fertiliser. Here, we compared the efficacy of a novel carbon-capture and N-rich organo-mineral fertiliser (CCM) to standard mineral N fertiliser (NH_4NO_3) at different rates and their interaction with two arbuscular mycorrhizal (AM) fungi inocula on potato crop in a fully factorial greenhouse trial. Results showed no significant AM fungal effects on agronomic parameters, likely due to poor AM establishment and low root colonisation. CCM performed similarly to mineral N fertiliser, increasing potato tuber yield. This study provides evidence that CCM can enhance potato growth, N uptake, and soil N retention while stabilising soil organic matter without compromising yield, comparable to mineral fertilisers. These findings indicates CCM as a potential alternative to mineral N fertilisers in potato production, addressing concerns about rising fertiliser prices, soil health, and environmental impacts while meeting crop N demands.

Drought and extreme rainfall change dairy farm grassland CO_2 fluxes and plant community composition

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Abstract

Extreme weather events are more common as climate change advances. These events likely interact with plant community composition and soil texture to influence CO_2 fluxes. We conducted an experiment on 8 dairy farm grasslands on clay and sandy soils across The Netherlands and subjected plots to drought and extreme rainfall. We found that CO_2 emissions were higher in droughted plots on both sandy and clay soils (no interaction with soil type), while extreme rainfall had limited effects. These differences disappeared after 4 weeks of recovery. After drought, plant communities had higher forb cover on sandy versus clay soils; extreme precipitation showed minimal effects. This suggests different extreme weather events will have contrasting effects on CO_2 fluxes and plant communities that do not always depend on soil type. This demonstrates that sweeping generalisations cannot be made concerning interactive effects between extreme climatic events and soil type when designing climate-proof productive grasslands.

Management of the soil microbiome to promote vineyard tolerance to drought

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Abstract

The role of the soil microbiome in mediating important global change stresses like drought and extreme temperatures to plants is becoming more appreciated. However, whether microbiomes can be actively managed to promote tolerance and sustainability in agriculture remains unanswered. This is particularly important for vineyards, which cover a vast portion of land worldwide and represent an important source of income for millions of people. In this study we identified the ways in which adding microbial communities from *whole vineyard soils* to grapevines can confer critical belowground shifts that increase plant tolerance to prolonged drought. We identified source-specific factors that filter for microbial communities and functions that then differentially mitigated the negative effects of

drought for two grapevine varieties in a large factorial growth experiment. This work highlights the potential of soil management of complex microbial taxa and functions to mitigate important climate stressors and promote grapevine productivity in vineyards.

Root exudate release and composition in declining *Fagus sylvatica* trees at their southern distribution range.

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Abstract

Root exudates are crucial in ecosystem function, influencing soil organic matter dynamics and microbial activity. Yet, quantifying exudation rates and characterizing their molecular composition under field conditions remain challenging. Further, little is known about how tree decline influences exudate rates and composition. During the summer of 2023, we monitored exudation rates and composition using liquid chromatography-mass spectrometry in healthy and declining *Fagus sylvatica* trees. We also examined how soil temperature and moisture regulate exudation rates and composition depending on tree health status. Mass-specific exudation rates were greater in declining trees, but differences were not associated with changes in root functional traits and persisted throughout the summer. Differences in exudate composition between healthy and declining trees mainly occurred at the beginning of summer, as amino acid abundance was two-fold greater in declining trees. Our study suggests that characterizing exudates can deepen our understanding of the connection between plant and soil function.

Multiple global change factors affecting the plant community in a field experiment

Rebecca Rongstock, Mohan Bi, Prof. Dr. Matthias C Rillig

Freie Universität Berlin

Abstract

Plants are subject to various factors of global environmental change, such as higher temperature, drought, different biocides and other chemicals, microplastics, heavy metal pollution and increased salinity. We present findings of a field experiment that includes single-factor-treatments and a factor gradient consisting of up to ten combined global change factors. We find that the changes within the factor gradient could not be predicted by the single factor effects, but exposure to an increasing number of factors led to a consistent directional effect Different species of plants showed different patterns in their percent cover over time suggesting differences in stress tolerance and competitive success. The decrease in a focal species correlated with flowering and pollinator visitation possibly leading to reduced reproductive success. In addition, leaf fungal pathogens increased, underlining the importance of species interactions in successfully coping with global change.

Tree Plantations Reduce Carbon Sequestration in Chilean Mediterranean Soils

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Abstract

Biotic mechanisms behind soil organic matter (SOM) formation and stabilization, particularly the accrual of microbial necromass within mineral-associated organic matter (MAOM), remain poorly understood, especially regarding the impact of human activities on SOM dynamics and long-term carbon sequestration. We analysed a total of 100 soil samples from forests, shrublands, and monocultures of pine and fruit trees in Chile, to identify the mechanisms of soil formation and stabilization. Soil organic matter was physically fractionated to obtain C and N content and stable isotopes of POM and MAOM.

Results indicate that irrespective of land use, MAOM-C is primarily derived from microbial necromass. Forests accrue more carbon per unit of soil clay and silt, as well as in POM fraction, compared to other land uses. In contrast, monocultures, especially pine plantations reduce soil-carbon pools, likely due to soil disturbance and microbial inhibition. These findings highlight the need for strategic and sustainable landscape-scale management.

Developing vibroacoustic monitoring of soil invertebrates

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Abstract

A growing trend in ecology and conservation is the use of sounds to monitor and 'sample' biodiversity. This promising sampling method has many benefits: it can provide data on abundance, diversity, and spatial distribution of a community, and offers a non-invasive approach. Whilst this technique is now commonly used to assess aquatic and above-ground terrestrial taxa, methods for vibrationally surveying below-ground have yet to be explored. Below-ground invertebrate research is often time consuming, expensive, and has spatial and temporal limitations. Here we test the effectiveness of two different vibrational sensors to monitor savanna invertebrates in red sand and black clay soils. Secondly, we build a novel vibrational library of savanna soil invertebrates with a focus on ants, termites, and beetle larvae. This research advances soil biota sampling by providing an assessment of the effectiveness of different vibrational sensors for biodiversity monitoring and characterises different belowground invertebrates.

Solar farm impact on soil carbon and plant biomass: A modelling approach

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Abstract

What is the impact of ground-mounted solar farms (SFs) on soil carbon and plant biomass? SFs may present risks and opportunities for ecosystem services due to their high land take but low infrastructure footprint. We assessed seasonal and multi-annual changes in plant biomass production and soil carbon accrual to answer this question and provide some of the first scientific evidence. We used meteorological and field data from 32 SFs in England and Wales to parameterise the MISCANFOR biomass growth model and a multipool-multicohort soil carbon model. Areas underneath solar panels produce significantly lower plant biomass than areas between solar arrays (gaps) and margins. Soils in gaps and margins accrue soil carbon over time, but soils under solar panels loose soil carbon over the SF's lifetime due to impacts on plant productivity and growth. These results will help optimise SF design and management to ensure the long-term delivery of ecosystem services.

Ecoenzymatic stoichiometry across urban ecosystems

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Abstract

Urban greenspaces have different nutrient and carbon inputs compared with nearby natural ecosystems, which may alter soil extracellular enzyme activities that govern the decomposition of the soil organic matter. In this study, we analyzed the activity of three ecoenzymes (β glucosidase, NAGA and phosphatase) related with CNP cycling in five urban systems (urban crops, roundabouts, parks, golf courses, and nearby natural ecosystems) across 53 cities from the Iberian Peninsula. We hypothesize that ecoenzymatic stoichiometry will vary significantly with urban system, reflecting differences in organic matter inputs and microbial community composition. The results of this survey, which covers a wide range of environmental and urban conditions, aims to provide insights into the variability of ecoenzyme stoichiometry in urban ecosystems, which can have important implications for the management of carbon sequestration and soil fertility in these areas.

No enhancement of soil carbon persistence by sheep grazing in a long-term calcareous grassland experiment

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Abstract

Soils contain a pool of carbon that is globally important, and which is generally more persistent than carbon in plant biomass, yet is becoming increasingly vulnerable to global change. Managing land to increase soil carbon sequestration and persistence may therefore improve long-term soil carbon storage and contribute to climate change mitigation. It has been hypothesized that grazing by large herbivores may enhance the persistence of soil carbon by increasing the amount of soil organic matter forming more stable associations with mineral particles (mineral-associated organic matter). We compared sheep-grazed and ungrazed plots within the Gibson Grazing and Successional Experiment located in the Upper Seeds calcareous grassland in Wytham Woods, Oxfordshire, using organic matter fractionation to estimate the surface carbon stocks in the mineral-associated and particulate organic matter fractions. Counter to predictions, after 35 years sheep grazing had not increased mineral-associated organic matter carbon stocks relative to ungrazed plots.

Soil-dwelling social insects as drivers of soil properties in anthropogenically modified tropical landscapes

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Abstract

Soil dwelling social insects are highly diverse and abundant in tropical forests, yet poorly known, particularly in terms of their impacts on soil properties, and influences of anthropogenic habitat change. Here we demonstrate that ants and termites are responsible for substantial soil turnover in lowland tropical rain forest, but that the diversity of species driving this process is significantly reduced in more disturbed habitats. Furthermore, each soil dwelling social insect taxon generates its own unique “fingerprint” in terms of impacts on local soil properties. This is potentially associated with high levels of variation in these soil properties over small spatial scales, presumably relating to the scale of influence of individual colonies. Taken together, these results indicate an important role for soil dwelling social insects in driving soil heterogeneity in tropical forests, and raise questions regarding their contribution to maintaining plant species richness in these hyper-diverse habitats.

Temporal dynamics of arbuscular mycorrhizal fungi and their association with regenerative agricultural practices in wheat

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Abstract

Arbuscular mycorrhizal (AM) fungi (Glomeromycotina sub-phylum) form symbiotic relationships with plant roots, providing essential nutrients and enhancing crop growth in low-input farming. AM fungi also offer benefits such as drought tolerance and pathogen resistance, leading to their use in commercial inoculants. It is important that we understand how inoculants, management practices and the native AM community interact in time and space.

This study used a multi-year winter wheat field trial to examine how regenerative practices — reduced tillage, commercial AM inoculum, and direct-drilled grass-clover leys — impact AM fungi communities.

The results showed clear seasonal shifts, with *Glomus* VT65 dominating in spring and *Paraglomus* VT281 in summer. The grass-clover ley supported a distinct AM community and more than doubled wheat yield compared to repeated wheat plots.

These findings show the impact of regenerative agriculture on AM communities depends on the interaction between soil management, crop choice, and the environment.

Relationships between plant traits and soil properties differ between wetlands with different water level management

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Abstract

Water level management is an important strategy for influencing vegetation development and creating suitable habitat for wildlife in managed wetland systems. Water level dynamics also affect soil carbon and nutrient cycling through changes in abiotic soil properties, plant traits and soil microbial communities. We hypothesize that seasonal inundated grasslands are dominated by plant communities with fast-growth related plant traits and bacterial dominated microbial communities, leading to lower carbon and nutrient stocks compared to non-inundated grasslands. To test this hypothesis, we compared soil and vegetation on winter inundated and non-inundated grasslands in a Dutch managed wetland area. Winter inundated grasslands had plant communities with more slow-growth related traits and soil microbial communities more dominated by fungi, but we found no differences between soil carbon and nutrient stocks. These findings show that water level management is important for plant and soil communities but not for altering carbon and nutrient stocks.

Restored Grasslands on the Tibetan Plateau: Deteriorating grassland Conditions and Disturbed Microbial Communities Highlight the Need for Native Grassland Preservation

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Abstract

Over 70% alpine meadows of the Tibetan Plateau have been degraded to various levels. Since 2000, China has launched extensive restoration initiatives in the Tibetan grasslands, involving grass replanting. However, the project's long-term effectiveness is under debate. This study examined soil nutrients and microbes in long-restored grasslands to assess the restoration efficacy. Using a space-for-time approach, we analyzed soil at different recovery stages, from 1 to 25 years post-restoration. Results showed that restored grasslands have lower soil organic matter(34.67%), carbon(39.16%), and nitrogen(29.29%) levels compared to natural grasslands, potentially reducing soil fertility and carbon storage. Furthermore, deteriorated signs were found on microbial association network and functional genes related to carbon cycling and plant pathogen in the grasslands under restoration, representing a rising soil microbial community fragility. Based on this, we advocate for policies and management strategies that prioritize the prevention of degradation over the restoration of already-damaged grasslands.

Time-dependent effects of a constant weak magnetic field on soil

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Abstract

The mostly positive impacts of constant weak magnetic fields on plant growth have raised interest especially in an agricultural context. However, impacts of such fields on the soil has been neglected. We here examined the effect of a constant, weak magnetic field (0.2 mT) on a lower moor soil from Brandenburg in a time-series experiment over the course of 7 weeks. We harvested after one, three, five and seven weeks. Depending on the time point, we found significant negative effects on soil enzymes, including phosphatase (organic phosphorus mineralization) and N-acetyl-b-glucosaminidase (chitin degradation). For more general soil parameters including pH, electrical conductivity and degradation of filter paper and green tea, we found non-significant effects. The results of our study indicate that already very weak constant magnetic fields can have significant effects on soil processes, which need to be studied and discussed in more detail.

Shifts in soil fungal and bacterial communities when grassland is converted to woodland

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Abstract

Grassland conversion into forestry, a key policy intervention, is likely to impact soil biogeochemical cycling, including carbon sequestration. Such impacts are driven by microorganisms, highlighting the importance of understanding how this conversion alters bacterial and fungal communities. We evaluated fungal and bacterial community composition and diversity across a *Pinus sylvestris* chronosequence comprising grassland, young (14-22 years) and mature (31-45 years) plantations. DNA from 36 soil samples was analysed, focusing on 16S and ITS2 regions. Species richness and alpha diversity did not vary across chronosequence stages. We observed significant shifts in fungal and bacterial community composition. Dominant fungal phyla were Ascomycota and Basidiomycota, while Proteobacteria, Actinobacteriota, and Acidobacteriota were prevalent among bacteria. Ectomycorrhizal fungal richness was significantly influenced by chronosequence stage, although diversity indices remained unchanged. Our future research will examine how these findings relate to soil carbon storage, further investigating the impact of converting grassland to forestry on carbon sequestration.

Rhizosphere fungal community composition is linked to aboveground pathogen infection history in a host plant population network

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Abstract

Pathogens are major drivers of plant fitness, but disease may be modified by co-occurring microbes, such as mutualistic mycorrhizal fungi. Yet, in wild plant populations, where infection is inherently variable, the relationship between aboveground disease and belowground fungal communities is unclear. To test this relationship, we characterized rhizosphere fungal communities in 20 *Plantago lanceolata* populations within a large host population network in the Åland Islands (Finland). The populations selected varied in infection history by a foliar pathogen, powdery mildew (*Podosphaera plantaginis*). We found that plants from more frequently infected populations had different fungal communities, and more diverse communities of arbuscular mycorrhizal fungi, than plants from healthier populations. While spatial distances between populations predicted dissimilarity in fungal composition, highly connected populations had higher fungal diversity than isolated populations. Our results suggest that the composition of belowground fungal communities may influence aboveground disease, or vice versa, amongst other environmental and spatial drivers.

Patterns and drivers of soil organic carbon fractions in urban greenspaces

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Abstract

Urban greenspaces can contribute to reduce the city carbon footprint by storing important amounts of soil organic carbon. Here we performed a standardized sampling of five different land uses (urban crops, parks, roundabouts, golf courses and natural ecosystems) across 27 cities in the Iberian Peninsula, and measured two main soil organic carbon fractions (POC and MAOC). We addressed whether POC and MAOC content was similar in urban than in natural ecosytems, and explored how environmental and management factors influenced POC and MAOC. Our results indicate that MAOC is the dominat fraction across land uses and cities, and that some of the urban greenspaces store a similar amount of organic C than its nearby natural ecosystem.

Drought- and heat-induced changes in the soil biome of managed soils

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Abstract

Soil biodiversity plays a critical role in supporting yields and ecosystem services in production ecosystems. However, the combined effects of climate change and soil management on soil biodiversity are not fully understood, as we lack evidence on how they vary across biogeographical contexts. We hypothesized that climate stressors have greater impact at higher latitudes and that sustainable soil management (SSM) reduces the effects of climate stressors. We conducted a two-year experiment across biogeographical regions of Europe, where we simulated drought and heatwave in seven field experiments. We quantified changes in microbial biomass and co-occurrence networks using PLFA analysis and amplicon sequencing. We found that SSM limited the impact of heatwave on microbial biomass, in Belgium and Ireland. While SSM did not prevent microbial biomass reduction during drought, it limited its surge after drought, in Latvia and Spain. Results indicated SSM can stabilize, to some extent, climate-induced changes on soil organisms.

The timing of emergence has long lasting effects on root growth

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Abstract

The timing of species emergence can impact survival, growth, and fecundity, but its effect on below-ground processes is less understood. We set up an experiment using perennial grassland species in an outdoor experiment in a climate with long winters. We manipulated emergence timing by sowing either early in the growing season or three weeks later. We monitored below-ground growth for four years using a root imager, a non-destructive method. Late emergence led to both reduced above- and below-ground biomass for three years. Average rooting depth was unaffected by the timing of emergence, however it was affected by winter; deeper roots survived better than shallow ones. Further, while above-ground biomass increased for three years, below-ground biomass already peaked after one year. In all, we showed that a subtle difference in the timing of emergence can have long lasting below-ground effects and that further, seasonality played an important role in root dynamics.

Quality overrules quantity: Modification of plant and fungal functional composition rather than mycorrhizal fungal abundance or diversity define inoculation effects in experimental grassland communities.

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Abstract

Microbial interactions importantly shape ecosystem functioning which is relevant during the current biodiversity crisis and subsequent impacts on ecosystem functioning like biomass productivity. The symbiosis between plants and arbuscular mycorrhizal fungi (AMF) is particularly relevant, since AMF regulating the biomass of most land plants. Plant and AMF functional traits modulate AMF effects on productivity through shaping mutual benefits and the interaction niche space of mycorrhizal symbiosis. AMF effects on productivity can be assumed to increase with interaction niche space i.e. high plant functional diversity. To discuss this hypothesis, we performed a full-factorial greenhouse experiment measuring ecosystem functioning of simplified annual grassland communities, that vary in interaction niche space i.e. plant and AMF (functional) diversity. Weak functional diversity effects on productivity point to interaction niche space being less relevant in modulating AMF effect on ecosystem functioning. Functional match between plants and AMF were more relevant in mediating AMF effects.

Assessing plant-microbial networks in European peatlands across an enviro-climate gradient

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Abstract

Peatlands are a vital terrestrial ecosystem, collectively serving as one of the largest carbon sinks despite covering only a small percentage of land globally. However, the carbon sink potential of peatlands is currently under threat due to widespread warming; therefore, it is imperative to better understand the biotic processes underpinning their functioning. Plant and microbial community interactions are a key driver behind primary production and decomposition processes in peatlands and are therefore very influential on their carbon sink function. As environmental and climate fluctuations often cause shifts in plant and microbial community assemblages, there are also likely related shifts in plant-microbial networks and their complexity. In order to evaluate the effects of enviro-climate changes on plant-microbial networks, vegetation and microbial composition data were gathered from twenty European peatlands along a gradient. We assess diversity in the plant and microbial communities, co-occurrence networks, and network complexity.

Worms without water: The response of *Allolobophora chlorotica* to drought stress in four soil types

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Abstract

To prevent desiccation, some earthworms induce aestivation, a period of low metabolic activity whereby they coil up and cover themselves in mucus, yet this survival strategy remains largely understudied. Greater insight into aestivation will improve our understanding of how climate change and the expected increased frequency and severity of droughts may threaten earthworms and their activities, which are vital to soil functioning. To investigate the influence of soil type on the earthworm *Allolobophora chlorotica's* response to drought, adults of known mass were subjected to gradual drying in four different soils, then extracted at a range of water contents and identified as active or aestivating, before being weighed. The effect of different soil water contents on the onset of aestivation was significantly influenced by soil type. Overall, *A. chlorotica* were incredibly resistant to desiccation, with losses in mass by as much as 50% being recovered after 24-hours in high moisture conditions.

The role of different urban greenspaces in supporting ecosystem services

Camelia Algora[1], María Leo[2], Mónica Ladrón de Guevara[3], Nuria Casado-Coy[4], Elena Aguilar-Santana[1], Josu G. Alday[5], Ulises Álvarez Ferraz[6], Cristina Armas[7], Felipe Bastida[8], Ana Beltrán-Sanahuja[4], Guillermo Bueno[9], Leonor Calvo[10], Axel Campos-Castro[4], María Dolores Carmona-Yáñez[11], Giada Centenaro[5], Sonia Chamizo[7], Joana Costa[12], Svetlana Dashevskaya[5], María R. Felipe-Lucia[9], María José Fernández-Alonso[13], Enrique Garcia de la Riva[10], Eva Garcia[14], José Alberto Herrera Melián[6], Juan José Jiménez[9], Beatriz Jiménez-Prieto[2], Ana López-Velasco[1,15], Carmen Lorenzo[2], Manuel Esteban Lucas-Borja[11], Lea de Nascimento[16], Iñaki Odriozola[17], Jesús Pérez-López[1], Pedro Antonio Plaza-Alvárez[11], Ivan Prieto Aguilar[10], Elena Rocafull[16], Alexandra Rodríguez Pereiras[3], María José Sánchez García[6], Andrea C. Sala-Navarro[4], Alejandro Terrones[7], Aurora Torres[4], Carlos Sanz-Lazaro[4], Jorge Durán Humia[3], Santiago Soliveres[4], Pablo García-Palacios[2], Manuel Delgado-Baquerizo[1]

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Abstract

Urban greenspaces are critical to support soil biodiversity and multiple ecosystem services. Yet, these greenspaces are heterogeneous, and we know little about how different types of urban greenspaces influence ecosystem services or biodiversity. Here, we surveyed soil and plant biodiversity and ecosystem services at four urban land-uses including city parks, vegetable gardens, golf courts, greenspaces at roundabouts, plus nearby natural ecosystems. Our survey is across 51 cities of the Iberian Peninsula with contrasting climates. The urban greenspace type impacted key soil services such as organic matter decomposition, carbon stocks, plant-macro- and micro-nutrients in the soil, and plant richness. Among land-uses, golf courts were distinct for some services. Precipitation was a key climatic factor interacting with the type of urban greenspace to determine service provision. Our work provides new insights on how contrasting types of urban ecosystem support ecosystem services in a context of climatic change and continuous urban population growth.

Ecological remediation of urban legacy pollution: Developing techniques for marginal brownfield bioremediation

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Abstract

Common remediation methods (e.g. soil washing and chelate-assisted phytoextraction) are effective at removing heavy metal (HM) pollutants from soil. However, they are also costly, mobilise pollutants via leaching and oxidation and fail to address reductions in microbial biodiversity caused by HM contamination . Diverse soil microbiomes can improve plant growth, nutrient cycling, disease resistance and ecosystem multifunctionality . Thus, promoting microbial diversity in combination with phytoremediation may encourage beneficial soil processes (e.g. soil nitrification) and aid extraction efficiency of hyperaccumulators .

Multi-plant systems have gained increasing interest as a potential bridge between biological and physiochemical technologies with regards to phytoremediation . This project utilises greenhouse and in-situ trials to examine the effects of multi-plant systems, as compared to monocultures, for four hyperaccumulator species. Growth of hyperaccumulators, microbial diversity of the soil and HMs in plants and soil are measured in-situ and greenhouse trials.

Greenhouse gas fluxes from established and emergent grasslands and the implications for nature-based solutions in England

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Natural England

Abstract

Greenhouse gas flux studies are fundamental to understanding the net emission and removal of greenhouse gases by terrestrial ecosystems. Evidence from UK grasslands is sparse and tends to be from intensive agricultural plots.

Emerging results from a novel, 24-month study are presented. Carbon dioxide measurements were collected from grasslands across the UK, using the static chamber method. More than 20 parcels were surveyed, with habitats from a range of soil types, sward diversity and management processes, enabling a broader analysis of the variety of grasslands in England.

Carbon dioxide emissions were detected all year round, thus allowing further analysis of seasonal dynamics. The influence of wider environmental variables, such as moisture and temperature are also explored, with fluxes detected at lower soil moistures than similar studies. These studies will help us to understand the carbon sequestering potential of grassland creation for nature-based solutions as part of the Nature Returns programme.

Flood risk changes the response of soil bacterial communities to extreme drought

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Abstract

An increasing number of studies are investigating the impact of drought on soil microbial communities, but there is still a lack of evidence on how environmental variability modulates microbial responses to that impact. Here we show data from a manipulative field study in Ireland where rain-out shelters were used to impose a spell of drought in soils across high and low risk of flooding. The data from this study show that these bacterial communities are strongly determined by soil moisture both in terms of taxonomic composition and diversity. Drought itself drives communities' structure towards the dry end of the soil moisture gradients. The preliminary results of this study suggest that microbial communities in low flood risk areas are more affected by drought, although we cannot rule out the possibility that subtle changes in the communities also occur in high flood risk areas subjected to drought.

Using Environmental DNA for Simultaneous Biodiversity Monitoring and Subsurface Water Flow Pathway Reconstruction in Soil Ecosystems

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Abstract

Soil ecosystems provide fundamental ecosystem services to humanity. High resolution biodiversity monitoring can enhance our understanding of this valuable ecosystem. Moreover, little is known about the flow paths water takes when entering the soil, and how soil structures impact on water runoff generation. Here, we explored the viability of environmental DNA (eDNA) for biodiversity assessment and simultaneously for subsurface water flow pathway reconstruction. We characterised 10 soil drilling cores (0.7-3.2 m depths) at 3 hillslopes (10x50 m) in 4 catchment areas in Germany and Austria through eDNA metabarcoding. In total, we detected 1793 microbial and invertebrate species and revealed distinct differences in community composition in the 4 catchments as well across geomorphological properties of the catchment. We could assign 516 indicator species across taxonomic groups in various depth layers and identify habitat-specific communities that can be used as hydrological tracers.

Evaluating Carbon Storage in Ecuadorian Coastal Tropical Dry Forests: The Impact of Climate and Soil Depth.

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Abstract

Forests are essential for mitigating climate change by acting as carbon sinks, capturing carbon dioxide, and converting it into biomass. Despite containing 25% of global carbon, tropical dry forests, such as those in Ecuador, lack detailed studies on their carbon dynamics. This research quantified the carbon storage in the soil, litter, and above-ground biomass of three subtypes of Ecuadorian tropical dry forests and analyzed variations between the rainy and dry seasons. The soil was found to be the largest carbon reservoir, with up to 75.51 Mg C ha^{-1}, followed by above-ground biomass, which remained constant throughout the year with values ranging from 12.78 to 37.08 Mg C ha^{-1}. Although litter's contribution is minimal, it plays a crucial role in enriching soil carbon. Understanding this dynamic enables the development of strategies to enhance carbon capture and the resilience of these ecosystems in the face of climate change.

Species Interactions

Herbivory is not the answer: we still don't know why some species are shifting downhill in the face of climate change

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Abstract

With the onset of climate change, most organisms are expected to shift their ranges uphill or poleward, tracking their optimal niches. However, recent reviews have found that 20-40% of species are shifting downhill or equatorward. We tested if counterintuitive shifts might be induced by a climate change-driven reduction in enemy pressure at the lower (warm) range edge. Reduction in herbivory might create suitable ecological conditions, opening previously unavailable habitats. We recorded the amount and types of herbivore damage in ten alpine plant species native to Kosciuszko National Park, Australia. Contrary to our prediction, there was no difference in the amount or types of herbivory at the expanding edge compared to the core distribution, in uphill, downhill, or non-shifting species. Critically, our lack of knowledge on range shifts might hinder conservation efforts, as downhill and equatorward-shifting species might be at particular risk of extinction in the face of climate change.

Functional responses and additive multiple predator effects of two common wetland fishes

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Abstract

In this study, we examined the effect of key predatory fish in floodplain wetlands, namely *Oreochromis mossambicus* and *Enteromius paludinosus*, towards Chironomidae prey, using a comparative functional response (FR) approach. We used single predator species as well as intra- and interspecific paired species to contrast FRs under multiple predator scenarios. Attack rate and handling time estimates from single predator FRs were used to predict multiple predators feeding rates, which were compared to observed multiple predator feeding rates to quantify potential MPEs. *Oreochromis mossambicus* had a steeper (initial slope, i.e., higher attack rate) and higher (asymptote of curve, i.e., shorter handling time and higher maximum feeding rate) FR displaying Type II FR, whereas *E. paludinosus* exhibited lower-magnitude FRs (i.e., lower attack rate, longer handling time and lower feeding rate). In multiple predator scenarios, feeding rates were well-predicted by those of single predators, both in conspecific and interspecific pairs.

Fluctuations in the structure of the plant-arbuscular mycorrhizal fungi network show anti-nestedness and modularity

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Abstract

Most null models to quantify network structure are based on algorithms that arbitrarily rearrange the observed connections in terms of who is connected to whom. The reshuffling of the connections in the null models is generally subject to constraints such as the total, observed number of connections to each species. Here, we analysed a large database of plant-arbuscular mycorrhizal (AM) fungal networks using a new approach that relaxes the very restrictive assumptions of conventional null models by allowing for fluctuations in network properties. We found that plant-AM fungal relationships are typically very modular, as expected, but also anti-nested, which is a new finding. We discuss the implications of these structural patterns for stability, especially in relation to how modularity, rather than nestedness, is expected to propagate perturbations through plant-AM fungal networks.

Exploring the Role of Spiders as Biological Protectors in Neotropical Savannas: A Case Study of Shrubs with Extrafloral Nectaries in a Post-Fire Environment

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Abstract

In several Neotropical savanna ecosystems, interactions between arthropods and plants with extrafloral nectaries (EFNs) remain poorly explored, especially in burnt environments. This study examines whether spiders attracted to EFNs on the plant *Heteropterys pteropetala* (Malpighiaceae) function as biological protectors, mitigating leaf herbivory and positively impacting plant fitness, through manipulative experiments. Our results demonstrated that spiders are attracted to plants exuding EFNs, resulting in a positive impact on reducing leaf area loss, but with a neutral effect on the protection of reproductive structures. This suggests a primarily protective role for vegetative structures, highlighting a nuanced interaction where spiders may act as commensals on reproductive parts. These findings underscore the complexity of spider-plant interactions and their implications for biodiversity in post-fire environments - CAPES-001; CNPQ-403647/2021-5.

Interactive effects of drought and plant biodiversity loss increase floral resources and alter pollinator behavior in drought-tolerant lemon beebalm (*Monarda citriodora)* in Central Texas.

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Abstract

Decreased precipitation due to climate change has resulted in severe and prolonged droughts. Additionally, with biodiversity declining globally, we investigated the combined effects of drought and plant biodiversity loss on the reproductive success of *Monarda citriodora,* an annual wildflower, visited by several pollinators. This study was conducted in an existing LTE consisting of 12 native grassland species in treatments of plant richness of 1 (*Monarda* monoculture), 2, 4, 6, and 12 species (*Monarda + 11 spp.)*, and watering (ambient, +100% average rainfall).We recorded floral traits, pollinator visitation rates and seed set of *Monarda* and found that both plant richness and drought treatment increased flower production significantly. No significant differences in other floral traits were observed. Pollinator visitation rates were significantly higher under the drought treatment. Our study demonstrates that *Monarda citriodora* is drought-tolerant in Central Texas and an excellent candidate for pollinator habitats, especially in the face of climate change.

Nutrient niche dynamics among an assemblage of wild pollinators

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Abstract

Food resources are essential for survival, growth, and reproduction, yet single resources rarely provide a balanced diet, driving competition among species with similar nutritional needs. Understanding how nutrients are distributed in nature and how they are used by co-occurring species is key to explaining species interactions and persistence. We investigated community-level macronutrient availability (proteins, lipids, carbohydrates) and nutritional niches for eight co-occurring wild bumble bee species by combining long-term plant-pollinator interaction data with pollen macronutrient analyses. We find considerable variation in pollen macronutrient profiles among plant species, with community-level composition fluctuating seasonally but remaining consistent across years and habitats. Co-occurring bumble bee species partitioned into two macronutrient niches, linked to feeding morphology and life stage. Niche differentiation was most pronounced during the worker phase of the colony life cycle, and short-tongued species exhibited shifts in nutritional niches between colony life stages, while those of longer-tongued species remained consistent.

Putting the Stress Gradient Hypothesis to the test: a soil-resource ecosystem engineering model to assess the ecological stability of plant antagonistic facilitation.

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Abstract

We develop a spatially explicit, consumer-resource model for belowground plant interactions between ecosystem engineers and exploiters to determine in what environmental conditions antagonistic facilitation via soil resource mining emerges as an optimal strategy. Following our modeling approach, plant interactions are an emergent property of resource use rather than postulated a priori via parameter choices. As predicted by the stress gradient hypothesis, facilitation emerges in stressful conditions only when the environmental parameter driving changes in the interaction between plants is the proportion of the resource that becomes readily available for plant consumption without any mining activity. Nevertheless, the amount of resource input and physical decay, commonly used to measure stress empirically, play a secondary role and do not neatly lead to stress gradient hypothesis patterns. Furthermore, we find that the total root biomass, often used to measure the sign of the interaction between plants, does not predict facilitation reliably.

Urban Plant-Herbivore-Parasitoid Interactions Depend on Scale

Grace J Soltis, Nora Underwood, Brian D Inouye

Florida State University

Abstract

Urbanization can alter species distributions, cause extinctions, and disrupt multi-trophic interactions, but how these effects vary with trophic level is less well-understood. We tested the magnitude and scale of the effects of urbanization in a tri-trophic interaction. We sampled seed-feeding tephritid flies and their parasitoids inside flowers of *Bidens alba*, a common plant in natural and urban areas, across sites near Tallahassee, FL, that varied in local *Bidens* density and urban variables (% impervious surfaces and remote-sensed NDVI). Both herbivore and parasitoid populations responded positively to local host density but responded to different scales of urban context. Fly attack was correlated with small scale (5 m^2) impervious surface cover, whereas parasitoid attack was correlated with large scale (400m radius) NDVI. This study illustrates how different trophic levels can respond to different scales of urban context, emphasizing the importance of considering scale when measuring the impacts of urbanization on natural populations.

Why does intraspecific variation in body size of an herbivorous insect increase plant damage and change the spatial distribution of damage? An evaluation of mechanisms.

Monica Paniagua Montoya, Dr. Brian D. Inouye, Dr. Nora Underwood

Florida State University

Abstract

Theory suggests that effects of intraspecific trait variation on species interactions can occur through multiple mechanisms, yet there are few empirical investigations of these mechanisms. We used a series of greenhouse experiments to evaluate mechanisms that increase plant damage and change the spatial distribution of damage when there is high intraspecific variation in body size of an herbivorous insect. We considered (1) Jensen's inequality, (2) the disproportionate effect of extreme sizes, and (3) facilitation of feeding. Our results suggest Jensen's inequality best explains an increase in plant damage by herbivore groups with greater intraspecific size variation. In contrast, the presence of extreme individuals—specifically, larger individuals—best explains higher spatial dispersal of damage with an increase in size variation, as larger individuals are more mobile. Our study shows it is important to consider different mechanisms when evaluating the role of trait variation in ecological communities.

Predicting avian hybridisation

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Abstract

As species ranges shift as a result of climate change and introduction to non-native areas, novel assemblages will form and new species interactions will occur. One of those interactions may be hybridisation. Hybridisation with colonists may be detrimental to native species or may preclude the spread of colonists in their new ranges. Therefore, predicting the likelihood of hybridisation has important conservation implications. We utilised a large dataset of North American avian species pairs and phylogenetic linear mixed models to determine the predictors of hybridisation. We included a variety of life history and ecological traits in our models including morphometric, colour, pattern, and song dissimilarity. We found that as species differ more in size, colour, pattern, song they are less likely to hybridise with one another. While this may seem intuitive this is the first study of its kind and scale to utilise species pair analyses and control for phylogenetic relationships.

Systematic distributions of interaction strengths across tree interaction networks yield positive diversity–productivity relationships

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Abstract

Tree–tree interactions in diverse communities are fundamental in driving growth rates, potentially shaping the emergent Diversity-Productivity Relationships (DPRs), yet remain poorly explored. Using data from a large-scale forest biodiversity experiment in subtropical China, we demonstrated that changes in individual tree productivity were driven by species-specific pairwise interactions, with higher positive net pairwise interaction effects on trees in more diverse neighbourhoods. By perturbing the interaction matrix obtained from empirical data in simulations, we revealed that the positive differences between inter- and intra-specific interactions were the critical determinant for the emergence of positive DPRs. Surprisingly, the condition for positive DPRs corresponded to the condition for coexistence. We further explored how these interaction strengths change across diversity level as network theory posits weak interactions tend to stabilising diverse communities. Our results thus provide a novel insight into how pairwise interactions regulate DPRs, facilitating the identification of tree mixtures that maximized productivity.

Multidecadal trophic responses of a top predator (California sea lions) reflect prey regime shifts

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Abstract

Tracking long-term trophic dynamics of top predators is important for understanding food web functionality in ecosystems with multiple modes and time scales of environmental variability. We analyzed the $\delta^{15}N$ values from California sea lion (CSL) tooth growth rings to generate a 55-year time series of their trophic ecology to understand if their foraging dynamics reflected multidecadal shifts in the California Current Ecosystem causing changes in prey abundances. We hypothesized that CSL foraging patterns would reflect available prey and trophic shifts would occur during fish stock collapses coincident with a marine heatwave. We show relationships between CSL foraging and prey abundances and captured a trophic shift during prey declines that coincided with poor CSL pup condition and preceded a multi-year unusual mortality event of CSL young. Our findings support the use of $\delta^{15}N$ values from predators as significant indicators of food web dynamics and as a tool for assessing ecosystem states.

Can Spring Wildflowers Keep Pace with Shifting Overstory Phenology?

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Abstract

Many plant species are shifting their phenology due to anthropogenic climate change. However, these shifts often occur at different rates due to species-specific phenological cues. For instance, some species rely heavily on photoperiod, while others rely on seasonal climatic changes as phenological cues. As the climate changes, these differences could result in variable phenological shifts, altering interactions among co-occurring species. For example, if spring ephemeral wildflowers shift their phenology differently from the timing of overstory leaf out, the changing light environment could affect wildflower fitness and carbon sequestration. Our study tests whether spring ephemerals are shifting their phenology and whether these shifts match the rate and direction of overstory leaf out shifts. If these ephemerals cannot keep pace with the advancing overstory phenology they could become shaded out, impacting their carbon sequestration, fitness, and long-term population persistence, with broader implications for forest communities.

Integrating intraspecific variation into population dynamics reveals how interacting species persist in mutualistic communities

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Abstract

Mutualistic interactions among organisms are fundamental to the origin and maintenance of biodiversity. Yet the study of community dynamics often relies on species-level values, ignoring how intraspecific variation can affect those dynamics. We propose a theoretical framework for evaluating the extent to which this kind of variation can influence species' persistence in mutualistic systems. Next, drawing from detailed empirical data on plant–pollinator interactions, we quantify intraspecific variation in the mutualistic benefits received by plants and incorporate this variation into estimations of the community's structural stability, a robust theoretical measure of species persistence. Through explicit consideration of intraspecific variation, we are able to demonstrate that having different combinations of specialized and generalized individuals within populations modifies the persistence of focal and co-occurring species. By providing a tool set that accounts for individual-level variation, we open the door to a better understanding of the mechanisms promoting biodiversity in mutualistic communities.

Soil microbes shift plant interactions under drought along a secondary successional gradient

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Abstract

Drought events, intensified by climate change, can change plant species interactions, affecting community composition and successional trajectories. We quantified the impact of soil microbes on plant interactions during drought and recovery in secondary successional grasslands. Seedlings of *Plantago lanceolata* and *Agrostis capillaris* were planted alone and in competition in cylinders with varying mesh sizes to manipulate access to the surrounding soil microbial community. These were placed in drought, control, or recovery plots at sites with one to 40 years of agricultural abandonment. Soil microbes shifted plant interactions from competitive to facilitative along the successional gradient under control conditions. Drought weakened these interactions and microbes had a more facilitative effect on *Agrostis* than on *Plantago*, especially at mid-successional sites. A similar, but stronger microbial effect was observed during recovery, suggesting a critical role for soil microbes in shaping drought-driven successional changes, supported by increased plant species abundance in the field post-drought.

Fecal DNA metabarcoding to understand the effects of climate change on the diet of high alpine birds

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Abstract

Climate change is expected to alter the snow cover and plant phenology in high alpine ecosystems. Such changes may have direct and indirect bottom-up effects on species at higher trophic levels, with subsequent consequences on herbivore diet and life history traits. Here, we study the seasonal and annual diet of willow (*Lagopus lagopus*) and rock ptarmigan (*Lagopus muta*) at Lifjellet in central Norway to understand how the timing of spring affects their food selection, quality and composition. We will use DNA metabarcoding data from 288 fecal samples collected over a five-year period to analyze the diet changes across the winter-spring transition and between the ptarmigan species. Furthermore, we plan to use microsatellite analysis and capture-mark recapture approach to examine the potential relationship between individual survival and dietary changes. By combining these results, we hope to contribute to better understand the complex dynamics between climate change, diet and ptarmigan population.

Trait-matching in frugivory leads to bird complementarity at global scales, but more in temperate areas

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Abstract

Trait-matching affects animal foraging choices, and ultimately, the ecological functions they sustain. In avian frugivory, critical for the dispersal of many plants, it is generally accepted that small birds cannot eat large fruits and that highly frugivorous species prefer lipid-poor ones. However, it remains unclear if such rules operate globally and if their strength varies with latitude and insularity. If trait-matching is widespread, dissimilar birds will play complementary roles within communities. If its strength varies, such complementarity will change at macroscales. We analyzed 59 plant-bird frugivory networks (6883 interactions, 1532 species) with a mechanistic frugivory model and showed that trait-matching affects frugivory across the globe, leading to complementary fruit choices of birds with contrasting beaks and diets. Yet, morphological trait-matching is stronger at high latitudes, especially on islands, where complementarity intensifies. By combining interaction networks and traits we could detect global drivers of frugivory and evaluate their functional consequences.

Thermal performance curves in complex food webs - Implications for stability under global change

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Abstract

Temperature is a key factor influencing biological processes, with many traits exhibiting unimodal or left-skewed thermal responses (thermal performance curves TPCs). This phenomenon has been shown to have critical implications for species interactions under warming, for example in consumer-resource models. Here, we explore the integration of TPCs within a complex food web model, Specifically, we consider the impact of the thermal response of movement speed, which influences energy intake through attack rates and energy loss via activity metabolism. Our findings reveal that shifting from traditional Arrhenius-based thermal sensitivities to empirically-supported thermal performance curves significantly affects food web persistence and vertical diversity under climate warming. Furthermore, these modifications can alter the interactive effects of warming and eutrophication, offering new insights into the stability and dynamics of ecological communities under global change.

Using large scale eDNA sampling to understand the comparative effects of Eurasian beaver (Castor fiber) activity and other environmental factors on spatial distributions of migratory fish

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Abstract

Reintroduction of keystone species is considered part of the solution to the current biodiversity crisis. The Eurasian beaver (*Castor fiber*) is one such species, shaping their habitat by felling trees, building dams and creating wetlands. However, while the potential benefits to aquatic biodiversity and ecological functioning have been widely promoted, concerns can arise surrounding the passability of dams for migratory fish, and the impacts that changes in flow may have on salmonid spawning habitats. Sequencing environmental DNA (eDNA) from water samples provides a cost-effective method to study species distributions across a large-scale. Here, eDNA samples (n=426) were collected from 142 sites across the UK's oldest and largest wild beaver population, located on Tayside, Scotland. Providing a unique opportunity to model the comparative impact of beaver presence and other variables on the distribution of a suite of important migratory fish species.

Effect of plant stress on scent-mediated pollination in wild tomato

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Abstract

Biotic and abiotic stresses are typically thought to have negative effects on pollination in plants, by deleteriously affecting key traits utilised by pollinators. However, the relative impacts of different stressors remain poorly understood. We compared the effect of abiotic (drought, nutrient limitation) and biotic (artificial herbivory) stress on the interactions between wild tomato, Solanum habrochaites, and bumblebee, Bombus terrestris pollinators. While abiotic stress had minimal effects on pollinator preference, behavioural bumblebee trials revealed strong attraction to herbivory-stressed plants compared to droughted, nutrient-deficient and control plants. Experiments testing the relative attractiveness of floral scent compounds suggest that olfactory, rather than visual cues, mediate the effect of biotic stress, suggesting that changes in floral scent may act as a 'cry for help' to increase pollinator recruitment and maximise reproduction under herbivory stress. Our study suggests the effects of environmental stress on plant-pollinator interactions may be more complex than typically assumed.

Does environmental stress affect wild tomato (*Solanum habrochaites*) pollen quantity and quality for bee pollinators (*Apis mellifera*)?

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Abstract

Plants and pollinating insects face increasing risk from natural and anthropogenic environmental stress, with abiotic and biotic stresses affecting both sides of the mutualism. The effects of diverse stresses on floral rewards could pose hidden risks to pollinators, but these impacts remain poorly understood. We manipulated drought, artificial herbivory, and nutrient deficiency in the wild tomato, *Solanum habrochaites*, and compared their effects on pollen production, pollen secondary metabolite content, and performance of honeybee, *Apis mellifera,* larvae fed experimental pollen. Drought led to reduced floral display and pollen production, and increased terpenoid and phenolic content in pollen, but only modestly affected larval growth rate and survival in our bioassay; larvae fed pollen from nutrient deficient plants had improved survival. Conversely, herbivory had little effect on pollen and pollen-fed bees. This study provides some of the first evidence that abiotic stress can impact pollen metabolism with potentially wide-reaching implications for flower-feeding insects.

Unveiling plant–herbivore interactions following glacier retreat using DNA metabarcoding

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Abstract

Glacier retreat opens up new areas that are rapidly colonized by living organisms. The dramatic retreat of glaciers worldwide strongly affects local communities and their networks, including plants and arthropod herbivores. Plant–herbivore interactions are some of the most common and important relationships that reflect ecosystem function and health. Thus, identifying the actual relationship of “who eats whom” is needed in order to study networks following glacier retreat. After sampling ground arthropods along a 140-year chronosequence on a glacier foreland, we used DNA metabarcoding to determine the hidden herbivory interactions from arthropod gut contents. We detected numerous additional hidden interactions from metabarcoding data compared to the single interactions from observational surveys. Plant–herbivore networks initially increase in the short term, then ultimately decrease with glacier extinction. These results show the high capability of using DNA metabarcoding to study the impact of glacier retreat on plant–herbivore interactions.

The balance of sensory information for ecosystem stability

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Abstract

Individuals sense other species in the environment and convert such inputs into information. This "information flow" between species regulates species interactions, such as foraging and mating. Here, we studied how consumer-resource dynamics are affected by such information flow. We used numerical simulations to investigate how information flow influences the stability of a 2-species system. We found that population dynamics exhibit three phases for decreasing information flow: 1) collapse of the system due to overexploitation of resources; 2) resilient interval, where both resource and consumer coexist; and 3) extinction of consumer due to sensory pollution. These results illustrate how sensory pollution can affect consumer-resource dynamics, causing their collapse. Because human activity is increasing sensory pollution by, e.g., lights, chemicals, and acoustic noise, our results are particularly relevant for understanding how such global changes are affecting ecosystem stability.

Fungicide but not herbicide exposure during development drastically reduces performance of a non-target butterfly

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Abstract

Agricultural intensification is one of the main drivers underlying biodiversity loss. Herbicides and fungicides are pesticides commonly used to control weeds and fungal plant diseases. Recent studies have suggested that excessive use of pesticides could negatively impact also non-target species living in the vicinity of agricultural lands.

We exposed larvae of the Glanville fritillary butterfly (*Melitaea cinxia*) to field-realistic levels of a herbicide, a fungicide and a combination of the two via their larval host plant (*Plantago lanceolata*). We assessed survival and performance in larvae and potential carry-over effects in adults under semi-natural conditions.

Our results showed significant increase in mortality in the larvae exposed to the fungicide and the combination treatments. Even though exposure to fungicide also impacted adult morphology, we found little evidence for other carry-over effects. Non-negative impacts of herbicide exposure on this specialist species warrants further investigation.

Gut morphology and pollen consumption differences across sexual castes in the buff tailed bumblebee (Bombus terrestris) and Ivy bee (Colletes hederae)

Sam Butler

University of Sussex

Abstract

While pollen makes up the majority of the larval diet of many bee species, it has been assumed that adult bees consume little pollen when foraging and cannot digest it. By microscopically examining gut contents, I quantified the amount, diversity and digestibility of pollen ingested by the social pollen generalist, *Bombus terrestris* and solitary pollen specialist, *Colletes hederae*.

Given pollen's role in ovary activation, I compared the gut contents between workers and queens, expecting queens to consume more pollen than workers. Pollen consumption in males has been completely overlooked so in both species, I compared males and females, expecting sperm production to be nutrient intensive. I also compared gut morphology across species, bee age and sexual castes, assuming that gut morphology may change to accommodate dietary requirements.

This research has important ramifications for understanding bee dietary needs and digestion, which could which could better inform our agricultural and environmental management.

Food fight: monosex prawns and crayfish as biocontrol agents against pest freshwater snails

Sharon Moscovitz[1], Shai Avraham Shaked[1], Ayal Moshe Green[1], Dmitry Portnikov[2], Haim Kalman[2], Eliahu David Aflalo[1,3], Ariel Emanual[4], Hanoch Glassner[4], Ofer Ovadia[1,5], Amir Sagi[1,6]

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Abstract

This study evaluates the effectiveness of non-GMO monosex decapods, *Macrobrachium rosenbergii* (prawn) and *Cherax quadricarinatus* (crayfish), as biocontrol agents against freshwater snails which transmit fish diseases, causing economical harm to fish farmers. In food-choice experiments, both decapods preferred snails with thinner, weaker shells, while harder-shelled snails were preferred less. The prawn exhibited selective behavior, while the crayfish demonstrated more opportunistic feeding and was surprisingly more efficient in snail predation than the prawn. Subsequent physical-mechanical tests on the snails revealed that the least preferred snail species had significantly thicker shells that required greater force to break. The monosex decapods could provide sustainable, non-invasive biocontrol solutions, potentially enhancing integrated pest management strategies in aquaculture, when the specific biocontrol agent could be tailored according to the local snail community, promoting a win-win-win sustainable polyculture for fish farmers when the biocontrol agent doubles as a valuable polyculture-grown protein.

Microplastic translocation in the liver: comparing three fish species with different feeding habits

Ms Giulia Papini[1], Prof Clara Boglione[2], PhD Arnold Rakaj[2]

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Abstract

The investigation of the interception and the consequent translocation of microplastics (MPs) in fish organs is necessary for understanding the MP dynamic bioaccumulation along the food web. In this scenario, this study aimed to investigate the MP interception and translocation in the liver of fish with different feeding habits and trophic levels: *Squalius cephalus*, a surface piscivourous, *Alburnus arborella*, an invertivore column-feeder and *Carassius auratus*, a benthic grazer. The specimens were collected in the Tiber river, downstream Rome City (Italy). The preliminary results of this study are shown in terms of presence (n. items/individual), concentration (n. items/organ wet weight), size and shape distribution. The preliminary results showed that the three species can intercept the same MP in different concentrations, shape and size proportions, and, at the same time MPs translocated into the liver show a species-specific variation.

Temporal dynamics of food-web structure in response to biodiversity changes in riverine ecosystems perturbations.

Dr Alain Danet[1,2], MSc Loubna El Madouri[3], Dr Maud Mouchet[2], Prof. Andrew P Beckerman[1], Dr Élisa Thébault[4], Dr Colin Fontaine[2]

[1]University of Sheffield. [2]CESCO, Muséum national d'Histoire naturelle. [3]Laboratoire d'Écologie Fonctionnelle et Environnement. [4]IEES, Sorbonne Université

Abstract

While there are widespread evidence of rapid biodiversity changes, little is known how food-web structure respond to those changes. Here, we used a standardized monitoring of 400 riverine fish communities over 1995-2018, from which we inferred the food-web structure for each sampling events using diet data and allometric scaling rules. We assessed the effects of community biomass and species richness temporal changes on temporal changes in food-web structure: connectance, average trophic level and redundancy. Our results suggest that food-webs that experienced a decline in community biomass experienced conjointly a loss of species at upper trophic levels and conversely. Species richness temporal trends had less clear effects on food-web structure. Both community biomass and species richness declines were associated with a decrease in redundancy, raising concerns about robustness of such communities. Our study highlights how biodiversity changes affect food-web structure, raising concerns about consequences on ecosystem functioning and robustness.

The dynamics of freshwater food webs under multiple threats

Miss Alina B Smith, Prof. Andrew P Beckerman

University of Sheffield

Abstract

Freshwater ecosystems are under threat from multiple environmental stressors yet play a disproportionate role in global biodiversity, containing 10% of described species despite covering 1% of the planet. Ecological models of species interactions are a powerful tool for predicting these stressors' effects by providing an interface between traits and community dynamics. Although considerable trait data exists to inform such models, accessibility difficulties and species bias often leads to species at lower trophic levels being assigned to larger groups. This aggregation may impact the capacity for models to predict community responses to climate change including diversity, stability and robustness to extinction. To address this, I have produced a trait database for phytoplankton and zooplankton providing information on body size, phylogeny and functional group membership for over 3500 species across 41 countries. I then use this data to demonstrate the consequence of aggregation on biodiversity using the bioenergetic food web model.

The Nuances of Food Webs: An Overview of Definitions, Scales, and Mechanisms

Dr Tanya Strydom[1], Jennifer A Dunne[2], Timothée Poisot[3,4], Andrew P Beckerman[1]

[1]University of Sheffield. [2]Santa Fe Institute. [3]Université de Montreal. [4]Québec Centre for Biodiversity Sciences

Abstract

Food webs are a useful abstraction and representation of the feeding links between species in a community and are used to infer many ecosystem level processes. However, the different theories, mechanisms, and criteria that underpin how a food web is defined and, ultimately, constructed means that not all food webs are representing the same ecological process. Here we present a synthesis of the different assumptions, scales and mechanisms that are used to define different ecological networks ranging from metawebs (an inventory of all potential interactions) to fully realised networks (interactions that occur within a given community over a certain timescale). Illuminating the assumptions, scales, and mechanisms of network inference allows a formal categorisation of how to use networks to answer key ecological and conservation questions and defines guidelines to prevent unintentional misuse or misinterpretation.

Climate change reduces plant-pollinator phenological overlap, even with generalized phenological advances over the past 8 years

Nerea Montes-Perez, Ignasi Bartomeus, Francisco P Molina

Doñana Biological Station (EBD-CSIC)

Abstract

Climate change is altering the phenology of interacting species, leading to a potential mismatch between them which could result in the loss of crucial ecosystem functions such as pollination. Although plants and pollinators are embeded into complex webs of interactions, it remains unresolved how species-specific phenological shifts scale up at the community level and the role biodiversity could play in buffering potential negative outcomes. We used an 8-year time series of seasonal abundance data for plants and pollinators, sampled in an area experiencing increased droughts and extreme high temperatures, to assess potential changes in phenological overlap. We found that overlap between interacting species has decreased over time, with a steeper trend for pollinators. Furthermore, while biodiversity enhances overlap, it is not buffering the reduction in overlap over time at the community level. Therefore, the ongoing impact of climate change threatens the presistance of pollination functions in natural ecosystems.

The impact of Eurasian minnow on diet and growth of Arctic charr and brown trout

Dr. Renee M van Dorst[1], Professor Pär Byström[2], Dr. Sven Norman[3], Dr. Gunnar Öhlund[1], Frieder Wittmann[1], Dr. Karin A Nilsson[1]

[1]Swedish University of Agricultural Sciences. [2]Umeå University. [3]Sportfiskarna, Sveriges Sportfiske- och Fiskevårdsförbund

Abstract

Brown trout (*Salmo trutta*) and Arctic charr (*Salvelinus alpinus*) are common fish species in cold subarctic lakes in Sweden. These lakes and the species within are impacted by range shifts of potentially competing fish species, like the Eurasian minnow (*Phoxinus phoxinus*). We studied the diet and growth of trout and charr in lakes with and without minnow to determine the potential impact of a further range expansion of minnow. We find little evidence of minnows being prey for trout or charr. Furthermore, minnow presence does not significantly affect the diet of trout, while charr's diet shifts from a combination of benthic and pelagic prey to a diet dominated by pelagic zooplankton with minnow present. Growth of trout and charr is likely affected by a combination of minnow competition and lake specific conditions. This study shows that range expansion of minnow may impact the ecology of already threatened Arctic charr populations.

Multi-trophic interaction networks mediate biodiversity effects on ecosystem multi-functionality

Georg Albert

University of Goettingen

Abstract

Biodiversity loss jeopardizes the multi-functionality of ecosystems that human well-being ultimately depends on. Multi-trophic species interactions are key to predicting the real-world consequences of biodiversity loss. However, studies explicitly linking species interactions and ecosystem multi-functionality remain rare and limited to a few types of interactions, rendering generalizations on the effect of species interactions difficult. By synthesizing species interaction data spanning multiple types of antagonistic and mutualistic interactions, we show that the size of species interaction networks is a key driver of ecosystem multi-functioning that aligns with positive species diversity effects. However, positive effects of similar and focused interactions (i.e. high niche overlap and low linkage density) seem to contradict complementarity mechanisms that are commonly assumed to drive species diversity effects. This can be resolved when considering the spatio-temporal dimension of species complementarity, advocating the explicit integration of species dynamics into research on multi-trophic species interactions and ecosystem functionality.

The impact of neighbours and fertilization on flowering time, plant size, pollinator visitation, and plant fitness

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Abstract

Flowering time is a highly plastic trait that varies in response to photoperiod, temperature, and fertilization. If a plant flowers too early or too late, this can reduce pollination and fitness. Although research suggests competition can alter a plant's flowering time, it remains unclear whether competition shifts flowering time enough to affect pollinator visitation and fitness. In this field experiment, we examined flowering time, pollinator visitation, and seed production for four entomophilous plant species under three conditions: neighbouring plants intact (control I), added fertilizer with neighbouring plants intact (control II), and neighbouring plants removed. Fertilization and neighbours inconsistently impacted flowering time across species. Plants grew larger floral displays in the fertilized and neighbour-removed plots but plants with neighbours, whether fertilized or not, attracted more pollinators. Larger floral displays in neighbour-removed plots increased pollinator visitation as well. Our results suggest neighbours can have complex impacts on flowering time and pollination.

Sensitivity of range-restricted Himalayan birds (*Phylloscopus tytleri* & *Callacanthis burtoni*) towards Climate Change

Miss GARIMA KUMARI, Dr. Parul Bhatt Kotiyal, Dr. Hukum Singh, Dr. Manoj Kumar

FOREST RESEARCH INSTITUTE, DEHRADUN, UTTARAKHAND, INDIA

Abstract

Climate change is expected to impact the distribution of species and disrupt interactions among living organisms. The study explores species distribution models (SDMs) for two range-restricted Himalayan birds (*Phylloscopus tytleri* & *Callacanthis burtoni*) in the Indian Western Himalayan region, under different IPCC climate change scenarios. Utilizing SDMs, we predicted shifts in habitat suitability of the two species under various climate change projections. Our approach integrates climate data, topographical features, and current species distribution records to assess potential habitat availability and quality changes. The findings indicate significant habitat contraction for the species, highlighting areas that may become unsuitable due to rising temperatures and altered precipitation patterns. Conversely, species may find new suitable habitats at higher altitudes. This research underscores the urgency for conservation strategies that incorporates climate forecasts, emphasizing the protection of climate refugia and corridors that facilitate species movement.

Nitrogen enrichment improves health and affects host-symbiont interactions on the coral *Pocillopora acuta*

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Abstract

Coral holobionts associate with photosymbiotic dinoflagellates and a myriad of other microorganisms in a complex multi-partner interaction, the metabolic benefits of which may play an important role in holobiont fitness. As nitrogen limitation regulates dinoflagellate populations and, therefore, metabolic interactions within the holobiont, we sought to understand how nitrogen enrichment representative of environmental eutrophication influences the holobiont. To achieve this, we exposed *Pocillopora acuta* to natural and ammonium-enriched conditions for 20 days. Nitrogen enrichment significantly increased coral coloration, photosymbiont density, and photosynthetic efficiency. While microbial community data are pending, our preliminary findings suggest that ammonium enrichment likely released the dinoflagellates from nitrogen limitation, subsequently increasing their health and proliferation, and ultimately boosting holobiont health. These results indicate a rapid response of the *P. acuta* coral holobiont to nitrogen enrichment, which may reflect a change not only in microbial community structure, but also in their metabolic bonds.

Do nocturnal and diurnal pollinators mutually compensate for loss of the other group?

Mialy Razanajatovo, Lea Aschmann, Marcus Morabito, Princia Rakotomamonjy, Huw Cooksley, Carsten Buchmann, Frank Schurr

University of Hohenheim

Abstract

Nocturnal and diurnal pollinators can be impacted by global change differently. Nocturnal pollinators might be disproportionately affected by asymmetric warming and light pollution. However, our knowledge of plant-pollinator interactions is biased towards diurnal interactions. To assess the contribution of nocturnal pollinators to seed set of ten common grassland species, we conducted a pollinator exclusion experiment which consisted of four treatments: exclusion of diurnal pollinators, exclusion of nocturnal pollinators, exclusion of both diurnal and nocturnal pollinators and open pollination. Seed set was largely pollinator dependent, and did not significantly differ under exclusion of diurnal pollinators, exclusion of nocturnal pollinators, and open pollination. This indicates that nocturnal and diurnal pollinators can mutually compensate for loss of the other group. Such a mutual compensation may act as a buffer under global change, given that insect communities are exposed to partly different pressures.

Can we infer interactions from contemporary monitoring approaches? Rarely!

Dr Chris S Sutherland[1], Ms Amber Cowans[1], Mr Albert Bonet-Bigata[2]

[1]CREEM, University of St Andrews. [2]University of Aberdeen

Abstract

Multispecies occupancy models are commonly used to infer species co-occurrence, but are the data we use fit-for-purpose? This talk examines sample size requirements for drawing robust inferences about species distributions and biotic interactions. Using a simulation study motivated by real-world monitoring scenarios, we examine how the ability to characterise interactions and co-occurence patterns is influenced by sample size and the nature of the interactions. We demonstrate that unbiased ecological insight about species interactions requires larger data sets than are used in typical contemporary monitoring programmes. Specifically, at least 400 sites are required to avoid biases in inferred occurrence and interaction strengths. Understanding the dynamics and persistence of ecological communities requires an understanding of the strength and direction of biotic interactions, yet, while new methods promise such insight, we caution against their use with limited data.

How does large mammal herbivory shape savanna ant communities?

Bjoern Matthies[1], Prof Kate Parr[1], Prof Jane Hill[2], Dr Lucy Smyth[3], Bosco Letuka[3]

[1]University of Liverpool. [2]University of York. [3]Natural State

Abstract

Mammalian herbivory is a key consumer shaping African savannas. However, both too much herbivory (e.g., large numbers of livestock) or too little herbivory (e.g. declines in wild herbivores) can lead to degradation by decreasing grass biomass and/or promoting woody encroachment. With research focussing on the effects of mammalian herbivores on vegetation, the cascading effects on terrestrial invertebrates remain understudied. Terrestrial invertebrates form the bulk of terrestrial animals, including groups such as ants that deliver important ecosystem services.

This talk will explore to what extend ant communities in the savannas of the Mount Kenya landscape are shaped by different types of native herbivores relative to livestock. The study sampled ground-dwelling ant communities with pitfall traps along a gradient of herbivory types and intensity, ranging from high-intensity livestock to full herbivory exclusion zones, addressing the question: How are ant composition, richness and functional traits affected by variation in large mammalian herbivory?

The relationship between biotic and abiotic stress tolerance of Northern Hemisphere woody plants

Dr Andrea Cerdeira-Pérez[1], Dr Lauri Laanisto[2], Dr Giacomo Puglielli[1]

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Abstract

Insect herbivory is ubiquitous and its negative impact on plant fitness represents an important selective pressure for plant adaptive strategies together with concurrent multiple abiotic limitations. The production and maintenance of plants' defence mechanisms against herbivory is energetically costly and depends on habitat stress levels. Therefore, there must be an eco-evolutionary relationship between biotic and abiotic stress tolerance.

The aim of this study was to explore how biotic stress relates with species abiotic stress tolerance syndromes. We compiled information on the feeding ecology of 6,000 species of phytophagous Lepidoptera and Hymenoptera associated with 799 Northern Hemisphere woody plants for which standardized information on tolerance syndromes to shade, drought, cold and waterlogging was available. We found contrasting tolerance-insect associations, that is, different insect feeding strategies were associated with different plants' abiotic stress tolerance strategies. This suggests strong co-evolution between tolerance to abiotic and biotic stress in woody plants.

Cities for honeybee and wild pollinators: Interactions between manage and wild pollinators and beekeeping sustainability

Federica Paradiso[1], Dr Katherine C.R. Baldock[1], Dr Matthew J Pound[1], Dr Rinke Vinkenoog[2], Prof Mark J Whittingham[3], Dr Mark A Goddard[1]

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Abstract

The increasing number of honeybee hives in urban areas negatively impacts some wild pollinators. Recent studies have examined potential competition, focusing on group-level analyses or single pollinator groups. In this study, we collected plant-pollinator interaction and floral resource data in urban parks and allotment gardens. Using GLMM, we explored the impact of honeybee hive density and floral resources on wild pollinator species richness, abundance, and plant-pollinator network properties. A social survey has been designed to investigate public perceptions of honeybee and wild pollinator interactions and pollinator-friendly management strategies. To ensure coexistence between wild and managed pollinators, a national beehive register is necessary to control hive densities. Synergistic actions between decision-makers, the general public, and beekeepers are essential to enhance pollinator food resources in urban landscapes and ensure the coexistence of the entire urban pollinator community.

The influence of reintroduced European beavers (*Castor fiber*) on the diversity and community composition of ground beetles (Coleoptera: Carabidae) in Eastern England

Mr Russell K Stevens

UKCEH. Anglia Ruskin University

Abstract

Beavers are keystone species and ecosystem engineers, modifying the environment and creating new habitats for other species. This study examined how the reintroduction of European beavers (*Castor fiber*) in England influenced ground beetle (Coleoptera: Carabidae) communities, a taxon of interest to arable farmers as a biocontrol agent. Carabids were sampled at three sites, at different stages of reintroduction (established; in process; no reintroduction), over two years and differences in diversity and community composition were analysed.

Results suggested the beaver reintroduction did not significantly affect carabid diversity in the short term. Local light availability and drainage had a significant positive influence on diversity and broader habitat variation was important at the landscape scale. Site differences in carabid communities were significant in the second year when the established reintroduction site displayed a more unique assemblage of species including wetland specialists.

These results provide a baseline against which future monitoring can be compared.

Modelling the resilience of oak-associated herbivorous insects to simulated loss of tree species in UK woodlands

Mr Kian Hayles-Cotton[1], Professor Jane K Hill[1], Professor Colin M Beale[1], Dr Michael JO Pocock[2], Dr Mark W Wilson[3], Dr Harriet F Downey[4]

[1]University of York. [2]UK Centre for Ecology & Hydrology. [3]British Trust for Ornithology. [4]The Woodland Trust

Abstract

Woodlands support important biodiversity and provide vital ecosystem services but are threatened by factors that can alter tree species assemblages and their associated biodiversity. We examined how woodland extent and connectivity affect the resilience (network connectance and robustness) of herbivorous insect communities, focusing on species associated with oak (*Quercus* spp.). We modelled a spatially-explicit bipartite network linking 25 tree species and 130 oak-associated insects and found that locations with low woodland cover (<10%) support a higher proportion of generalist species, which were 8% more resilient to tree species extinction than locations with high woodland cover (>50%). Resilience also varied with woodland connectivity which primarily benefited generalist species and resulted in an increased insect community robustness to tree species extinction. Our results suggest that more species-rich woodlands are not necessarily more resilient to the loss of host trees; we also highlight the need to conserve rare specialist species within UK woodlands.

Inhibition of the shikimate pathway by glyphosate disrupts the stability of symbiosis and impairs host fitness across diverse grain pest beetles

Dr Sthandiwe Nomthandazo Kanyile

Max Planck Institute for Biology

Abstract

Glyphosate is a widely used herbicide and potent inhibitor of the shikimate pathway which is essential for producing aromatic amino acids like tyrosine in plants and microbes. Although insects lack this pathway, many rely on symbiotic microbes that possess it. By examining four beetle families, encompassing species with and without intracellular shikimate pathway-encoding symbionts, we reveal a novel and unexpected mechanism by which glyphosate may modulate host-microbe interactions. We observed a complete failure to enter metamorphosis upon glyphosate exposure in two tenebrionid species that lack specialized shikimate pathway encoding symbionts. An analysis of the gut microbial community revealed very mild changes in composition, and no reductions in microbial density. Remarkably, the effects of glyphosate on tenebrionids were rescued when microbiota burden was reduced by antibiotic treatment or supplementing the diet with tyrosine- indicating that glyphosate triggers detrimental host-microbe competition for tyrosine.

Simulating pollination and dispersal of two Kenyan tree species (Adansonia digitata and Melia volkensii) to assess how carbon-motivated tree planting may affect tree population viability

Dr Emma Gardner

UK Centre for Ecology and Hydrology

Abstract

Tree planting is being advocated to absorb atmospheric carbon and help meet net zero targets, but it can have complex consequences for ecosystems. It affects species distributions, with knock-on impacts on ecosystem functioning, and it is unknown whether or not planted trees will be able to form self-sustaining populations. This is especially true in human-modified landscapes and for trees with complex multi-species interactions.

We explore this for two Kenyan tree species: *Adansonia digitata* and *Melia volkensii*. These rely on pollination by bats and bees, with dispersal by baboons and ruminants, respectively. Each of these pollinators and dispersers has distinct patterns of landscape use and movement constraints. We show how process-based models can be used to a) simulate these species' distributions and interactions, b) predict how these may be perturbed by increasing tree cover, and c) estimate the consequences this may have for tree population viability.

Species interactions during community assembly: influence of recolonising nest predator, Pine marten (*Martes martes*) on cavity nesting tawny owl (*Strix aluco*) reproductive success in a commerical plantation

Anna Kellner, Dr Xavier Lambin

University of Aberdeen

Abstract

Refugia from predation can stabilize otherwise unstable predator-prey interactions by providing either spatial refuge (areas used only by prey but not predators), or temporal refuge (periods when predators switch to other prey). Despite the theoretical importance of refugia, empirical evidence remains limited. This study examines the impact of predation by arboreal pine martens on cavity-nesting tawny owls as martens recolonize their native range. We found that the likelihood of owl nest failure due to marten predation increased by 5% as marten occupancy probability in the study area rose from 0 to 60%. Additionally, the probability of nest failure was slightly reduced when field voles, a key prey species, were abundant. These findings suggest that tawny owls benefit from both spatial and temporal refugia during the early stages of pine marten recolonization, with vole abundance providing a partial mitigating effect on predation pressures.

Resin tapping influences the insect abundance and diversity in Atlantic pine forests

Dr Margarita Lema[1], Dr Hugo Mas[2], Mr Roberto Touza[1], Mr Marcos Braña[1], Mrs Claudia Galera[1], Mr Victor Amoedo[1], Mrs Marta Swiech[1], Dr Rafael Zas[1]

[1]Spanish National Research Council. [2]Vaersa - Generalitat Valenciana

Abstract

Resin tapping causes carbon restriction and elicits plant responses that may affect the emission of volatile organic compounds (VOCs), an airborne chemical message essential for tree-organism interactions, such as herbivore insects (e.g. bark beetles), that may be either more attracted or repulsed to tapped trees. Changes in VOCs emitted by pine trees could also impact the presence and abundance of organisms of higher trophic levels such as insect predators. The ecological impacts of resin tapping on the interactions of pine trees with insects remains unexplored. In two sites in NW Spain we settled opaque flight-interception (Network 1) and transparent flight-interception traps (Network 2), maintained for four months (from June to September) during two years. All captured individuals were identified to species level (when possible) and quantified. We found that tapping operations lead to differences in the attraction of some species of herbivore insects, leading to changes in their predators.

Theoretical or Computational Ecology

Improving resilience quantification inspired by plant interaction measurement

Zewei Zhuang[1], Prof. Rubén Díaz-Sierra[2], Prof. Yuxin Chen[1]

[1]Xiamen University. [2]National University of Distance Education

Abstract

Assessing resilience is critical under increasing anthropogenic and natural disturbance. But it is challenging to quantify resilience to both positive and negative disturbances and compare resilience across ecosystems and studies. We propose to address these challenges by learning from plant interaction measurement, as both need to compare positive and negative impacts and share many metrics. These similarities inspire us to advocate that at least four criteria (symmetry, monotony, boundedness and standardization) should be followed when developing and selecting resilience metrics. We find that a metric commonly used in plant interaction can be adapted to satisfy all four criteria and illustrate how application of this metric can improve resilience comparisons. Our work bridges the studies of resilience and biological interaction to improve the quantification of resilience.

Importance of observation error correction in stability analysis of grassland communities

MSc Verena Haring, MSc Lina Mühlbauer, Prof. PhD Adam Thomas Clark

University of Graz

Abstract

Ecological systems are shaped by stochastic fluctuations, which necessitates a nondeterministic approach for assessing their dynamics. Here, we apply a "particle filter" stochastic simulation algorithm to distinguish between "true" variability in the system caused by "process noise," vs. apparent variability caused by "observation error." We use the particle filter to analyze time-series of grassland plant community dynamics across biodiversity levels, observed at a daily frequency in a greenhouse experiment. Our results show that failing to account for observation error can lead to overestimates of overall variability, and incorrect characterization of biodiversity-stability relationships. Whereas observed biomass estimates predicted a linear decline in temporal variability with biodiversity, observation error-corrected estimates of temporal stability included a significant nonlinear component, with the lowest stability at the intermediate diversity levels. These results indicate a complex impact of diversity on system stability, and highlight the importance of considering and correcting for observation error in further studies.

Assessing impacts of bycatch policies and fishers' heterogeneous information on food webs and fishery sustainability

Professor Fernanda S Valdovinos, Appilineni Kushal, Professor Michael R Springborn

UC Davis

Abstract

Ecosystem-based fisheries management (EBFM) is increasingly acknowledged for its potential in understanding and managing interactions between fisheries and marine ecosystems. Challenges in executing EBFM stem from incomplete understanding of species interactions in marine food webs and the interplay with human activities. To address this gap, we develop a network framework that merges the complexity of food webs with the economic dynamics of different management strategies. We modeled the dynamics of hundreds food webs of 20-30 species, each exploited by five fishers who harvest the biomass of target and bycatch species. These models are subjected to two bycatch management scenarios which we compared to an open access scenario lacking any regulations. We evaluated the ecological and economic implications of the different management policies, including species extinctions and fishery profitability. Our framework paves the path for policymakers to understand the consequences of different management strategies while considering the ecological intricacies of fisheries.

Life in Savannas: Role of water and nutrients as determinants of plant community composition in an African savanna ecosystem

Mr. Manish Sarkar[1], Dr. David Ward[2], Dr. Karen C. Abbott[1]

[1]Case Western Reserve University. [2]Kent State University

Abstract

African savannas are characterized by transitions between woodland and grassland due to competition for water and nutrients as well as other environmental factors (e.g. herbivory, fire). The vast majority of savanna ecosystems are thought to be shaped by water stress, but nitrogen is also a common limiting factor in competition between savanna plants. Further, it has been argued that water availability controls nutrient uptake, such that water limitation and nutrient limitation are effectively the same process. We have developed a model of competition between woody plants and grasses for available soil water and nitrogen. We consider water limitation and nitrogen limitation both alone and in combination. By comparing the behaviors produced by these models, our work reveals how these processes act together to maintain the structure and stability of savanna ecosystems.

Adaptive sampling in ecology

Dr Peter Henrys, Dr Thomas Mondain-Monval, Dr Susan Jarvis

UK Centre for Ecology & Hydrology

Abstract

Most ecological monitoring uses a fixed design, which is outlined at the start of the study and then does not change. However, having a fixed survey design can be inefficient, particularly if we are interested in a rare species, or we have much more uncertainty about ecological conditions in parts of our study area. In these cases, we might collect more observations of the rare species or best reduce uncertainty if we can redistribute sampling effort after the study begins. Adaptive sampling allows us to use data that have already been collected to maximise the information content of new data collection. We describe a new conceptual framework for adaptive sampling in ecology and demonstrate how ecologists can use it to make decisions about their sampling. To illustrate the concept, we explore how adaptive sampling could be used to better estimate species distributions for a hypothetical species in Great Britain.

Modelling the eco-evolutionary assembly of complex microbial communities

Dr Miguel Lurgi, Dr Gui Araujo

Swansea University

Abstract

Identifying the mechanisms behind patterns of community organisation is fundamental to understand community assembly. However, a comprehensive picture of how ecology and evolution come together to generate community organisation is in its infancy.

We develop an eco-evolutionary model of interaction networks considering interaction-driven population dynamics and evolution through speciation and inheritance of interactions. We found a threshold in the strength of ecological interactions separating evolved communities into two distinct types. Weak interactions produce sparse community interaction networks dominated by competition. This type of community matches data for macroecological patterns of microbial communities. Strong interactions give rise to highly mutualistic communities. In this case, mutualism makes communities more stable, allowing them to accommodate a larger number of interactions and complexity.

Community types can potentially reflect ecological differences across scales, separating microbial from non-microbial communities, with the potential to unify results suggesting that large communities are dominated by either competition or mutualism.

Inductive link prediction boosts data availability and enables cross-community link prediction in ecological networks

Barry Biton, Rami Puzis, Shai Pilosof

Ben-Gurion University of the Negev

Abstract

Predicting species interactions within ecological networks is vital for understanding ecosystem functioning and response to changing environments. Current link prediction models often fail to address this issue as they are limited to single networks. Here, we use inductive link prediction (ILP), which leverages structural similarities across diverse ecological networks. Our model pools data across communities of different kinds and uses transfer learning to enable prediction within and between different ecological communities and for novel networks. We applied our model to 538 networks across four community types: plant-seed disperser, plant-pollinator, host-parasite, and plant-herbivore. ILP outperforms non-ILP models (e.g., 0.5 vs 0.39 recall). Host-parasite and plant-pollinator networks had the highest and lowest PR-AUC of 0.3 and 0.17, respectively. However, the efficacy of cross-community predictions varies, with plant-pollinator networks consistently under-performing as train and test sets. Our study underscores the potential of ILP to generalize link prediction across different ecological contexts.

Using NDVI to improve LiDAR-based Canopy Height Models

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Abstract

LiDAR-derived Canopy Height Models (CHM) suffer from low accuracy at low resolutions and on steep ground. This study explores the use of Normalised Difference Vegetation Index (NDVI) as a filter for CHM to remove false positives. The effects of varying NDVI threshold on accuracy and other metrics are investigated, and a tool to optimise threshold using training data and supervised learning is developed. For the study site, the CHM's binary classification accuracy increases by over 25% to 92.57% at a NDVI threshold of 0.18. The suitable threshold will depend on the site, the application of the CHM, and the preference for reducing Type I or Type II errors. The Receiver Operator Characteristics (ROC) Area Under Curve (AUC) for the NDVI-based model is 0.921. The results demonstrate the potential to use NDVI to improve vegetation classification accuracy, supporting better modelling of above-ground biomass, habitat structure, and monitoring of habitat restoration efforts.

How life stage matters for competitive dynamics - modelling the impact of stage-dependence on pairwise species competition in a herbaceous plant community

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Abstract

In most multicellular organisms, ontogenetic niche shifts modify the strength of biotic interactions, including competition as a function of the life cycle stage of the interacting individuals. However, it remains to be explored whether stage-dependence in the strength of intraspecific and interspecific competition can affect short-term community dynamics under disturbance regimes and alter the conditions for long-term coexistence. To determine the impact of stage-dependence on competitive dynamics, we developed a two-species projection model with stage-explicit competitive coefficients and parameterised the model using long-term demographic data from an alpine herbaceous plant community in Colorado, USA. Using empirically determined stage-dependent competitive coefficients and model simulations, we find that increased difference between the competitive effect of juveniles and adults could amplify short- and long-term demographic fluctuations. Our findings highlight that stage-dependence in competition could be common and important for accurately predicting community dynamics for conservation and ecosystem management.

When dates disagree: radiocarbon and sighting-based models reveal unexpected Great auk (*Pinguinus impennis*) persistence in the Northwest Atlantic

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Abstract

Methods to infer extinction employ distinct data types inherent to palaeontological or neontological settings, yielding a potentially disjointed view of the extinction process that may limit the application of conservation lessons from the fossil record. We leverage the historical extinction of the Great auk (*Pinguinus impennis*) to interrogate the outcomes of both data types (286 quality-scored occurrences) and models (Gaussian-Resampled Inverse-Weighted McInerny, Solow & Beet) on inferring extinction across centennial timescales. While the last confirmed individual was captured in 1844 CE in Iceland, range collapse dynamics have not been explored due to sampling, preservation, and cultural biases. Sighting-based estimates suggest the Northwest Atlantic population persisted a decade longer (1860 CE) than the Northeast Atlantic population, making it a previously unrecognized stronghold. Radiocarbon-based models estimate extinction later (post–2000 CE) across the species' range, indicating that greater uncertainties associated with radiocarbon dates and calibration may constrain their relevance on a conservation-relevant timescale.

Dispersal increases diversity in eco-evolutionary assembled mutualistic communities

Dr. Gui Araujo, Dr. Miguel Lurgi

Swansea University

Abstract

Unveiling the mechanisms behind the assembly and composition of ecological communities is essential to understand the drivers of biodiversity. Communities are assembled by the joint contribution of ecological and evolutionary processes. A ubiquitous process driving community assembly is the exchange of individual organisms between communities via dispersal. However, the role of dispersal in the evolutionary assembly of communities is not currently understood. We model the eco-evolutionary dynamics of assembly by speciation in metacommunities, with new species inheriting interspecific interactions that shape community dynamics. We found that dispersal increases diversity and complexity of evolved mutualistic communities, while the opposite happens for communities assembled through invasion. Interestingly, rich transient dynamics result in higher diversity for intermediate levels of dispersal in the short term. Our results advance our understanding of how spatial connectivity patterns between communities can affect different aspects of biodiversity such as species richness and the distribution of interaction types.

Unraveling invasion success: A causal-network approach to linking major hypotheses in the field

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Abstract

Invasion success is explained by various hypotheses, often focusing on biotic interactions and eco-evolutionary processes, with some overlapping in their proposed mechanisms. For example, hypotheses like biotic resistance share the idea that species with distinct niches from the recipient community may have higher invasion potential. However, existing studies lack information on causal relationships among these hypotheses. To address this, we propose using causal network graphs, where connections between variables represent hypothesized causal relationships. We demonstrate this approach by modeling six major invasion hypotheses, combining them into a single causal network, and exploring population processes leading to invasion success. This step-by-step approach allows for precise definitions of variables and relationships, facilitating the development of machine-readable networks linked to ontologies. Such causal networks could support synthesis efforts and enable AI tools to extract causal inferences, with potential applications across invasion science.

Simulating moth population responses to land use and weather to inform climate-resilient, moth-friendly landscape decision-making

Ms Claudia I Acerini, Dr. Emma Gardner

UK Centre for Ecology and Hydrology

Abstract

Macro-moth species in the UK have shown significant changes in their abundance and distributions. This has been linked to habitat loss, habitat fragmentation, and climate change. Moths are an essential food source for many bat and bird species and act as night-time pollinators. Decreases in moth abundance and distributions therefore pose significant threats to ecosystems. Process-based modelling can help us understand how landscapes might be modified to support moth populations in the context of a changing climate. Moth4pop is a process-based model that predicts how British moth species respond to changing landcover and climate. For a given landscape, it accounts for habitat specialist and generalist traits, movement behaviour and measured responses to seasonal weather variables to predict moth abundance at fine spatial scales and how this changes over time. We describe how this model was built and tested, and how it can be used to inform climate-resilient, moth-friendly land-use decision-making.

Skewness enables stabilising effect of hierarchy in complex competition networks

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Abstract

Ecological networks have been shown to contain stabilising patterns of interaction strengths. These patterns are usually studied by randomising observed links, but the influence of the underlying distributions of interaction strengths remains unclear. Here, we used the stabilising effect of hierarchy in competition networks to study the relationship between patterning, link strength distributions and stability. We found skewed distributions of interaction strengths within 30 empirical competition networks, with many weak and few strong links. This distribution of interaction strengths was necessary to reproduce the stabilising effect of hierarchy, as skewness enabled patterns that reduced the weight of both short and long feedback loops. Thus, the stabilising effect of hierarchy did not appear in systems with uniform or normal distributions of interaction strengths. This has important methodological implications, since theoretical studies often assume normal or uniform distributions to study ecological stability and might thus overlook stabilising patterns present in real systems.

Towards estimating vegeation structure from orbit: a case study for tropical forest

Leonard Schulz, Prof. Andreas Huth

Helmholtz-Centre for Environmental Research

Abstract

Reliably estimating existing forests is crucial for a planetary carbon balance investigation. A challenging factor of uncertainty is the high local variability in biomass. Remote Sensing based methods from orbital measurements are able to capture local features on a global scale. Out of the different large-coverage measurement satellite missions, the TanDEM-X Radar provides both a spatially high resolution and temporal consistency. The specific bistatic backscattering methodology allows for interferometric analysis and therefore detailed investigation of vertical forest structure. We present different interferometric concepts to invert vegetation height and discuss results along ground-based insights from forest models and airborne Lidar derived metrics.

Applying the Digital Twin Concept to Ecological Reality: Challenges and Lessons Learned

Simon Rolph, Chris Andrews, Dylan Carbone, Jan Dick

UK Centre for Ecology & Hydrology

Abstract

Digital twins, dynamic and interactive digital replicas of real-world systems, are often heralded as paradigm-shifting. In the face of biodiversity loss, digital twins could offer crucial tools for identifying impacts, mitigations, and solutions.

A prototype digital twin (pDT) within the Horizon Europe BioDT project explored the role of digital twins for the monitoring and management of cultural ecosystem services, focusing on the Cairngorms National Park. In evaluating the relevance of digital twins for biodiversity, we found that digital twins align with the user need of interactive tools for decision support. However, we identified development barriers, including the complexity of ecological systems and the challenges of adapting existing biodiversity models to high-performance computing environments.

While digital twins hold promise for biodiversity research, strategic deployment is crucial. We need clarity in the definition of digital twin being followed, backed by clear motivations for using digital twin approaches.

ESTIMATION OF VEGETATION-DERIVED ROUGHNESS USING SCE-UA METHOD AND SATELLITE IMAGE ANALYSIS

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Abstract

In recent years, numerical simulations have been extensively used for flood reproduction and future damage prediction. Efficient and accurate identification of vegetation parameters within numerical models is crucial for considering Nature-based solutions for flood mitigation. Specifically, it enables the proper assessment of the impacts of expanding or reducing vegetation areas within a watershed on flooding. This study aims to quantitatively evaluate the relationship between the roughness coefficient of river areas, derived through parameter optimization of a distributed rainfall-runoff inundation model, and NDVI values obtained from satellite image analysis. Rainfall-runoff analyses were performed for seven sub-watersheds in the Tohoku region of Japan, each experiencing distinct heavy rainfall events. Concurrent satellite images were used to estimate NDVI values for vegetation within the river channels. The results indicate a moderate correlation between the roughness coefficients and NDVI values, suggesting that river roughness can be estimated from NDVI data.

The effect of pseudo-absence technique and algorithm choice on the temporal and spatial transferability of species distribution models.

Mr Joshua C Wilson[1,2], Dr Philip N Trathan[1,2], Dr Hugh J Venables[2], Dr Ryan R Reisinger[1]

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Abstract

Species distribution models often use tracking data to predict and project habitat suitability to inform dynamic spatial management. This requires models that can transfer accurately through time and sometimes through space, often requiring extrapolation into new environmental conditions. However, many of the modelling choices that optimise transferability are unclear. Here we built species distribution models with marine mammal and seabird tracking data from the Southern Ocean and projected them in time and space. We tested nine different model configurations to assess how the choice of pseudo-absence technique and model algorithm influences temporal and spatial transferability. Models consistently achieved high temporal transferability scores when using background sampling or correlated random walks, and random forests using background sampling emerged as the best-performing models overall. Meanwhile, no model configuration consistently attained high spatial transferability scores. We recommend using random forests with background models when projecting through time, and caution against spatial transfers.

Integrating Demographic and Dispersal Processes to Predict Range Expansion: The Case of the tropical tent-web spider

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Abstract

The study of range expansions is crucial in ecology due to its impact on future biodiversity patterns. Species distribution models (SDMs) often fall short in accurately predicting range shifts due to their lack of consideration of important dynamic ecological processes. This study focuses on the orb-weaving spider *Cyrtophora citricola* (Forskål, 1775), a range-expanding species in the Iberian Peninsula, to investigate how integrating demographic and dispersal processes can enhance predictive accuracy of range expansion models. We use a process-based model to reconcile contrasting predictions of potential range expansion from regional and local SDM approaches. Our results demonstrate that integrating ecological processes explicitly provides a more robust framework for predicting the direction of *Cyrtophora citricola* range expansion. In the face of ongoing environmental changes in the Anthropocene, this integrated approach has broad implications beyond a single species, providing valuable insights for conservation planning and adaptive management in response to climate change.

Clements, Gleason and axiomatic ecology: there is only one type of ecosystem

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Abstract

Clements believed that ecosystems can be naturally classified into distinct types, while Gleason argued that there is no such natural classification. We find out who was right in the framework of topological methods. We define the set of ecosystems based on axioms about two-species ecosystems and rules for constructing new ecosystems from existing ones. We show that the set of ecosystems constructed in this way forms a single type with respect to properties such as total biomass or productivity, supporting Gleason rather than Clements. Nevertheless, there may be interpretable patterns in the dynamical structure of ecosystems based on natural measures of dissimilarity. We present two case studies of such structure: comparison of competing models for a subtidal marine community, and patterns in a large collection of ecosystem models.

Modelling the effects of dispersal and habitat quality on an aquatic-terrestrial meta-community

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Abstract

The effects of dispersal on community structures are generally not well understood and vary widely between different communities. We created an ordinary differential equation model, representing a watershed with aquatic-terrestrial communities (consisting of two predators and two prey) in an explicit two-dimensional landscape. These two-dimensional landscapes are used to compute different predator dispersal paths between habitats, depending on the landscape structure. We analyzed the effects of dispersal and habitat quality on community composition. We predict that habitat quality has a strong positive effect on the abundance of aquatic emerging prey and on the abundance of the predator with aquatic preference – conversely habitat quality is negatively related to the abundance of the terrestrial prey. Dispersal has a strong effect on both predators, sometimes positive sometimes negative. Our results suggest that the relative combined effects of habitat quality and dispersal can structure spatially explicit meta-communities.

Demographic stochasticity can de-stabilise non-hierarchical (intransitive) competitive communities

Prof David J. Murrell

University College London

Abstract

Non-hierarchical (intransitive) competition exemplified by the rock-scissors-paper game has attracted attention as a mechanism for coexistence, in microbial, plant and coral communities. Motivated by plant communities, I analyse a stochastic, individual-based model (IBM) that is based on Lotka-Volterra competition and has spatially localised competitive interactions and dispersal, and from which the expected population-level dynamics can be derived. Analysis of the IBM shows how sustained noisy population cycles driven by demographic stochasticity (quasi-cycles) are a common feature of intransitive competition, especially where it is most important for promoting coexistence. This feature is not in the deterministic model has not been reported in previous studies. The prevalence of quasi-cycles is insensitive to total population size, but the amplitude of oscillations is much larger for small populations. These results have important implications for the applicability of deterministic models to empirical data and highlight the importance of analysing stochastic models in ecology.

The implementation of network meta-analysis in ecological contexts; a case study using crop yield data

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Helmholtz Centre for Environmental Research GmbH - UFZ, Germany

Abstract

Deciding on the best intervention can be complex, especially with multiple options. However, by combining direct and indirect evidence, network meta-analysis (NMA) can allow for the comparison of these options in a single, coherent analysis. This method extends the traditional pairwise comparison and provides estimates of relative effects between all interventions. In this study, we explore how NMA can be applied in ecological studies – specifically, in comparing the effectiveness of various interventions used to improve (crop)yield.

We conducted a systematic review and extracted data from three meta-analytical studies that explored the response of yield to an intervention. Each study structured data as a pairwise comparison between an intervention and a control. Using yield as the measure of effectiveness, we evaluated four interventions – liming, straw return, super absorbent polymers, and a no-intervention control. All measurements came from field experiments, and we combined data from 3,700 papers for our analysis.

Neural ordinary differential equations for ecological and evolutionary dynamics

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Abstract

Inferring ecological interactions is hard because we often lack suitable parametric representations to portray them. Neural ordinary differential equations (NODEs) provide a way of estimating interactions non-parametrically from time-series data. NODEs, however, are slow to fit and difficult to analyse.

We provide a fast NODE fitting method, Bayesian neural gradient matching (BNGM), by interpolating time series with neural networks and fitting NODEs to the interpolated dynamics with Bayesian regularisation. Our method reduces fitting time to only a few seconds, provides accurate estimates of ecological interactions in an artificial system where ground truth is known, and reveals the strongest drivers of population dynamics in an experimental microcosm and in the Maizuru Bay system featuring 11 species.

Overall, NODEs alleviate the need for a mechanistic understanding of interactions, and BNGM alleviates the heavy computational cost. This is a crucial step availing quick NODE fitting to larger systems and objective estimation of interactions.

A moving average approximation for population models with dynamically varying stage duration, that reduces bias and computational time

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Abstract

Environmental stochasticity can affect all demographic rates of a population, including the duration of life history stages. Mathematical models were developed to approximate the abundance and stage duration time series from the “growth rate” time series of a “developmental index” (e.g., body mass) which determines stage duration via delay differential equations. This computation is slow and generates a consistent bias – underestimating mean stage duration time – which cascades down to the computation of the corresponding population abundance time-series. We propose an alternative approximation for the stage duration, based on the moving average of the developmental index’s growth rate, which does not incur such a bias and is computationally faster. Further, it permits approximation of relevant statistics of the stage duration, such as its variance and temporal autocorrelation, without relying on (biased) simulations. This is crucial to predict how populations/communities of organisms with complex life histories will fare in changing environments.

Metacommunity dynamics shape multi-scale biodiversity patterns in fragmented landscapes

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The German Centre for Integrative Biodiversity Research (iDiv) Halle-Leipzig-Jena, Leipzig, DE

Abstract

Habitat loss and fragmentation are interacting phenomena that can shape patterns of biodiversity. While some studies attempt to understand patterns at the landscape scale, others use the scale of individual fragments within a landscape. The scale-dependent nature of biodiversity coupled with the variable structure of ecological communities have made it difficult to make general statements regarding biodiversity dynamics in fragmented landscapes. Here we take an approach that focuses on the ecological processes of communities to understand how biodiversity patterns are shaped at landscape and fragment scales across a gradient of habitat loss. We use a theoretical metacommunity model to explore how the breadth of habitat preference, the structure of competition and dispersal dynamics jointly structure biodiversity patterns in fragmented landscapes. We highlight the importance of these processes and show the conditions under which contrasting and counterintuitive responses of biodiversity to habitat loss across spatial scales are expected.

A Virtual Ecosystem to understand the resilience of tropical rainforests

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Abstract

The complexity of an ecosystem unfolds from the dynamic interplay between organisms and their environments. Over recent decades, 'general ecosystem models' have been developed which aim to capture this complexity to understand ecosystem behaviour and predict emergent phenomena. However, these models will often ignore entire biotic domains and generally do not treat microclimate as an interactive, fully integrated part of the simulated ecosystem. Thus, important feedbacks are missing which could be crucial to understand ecosystem response to future global change. With the Virtual Ecosystem, we aim to address this limitation by doing two things: representing microclimate and hydrological processes in their full complexity rather than treating them as boundary conditions, and explicitly modelling all three relevant terrestrial biotic domains (plants, animals and soil microbes) using metabolic principles. The first version of the Virtual Ecosystem is based around the Stability of Altered Forest Ecosystems (SAFE) in the rainforest of Sabah, Malaysia.

Building infectious disease databases with large language models

Dr Maxwell Farrell

University of Glasgow

Abstract

Large relational databases of which pathogens infect which hosts underlie models that predict future emerging infectious disease threats, and guide surveillance of cross-species pathogens. These databases are often built through manual curation of scientific literature, but as the number of scientific papers continues to grow exponentially, researchers need new approaches for extracting and harmonising data contained in scientific texts. Harnessing large language models (LLMs) to identify host-pathogen interactions and the contexts of infection mentioned in scientific texts can radically scale the efficiency of creating foundational databases in disease ecology. Here we explore LLM prompting to directly create and merge knowledge graphs from scientific abstracts. We find that LLMs can readily identify host-pathogen interactions as well as provide rich meta-data on individual interactions and study design, and discuss potential approaches for prompt-design, validation, and harmonisation of LLM-generated knowledge bases.

Aligning sensor data, artificial intelligence and statistical methods in ecology

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Abstract

Artificial Intelligence (AI) has transformed identification of species and individuals in ecological data, but a general AI-assisted pipeline from data collection to inference is yet to emerge. Key challenges include decisions around classifier choice, confidence score interpretation, and statistical methods for drawing ecological conclusions. Drawing on experiences with passive acoustic monitoring and camera trapping, we propose a conceptual framework to guide the use of AI in ecological monitoring using remote sensors. Through a case study, we consider the implications and opportunities for deciding on methods that are used at each step of the pipeline. We highlight the management of errors from both sensors and classifiers, and offer practical advice for integrating AI into ecological workflows.

Follow the light: what forests' solar reflectance spectra tell us about their structure and productivity

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Abstract

The light that a forest reflects contains a vast array of information about its structure, productivity, and health. For example, leaves' property of absorbing red light while reflecting infrared light inspired the development of the NDVI as a proxy for the leaf area index (LAI). Now, new hyperspectral satellite instruments yield large-scale reflectance measurements for not only a few but hundreds of different wavelengths (VIS and NIR). However, identifying the connection between forest attributes and the reflectance for the individual wavelengths is challenging, partially due to a lack of large-scale ground data.

Here, we combine field data, forest models (FORMIND) and radiative transfer modelling, to systematically analyze how biomass, LAI, and primary production reveal themselves in forests' reflectance profiles. As our novel approach considers 200 000 forests in different states, it provides generalized insights and thus new avenues to analyze the ecology of forests based on hyperspectral satellite data.

Tropical forest and disturbances: linking forest modelling and remote sensing

Prof.Dr. Andreas Huth, Piet Schimke, Rico Fischer, Ulrike Hiltner

Helmholtz Centre for Environmental Research - Ufz

Abstract

Disturbances, such as extreme weather events, fires, and biotic agents, can have strong impacts on tropical forests. In the future, the intensity of disturbances will likely further increase.

This study aims to analyse the consequences of increased mortality on tropical forests dynamics using forest modelling and remote sensing. We applied an individual-based forest model to tropical forests in French Guiana. The mortality level had a strong influence on forest attributes. We obtained a simple multidimensional relationship that allowed for the estimation of biomass loss rates from forest height and LAI. We applied this relationship to remote sensing data to map biomass loss rates for whole French Guiana. Results have been compared with field data.

We estimated a countrywide mean biomass loss rate of 3.0% per yr. The approach described here provides a novel methodology for quantifying biomass loss rates in forests from remote sensing.

ECOBRIDGE: a knowledge-based expert system to produce high-resolution land cover/land use maps from coarser sources

Josep Serra Gallego[1], Hollie Blaydes[2], Emma Gardner[1], Richard F Pywell[1], John Redhead[1]

[1]UKCEH. [2]Lancaster University

Abstract

Future land use scenarios are often generated at coarse spatial resolutions, but modelling their ecological impacts often requires finer-resolution information on landscape composition and structure. We introduce ECOBRIDGE (Ecology and Biodiversity Integrated Downscale Generation): a knowledge-based expert system to produce high-resolution land cover/land use maps from coarser sources. ECOBRIDGE is an open, ArcGIS Pro workflow that draws on expert knowledge defining land use/land cover change to parse a low-resolution baseline and scenario, alongside a higher-resolution baseline. ECOBRIDGE outputs high-resolution spatial data for the scenario, as both a raw pixel map and an intelligent mapping layout which considers features of the landscape. ECOBRIDGE also facilitates knowledge transfer from a human-dependent expert system to an Artificial Intelligence framework by packaging the information driving the downscaling process into a deep learning model. ECOBRIDGE offers an efficient, reproducible route to bridging the gap between available low-resolution datasets, and more accurate high-resolution information.

Assessing the recovery of communities in landscape-scale restoration

Klementyna Gawecka, James Bullock

UK Centre for Ecology & Hydrology

Abstract

Ecosystem restoration is becoming a widely recognised solution to the biodiversity crisis. However, to ensure their sustainability, restoration actions must be designed to achieve effective recovery. This requires predicting the response of highly complex ecological systems with many interdependent species and their relationship with the landscape. As the result of these challenges, our understanding of how ecosystems recover is still limited. In this study, we explore the dynamics of recovery of ecological communities following landscape-scale restoration. By employing spatially explicit metacommunity models, we assess the rates and trajectories of community recovery under various scenarios. We show that community recovery is affected by the spatial distribution of restored habitat in the landscape. However, this effect is mediated by interactions between species – whether they are of mutualistic or antagonistic nature. Our results highlight the importance of considering interactions between species, as well as the landscape-scale habitat arrangement in restoration projects.

Balancing Act: How Local Structure and Spatial Diversity Shape Mutualistic Network Stability?

Dr Subhendu Bhandary, Professor Jordi Bascompte

University of Zurich

Abstract

Complex metamutualistic networks often experience sudden shifts between states of persistence and collapse. These are expected to be influenced by both local and spatial structures. However, their relative contributions remain unclear. This study investigates how local and spatial network structures jointly shape the dynamics of collapse. We examine how dispersal rates affect co-extinctions in isolated patches and find that local structural properties, such as nestedness and modularity, are crucial for species persistence. Yet, spatial structures, particularly when combined with dispersal dynamics, significantly influence collapse timing. Our results show that spatial heterogeneity, coupled with robust local interactions, enhances network resilience, while homogeneous spatial structures are more prone to collapse. These insights underscore the importance of integrating both local and spatial dynamics to fully understand tipping points in ecological networks.

Building Process-Based Virtual Data Scientists for Real-Time Ecological Data Analytics: Enhancing Access to Complex Datasets

Artur M Trebski, Dr Elise Gallois, Dr David W Redding

Natural History Museum, London, UK

Abstract

Large ecological datasets are often generated or used for specific studies and later released as raw data. However, non-expert users, such as policymakers, may struggle to utilise these datasets effectively to aid management and conservation decisions. This project presents a chatbot, designed to overcome these challenges by simplifying data querying, visualisation, and analysis for non-technical users. Developed using Large Language Models (LLMs), LangChain, and LangGraph, the tool enables real-time interaction with ecological data through a structured, knowledge-led framework, ensuring precise, actionable outputs that meet user needs. By integrating agents for tasks such as database querying, document retrieval, statistical analysis and data visualisation, this tool allows conversation-based interactions with epidemiological datasets, effectively creating a "Virtual Data Scientist". By improving access to complex data, this project supports informed decision-making in all disciplines where large, incomplete datasets are prevalent, promoting more impactful and equitable use of data in the future.