# School of Animal, Rural and Environmental Sciences:

# Research Conference Programme

# 13th September 2024

# Brackenhurst Campus, Nottingham Trent University

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Posters are located in Bramley TG9. Tea and coffee served in the day in the Bramley TG8. Students to stand by their posters during the two refreshment breaks in the morning and late afternoon.

***9:00 Registration (Bramley TG9) Refreshments served (Bramley TG8)***

***9:25 Welcome Prof Dawn Scott (Bramley TG10)***

**Session 1 Chair: Prof Andrew Gill**

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|---|---|---|---|
| 09:30 | Sarah Curtis | Brown Hyaena (*Hyaena brunnea*) Population Density in the Hyper-Arid Namib Desert | 10 mins |
| 09:40 | Emily Harper | Developing a body condition assessment tool for hedgehogs | 10 mins |
| 09:50 | Rob Collier | Bourne to be wild: Enhancing the aquatic–terrestrial biodiversity of temporary chalk streams | 10 mins |
| 10:00 | Evangelos Achilleos | Evaluating the conservation strategies currently employed for the Hyacinth Macaw (*Anodorhynchus hyacinthinus*) | 10 mins |
| 10:10 | Emily Burton | REACT FIRST —Turning CO2 Into Animal Feed For Net Zero UK Food Production | 15+5 mins |
| 10:30 | Helen Hicks | Superweeds: A problem of short-term thinking and rapid evolution | 15+5 mins |

***10.50 Refreshment Break with Posters. (Bramley TG9) 30 mins***

**Session 2 Chair: Dr Richard Yarnell**

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| 11:20 | Chungui Lu | Innovations in Smart Agriculture: Enhancing Crop Yields and Functions for Food Security and Health | 15+5 mins |
| 11:40 | Katie Davies | The post release behaviour of rehabilitated European hedgehogs *Erinaceus europaeus* | 10 mins |
| 11:50 | Katie Wilshaw | Analysis of metabolic changes during broiler development using 1H-NMR | 10 mins |
| 12:00 | Hannah Jenkins | Zoo Species Planning - How Can We Maximise Our Conservation Contributions Through Strategic Planning | 10 mins |
| 12:10 | Angelo Pernetta | Horns, claws and scales; understanding and mitigating anthropogenic impacts on biodiversity | 20+5 mins |

***12:35 Lunch (Bramley TG8) 1 hour 15mins, lunch ends 13:50***

**Session 3 Chair: Dr Samantha Ward**

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| 14:00 | Nicholas Midgley | Marine litter on the Isle of Skye: A local, national or international problem? | 15+5 mins |
| 14:20 | Holly Bassett | Monitoring and discriminating solitary bee nesting behaviour using continuous vibrational measurements | 10 mins |
| 14:30 | Antonio Uzal | Restoring habitats in Kenya's Greater Maasai Mara – an NTU-Earthwatch project | 15+5 mins |
| 14:50 | Emma Cartledge | Early insights into the National Hedgehog Monitoring Programme | 15+5 mins |
| 15:10 | Billy Howard | Reintroducing beaver (Castor fiber) as a tool for restoring and managing lentic wetlands. | 10 mins |

***15:20 Refreshment Break with Posters (Bramley TG9) 30 mins***

**Session 4 Chair: Dr Helen Hicks**

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| 15:50 | Aurelie Jolivald | Feeling the HEAT: can zoo-housed captive meerkats (*Suricata suricatta*) recognise human emotions? | 15+5 mins |
| 16:10 | Felipe Melo | BioRestNet: a network of biocultural restoration | 15+5 mins |
| 16:30 | Lucy Clarke | How can nature act as the first line of flood defence? | 15+5 mins |
| 16:50 | Andrew Gill | Agricultural biochemistry and sensing – future opportunities in research and commercial science | 20+5 mins |

***17:10 Close and Prize Giving (until 17:30) Dr Richard Yarnell and Dr Helen Hicks***

***17:30 Refreshments (finishes at 19:00)***

## Talk Abstracts

### Brown Hyaena (*Hyaena brunnea*) Population Density in the Hyper-Arid Namib Desert

Sarah Curtis[1], Emsie Verwey[2], Dawn Scott[1] & Richard Yarnell[1]
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The ability to monitor large carnivore densities is crucial for accurate population monitoring and consequently implementation of conservation management strategies. Although carnivore population declines are well-reported across Southern Africa, density estimates for many large carnivores are lacking outside of research hotspots. These estimates are important for species such as the brown hyaena (*Hyaena brunnea*), which as the least-studied member of the Hyaenidae typically exist outside of these hotspots alongside being an indicator of ecosystem health. This study aims to provide the first brown hyaena density estimates within a hyper-arid region of north-west Namibia, providing vital information on this species in an understudied locality and biome. As an arid-adapted species fulfilling both apex and mesopredator roles within the ecosystem, it is important to estimate a baseline density to allow for future population monitoring. Spanning a duration of ten months from November 2022 to August 2023, this study utilised camera trapping to allow for spatial-capture-recapture analysis of the brown hyaena population to estimate their density. This talk will discuss early results for this research and discuss the potential implications for both brown hyaena conservation and arid-adapted carnivore research.

### Developing a body condition assessment tool for hedgehogs

Emily Harper[1], Dawn Scott[1], Iain Barber[2] & Richard Yarnell[1]
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Body condition measures have been used as a proxy for fitness and as a guide to an animal's health. This is important in wildlife rehabilitation where resources can be directed towards animals with the best chance of survival. European hedgehogs *(Erinaceus europaeus)* are the most rescued wild mammal in the UK. However, no body condition assessment has been produced for hedgehogs.

This project aimed to develop a body condition assessment for hedgehogs that could be used by rehabilitation practitioners to evaluate a hedgehog's condition. A comparison with wild hedgehogs was carried out to establish seasonal variations in body condition.

99 wild hedgehogs were captured, weighed, their ratio measured (their circumference length and breadth-wise), sexed and photographed. 125 hedgehogs admitted to rehabilitation were similarly assessed and the outcome of their time in rehabilitation was recorded. From the ratio, a five-point scale with photographs was produced and hedgehogs were assessed on the scale. Data were analysed to determine which factors related to outcomes from rehabilitation.

The findings of this study will help to enable wildlife rehabilitators to make informed treatment decisions for hedgehogs. The study also provides a simple field assessment tool to analyse body condition for hedgehogs in the wild.

**Bourne to be wild: Enhancing the aquatic–terrestrial biodiversity of temporary chalk streams**

Rob Collier[1], Rachel Stubbington[1] and Tim Sykes[2]
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Temporary chalk streams, also known as winterbourne streams, naturally transition between wet and dry conditions, creating high habitat diversity and thus supporting high biodiversity. The majority of winterbourne streams have been affected by anthropogenic impacts including abstraction, pollution and physical habitat modification, threatening their natural form, function and their biodiverse communities. As a result, tailored restoration actions are needed to improve the ecological health of winterbournes. A core aim of our research is to assess the biological and physical diversity of chalk streams. We will determine how environmental characteristics influence their individual and collective biodiversity, and we will identify the physical habitat features that support high biodiversity and particular species of interest, including Nationally Rare winterbourne specialist insects. A second aim is to evaluate how specific restoration measures alter physical habitat diversity and biodiversity of winterbourne streams, using a before-after-control-impact (BACI) approach. Specifically, we will compare the effects of restoration on the aquatic and terrestrial communities that inhabit winterbournes during their wet and dry phases, respectively. To address these aims, 'MoRPh' (Modular River Physical) surveys will be used to assess physical habitats, and aquatic and terrestrial communities including invertebrates will be sampled during wet and dry phases, respectively.

**Evaluating the conservation strategies currently employed for the hyacinth macaw (*Anodorhynchus hyacinthinus*).**

Evangelos Achilleos[1], Samantha Bremner-Harrison[2], Charlotte James[1] , Katherine Whitehouse-tedd[1], Helen Taylor[3] , Stephen WR Harrison[4], and Simon Tollington[1]
[1]*School of Animal, Rural & Environmental Sciences, Nottingham Trent University, UK*
[2] *Vincent Wildlife Trust, Bronsil Courtyard, Ledbury, UK*
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The hyacinth macaw, threatened by poachers, wild fires, agriculture and habitat fragmentation is managed in a disintegrated fashion due to minimal collaboration between *ex situ* and *in situ* organisations. The One Plan Approach (OPA) aims to develop relationships and establish partnerships; bridging the gap between captive and wild populations to achieve holistic conservation. This study aims to integrate relevant stakeholders in furthering the conservation management of the species by developing the foundation for a One Plan Approach; through workshops, evaluating conservation efforts in South America; comparing genetics between captive and wild macaws; but also assessing the reproductive output of the captive population. This talk will present qualitative results from an online workshop conducted with 11 participants, from *ex situ* and *in situ* organisations; in identifying the historic collaborations between establishments conserving the macaw; while prioritising which factors are driving future partnerships.

## REACT FIRST —Turning $CO_2$ Into Animal Feed For Net Zero UK Food Production

Emily Burton[1], Dawn Scholey[1] & Ashraf Alkhtib [1]
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REACT-FIRST is the UK's first-ever scalable route to the sustainable generation of protein capturing the carbon dioxide from bio-energy generation. This project was funded by Innovate UK as the flagship project of their Farm Innovation Pathway programme aiming to increase UK agricultural productivity and global competitiveness. REACT-FIRST is led by carbon recycling biotechnology company Deep Branch, which has pioneered a process that uses microbes to convert carbon dioxide from industrial emissions and turns them into high-value proteins. The project partners create a unique consortium that is end-to-end value-chain-wide, with experts on responsible innovation to assist in avoidance of unintended consequences. The aim of the project is to use microbes to convert CO2 directly from industrial emissions into a totally novel, new type of single-cell protein. The role of the NTU poultry research team is to optimise the new feed material so the UK is less dependent on complicated and fragile supply chains that often involve high environmental impact. In this talk we will share our findings to date on both the scale up of production, the material produced and our responsible innovation journey.

## Superweeds: A problem of short-term thinking and rapid evolution

Hicks HL[1], Comont D[2], Varah A[3], Goodsell R[4], Hardy K[1], Childs DZ[4], Neve, P[5], McLean S[1], Norris K[3], Freckleton, RP[4]
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Globally, weed infestation accounts for a third of crop losses worldwide. Here I present an overview of a four-year collaborative research programme investigating the scale, drivers and implications of herbicide resistance in a UK arable weed (black-grass *Alopecurus myosuroides*), estimated to cause a loss of almost one million tonnes of wheat yield per year in the UK. Contrary to previous literature, industry recommendations and common agricultural sector practice, simply increasing herbicide diversity does not reduce the likelihood of herbicide resistance evolving. And contrary to farmer behaviour, it is more rational economically to prevent resistance arising than it is to deal with it afterwards.

I will also present a proof-of-concept eDNA project seeking to accurately detect weed seed densities in the soil to allow farmers to target herbicide usage to specific areas, rather than spraying entire fields. I will present an ongoing project providing insights on decision making behaviours and risk perception in farmers and an exciting new project looking at the potential of weedkillers to be the driver of the next global pandemic!

## Innovations in Smart Agriculture: Enhancing Crop Yields and Functions for Food Security and Health

Chungui Lu, Gadelhag Mohmed, Gultekin Hasanaliyeve, Weituo Sun, Soojin Oh, Helen Baxter
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**ABSTRACT:** This presentation highlights the recent funding successes and research findings of Prof. Chungui Lu's team, focusing on vertical farming and sustainable agriculture. Through projects like the Flowerbx KTP initiative, EU Horizon and commercial partnership with Amway, the team use intensive vertical farming techniques for high-value crop production and resource use efficiency. These innovations enhance crop yields, quality and plant function, while expanding the range of cultivable crops beyond conventional farming capabilities.

Prof. Lu will discuss advanced technologies such as LED lighting, nanoparticles, and biostimulants, which regulate plant growth and improve food quality. These technologies, coupled with SMART systems—including AI, IoT, and 3D-Multispectral Crop Phenotyping—optimize nutrient-use efficiency and boost food productivity. The team's innovative use of agricultural big data from controlled environments allows for predictive modelling of plant growth through machine learning and deep learning techniques, creating optimized light and nutrient solution "recipes."

By integrating these cutting-edge technologies, Prof. Lu's group research aims to deliver more nutritious food, address global food security challenges, and provide local employment opportunities. This presentation will offer insights into how vertical farming and sustainable agriculture can contribute to a more resilient and productive agricultural sector during global disruptions.

## The post release behaviour of rehabilitated European hedgehogs *Erinaceus europaeus*

Kate Davies[1], Dr Antonio Uzal[2], Dr Dmitry Kishkinev[3], Dr Sophie Rasmussen[4] & Prof. Dawn Scott[2]

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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.

## Analysis of metabolic changes during broiler development using $^{1}$H-NMR

Katie Wilshaw[1], Elena Hunter[1], Jaqueline Boyd[1], Huw Williams[2], Emily Burton[1]
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As a basis for future research investigating the impact of diet on chicken metabolism, proton nuclear magnetic resonance ($^{1}$H-NMR) was utilised to evaluate broiler chickens' changing systemic metabolic profile during the first five weeks post-hatch.

Ninety-six male broiler (Ross 308) chicks were raised on a standard commercial wheat/soya broiler diet fed *ad-lib*. Sixteen birds were blood sampled post-mortem on days 0, 7, 14, 21, 28 and 35, and metabolic profiles were established using $^{1}$H NMR-based untargeted metabolomics.

Thirty-five metabolites were identified from the 1D $^{1}$H-NMR spectra and confirmed with the 2D $^{1}$H-$^{13}$C experiments. The concentration of 31 metabolites was calculated, and 29 metabolites were identified that showed significant changes in concentration across the time points. Using pathway analysis, we demonstrated changes in energy synthesis and nutrient utilisation during growth. An example is the increase in citrate, fumarate and succinate between d0 and d7 birds. The increase in concentration suggests a shift to increased aerobic metabolism and coincides with decreases in creatine, an energy storage molecule used by chicks during hatch.

This study provides an overview of chicken serum metabolic profiles during development, allowing us to understand metabolic changes occurring during development and select an appropriate sampling time point for future dietary studies.

## Zoo Species Planning - How Can We Maximise Our Conservation Contributions Through Strategic Planning

Hannah Jenkins[1], Rachel Welton[2], Charlotte James[1] & Samantha Ward [1]
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Zoological institutions provide much needed support to threatened species across the globe through *in situ* and *ex situ* conservation activities. These conservation activities are often expensive, and zoos must balance commercial success with conservation output to ensure that their institutions are profitable and able to contribute to their conservation goals. For this reason, strategic species planning is vital to the success of a zoo or aquarium and its successful contribution to conservation.

A retrospective analysis was undertaken on zoological collections to understand whether zoological institutions respond to changes in conservation criteria, such as IUCN Red List status, CITES Appendix, and breeding programmes, thereby using conservation criteria in their species planning. The analysis showed that zoological collections were not responding to changes in IUCN Red List status and CITES Appendix, and therefore IUCN and CITES not strong influencing criteria in species planning decisions. Zoological collections did respond to changes in breeding programme status, which stresses the importance of evaluating which breeding programmes are created and managed by the community to maximise conservation success. The results from this analysis provide background for the development of a strategic planning framework to support the community with species planning decisions.

## Horns, claws and scales; understanding and mitigating anthropogenic impacts on biodiversity

Angelo Pernetta
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As a conservation ecologist, my research to date has focussed on understanding and mitigating the impacts of anthropogenic activities on species of conservation concern. As a new member of staff to the School of Animal, Rural and Environmental, I wanted to take this opportunity to provide an overview of some of my recent and current collaborative research projects highlighting how these span a range of disciplines including ethology, ecology, ecotoxicology and conservation biology to address management issues relating to the conservation of White Rhinoceros in South Africa, the morphological and behavioural impacts of chemical and microplastic pollution in British aquatic environments and the consequences of habitat degradation and invasive herpetofauna for the Barbados leaf-toed gecko.

## Marine litter on the Isle of Skye: A local, national or international problem?

Nicholas G. Midgley[1], Thomas Stanton[2], Emily Johns[3], Melissa Schiele[2 & 4], Isobel Evans[5], Deirdre McKay[6], Antonia Law[5 & 6], Catherine Sanders[7], Savannah Worne[2] & Guaduneth Chico-Leon[8]

*[1]School of Animal, Rural & Environmental Sciences, Nottingham Trent University, UK; [2]Loughborough University; [3]Skye Beach Cleans; [4]Cheltenham Muscat School, Oman; [5]University of Nottingham; [6]Keele University; [7]University of Lincoln; [8]WaterLANDS Horizon 2020, Ireland*.

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Marine litter is any material that has been either manufactured or processed and subsequently discarded in a marine or coastal setting. Interest in marine litter is increasing because of a range of long-lived plastics with the potential to cause damage e.g. endanger wildlife, cause environmental or economic harm, and impact upon the quality of life for coastal communities. Beaches on the Isle of Skye, in the Inner Hebrides archipelago off the west coast of Scotland, were surveyed in 2023 and 2024. Some surprising results were found from these marine litter surveys that relate to both the quantity and type of marine litter that is washing up on Isle of Skye beaches. Unexpected evidence regarding the range of sources of the marine litter is also identified that is helping to aid our understanding of the marine litter provenance.

## Monitoring and discriminating solitary bee nesting behaviour using continuous vibrational measurements

Holly Bassett[1], Rachel Stubbington[1] & Martin Bencsik[1]
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Despite their crucial ecological role, solitary bees are significantly understudied compared to social bees, and traditional monitoring methods are often invasive and destructive. Emerging technologies such as accelerometer sensors offer promising alternatives for efficient, cost-effective, and ethical research. This research aims to demonstrate distinct vibrational signals from solitary bees, which can be used to monitor nesting activity by discrimination of accelerometer signals. Accelerometers are used in cavity nests to capture vibrational signals associated with the nesting behaviour of solitary bees, presenting a novel, non-invasive monitoring technique. This presentation showcases early results, highlighting the potential of accelerometers to provide detailed insights into solitary bee activities, thereby advancing research and conservation efforts. The research focuses on the application of accelerometer sensors to monitor vibrational patterns in modified 'bee hotels,' allowing for the discrimination of different nesting behaviours. This innovative method not only enhances our understanding of solitary bee ecology but also contributes to the broader conversation on ethical and reliable insect monitoring techniques. The findings have significant implications for environmental research, conservation, and agriculture, emphasizing the importance of solitary bees in maintaining ecosystem health. This work represents a substantial step forward in developing sustainable approaches to study and protect these vital pollinators.

## Restoring habitats in Kenya's Greater Maasai Mara – an NTU-Earthwatch project

Antonio Uzal & Felipe Melo
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Kenya's Greater Maasai Mara Ecosystem has undergone severe ecological degradation during the past four decades, resulting in drastic declines in large mammal populations and the loss of seasonal wildlife migrations. The most severe and rapid type of land degradation in the Mara has been the conversion of rangeland to cropland, followed by the extensive grazing by livestock, which has rapidly increased over recent decades. Starting in 2025, Earthwatch participants will be deployed to help in the long-term monitoring efforts to assess the success of savannah restoration strategies within 121 ha of degraded land where NTU is setting up a range of manipulative experiments. Participants will also help establish a surveillance network across 10,000 ha of savannah, allowing us to monitor ecosystem degradation over time. Collaborating with Earthwatch will be a cost-effective way to conduct extensive field research by leveraging the passion and dedication of participants motivated by genuine environmental interests. This presentation will delve into the project and provide insights for partnering with Earthwatch on similar initiatives.

## Early insights into the National Hedgehog Monitoring Programme

Emma Cartledge[1] & Richard Yarnell[1]
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Estimates of population size are essential for managing and conserving wildlife. Hedgehogs are a species of conservation concern, currently listed as Vulnerable to extinction, but true assessment of their conservation status is limited by a lack of data on population numbers and trends. Robust population estimates, repeated across time and space are needed to detect trends and identify populations at risk. In 2023, we began the first of our surveys for the National Hedgehog Monitoring Programme. The project is a 3-year pilot that uses a network of camera traps to provide, for the first time, robust annual hedgehog population estimates across a range of habitats and regions of Great Britain. The project also tests the feasibility of applying a citizen science framework to a large-scale standardised camera trapping scheme. This talk will provide an overview of the first two years of surveys, the challenges involved and project plans.

## Reintroducing beaver (*Castor fiber*) as a tool for restoring and managing lentic wetlands.

William Howard[1,2], Dr Ben Clutterbuck[1], Dr Samantha Bremner-Harrison[3] & Prof. Dawn Scott[1].
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Monitoring species reintroduction projects can provide valuable insights into the ecological impacts of species recovery. The European beaver (*Castor fiber*) is an ecosystem engineer that has been reintroduced into the areas of the U.K. in nature-based restoration efforts. The reintroduction of European beavers (*C. fiber*) into a local Nottinghamshire Wildlife Trust wetland provided a unique opportunity to investigate their role in restoring and managing lentic ecosystems. The aim of the project was to quantify the ecological impact of beaver activity by assessing habitat changes within an experimental beaver release site compared to an adjacent control site. Beaver habitat utilisation, including the extent of tree disturbance, were assessed through comprehensive beaver sign surveys which were conducted over a two year period after their establishment. Aerial photography and LiDAR surveys were conducted to assess habitat changes, and also, to determine the effectiveness of these alternative methods at detecting beaver impacts.

Overall, the study will help evaluate different methods of monitoring beaver activity and habits changes post release, as well as determining the immediate ecological and habitat changes following species reintroductions into complex lentic habitats.

## Feeling the HEAT: can zoo-housed captive meerkats (Suricata suricatta) recognise human emotions?

Aurelie Jolivald [1] , Annika Paukner [2] & Samantha Ward [1]
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[2] *School of Psychology, Nottingham Trent University, UK*
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Most domesticated mammalian species (horses, cats, dogs, cattle) are capable of human emotion recognition (HER), i.e. can recognise human emotions using facial and vocal cues. In those species, HER gives rise to emotional transfer, the phenomenon by which an animal matches the emotional state of the human it observes; this has important welfare implications in the context of human-animal interactions. However, the capacity for HER has not yet been investigated in non-domesticated mammal species, which may experience human-animal interactions in zoos or in the wild. In this novel study, groups of captive zoo-housed meerkats were trained to enter a test arena and their behavioural responses to audio and video clips of human emotional signals were recorded. Pilot results show that groups of meerkats can be trained to voluntarily take part in this procedure without handling, restraint, or social isolation, and that behavioural responses (e.g. time spent in the test apparatus) differ between types of human emotional stimuli. Further work is planned to explore the capacity for emotional transfer in this species.

## BioRestNet: a network of biocultural restoration

Felipe Melo[1], Antonio Uzal[1], Raihana Ferdous[1], Marcello Di Bonito[1]
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Degraded areas are widespread across the world as the result of non-sustainable management practices. In Kenya, savannas have experienced overgrazing and many threatened and endemic species of plants and animals have vanished or are present in reduced population numbers, affecting both ecosystem functioning and cultural reproduction of local communities. Biocultural restoration approaches seek to recover ecosystem functionality, whilst helping communities to attend to their daily basic needs under culturally relevant customary rules and territorial sovereignty. Biocultural restoration programs can help IPLC to conserve and restore biodiversity. Biocultural restoration differs from business-as-usual programs due to its communitarian nature, generating jobs and co-creating expertise by, for and with local people to act on restoration and conservation programs. This project aims to merge both local ecological knowledge and evidence-based science to co-create protocols of biocultural restoration. Our goal is to promote restoration of the savanna ecosystem in the Kenyan Massai Mara focusing on the biological and cultural recovery of grasslands and woodlands, home of many threatened and endemic species of plants and animals. Our goal is to co-create a long-term restoration program linked to a cutting-edge research agenda with long-lasting benefits for both people and nature.

## How can nature act as the first line of flood defence?

Lucy Clarke[1]
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*lucy.clarke@ntu.ac.uk*

Flooding is one of the main natural hazards in the UK, with 5.2 million properties currently at risk of flooding and this is predicted to increase in the coming decades. Since the implementation of the European Union Water Framework Directive in 2000 there has been a change in the way that rivers are managed to mitigate flood risk, and an increasingly participatory approach to the governance of water bodies. Natural flood management (NFM) schemes utilise a suite of techniques over a landscape scale to attenuate or 'slow the flow' of water, and in addition to reducing flood risk these have the potential to deliver multiple benefits to wider beneficiaries for water quality, biodiversity, green spaces and farming. This presentation will provide an overview of a variety of research case studies undertaken to assess the effectiveness of NTM interventions, their influence on biodiversity and how implementation of these schemes can be used to engage communities with the natural environment and build resilience in flood prone communities.

## Agricultural biochemistry and sensing – future opportunities in research and commercial science

Andrew C. Gill[1]
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Some of the world's most pressing problems include climate change, feeding an ever-expanding population, keeping people healthy into old age and protecting the environment. These problems converge on agriculture: we need to ensure we are producing sufficient quantities of nutritious, high-quality food that facilitates healthy ageing, and we need to do so using systems that are resilient to increasingly-hostile weather patterns and which do not exacerbate damage to the environment. And the whole thing needs to be economically-viable. Easy eh?

I have spent much of my career addressing problems in animal, plant and human health, by adopting truly cross disciplinary approaches to the study of host-pathogen interactions. Most recently, I have used combinations of remote sensing and molecular approaches to track growth, disease and quality of fresh produce. I will touch on some of this background to exemplify some potential future avenues for research at ARES/NTU, which include harnessing pockets of existing expertise in other schools to enhance our research portfolio, particularly as we move to smart agricultural practices and circular economies in the fresh produce supply chain.

## Poster Abstracts

### Saving endangered species with minimum management strategies

Adrien Gelle[1], Esther Kettel[1] , Malcolm Nicoll[2], Vikash Tatayah[3], Ken Norris[4,3], Jim Groombridge[5] & Simon Tollington[1]

*[1]School of Animal, Rural & Environmental Sciences, Nottingham Trent University, UK*

*[2]Zoological Society of London, [3]Mauritian Wildlife Foundation, [4]Natural History Museum, [5]University of Kent*

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Managing threatened species (nests manipulation, supplementary feeding, etc..) is a key way in which conservationists can help prevent extinction. However, when a previously small population increases in size monitoring can become increasingly difficult. The aim of this project is to use individual-based datasets to build advanced Capture-Mark-Recapture models of key demographic parameters for the Echo parakeet, a species endemic to Mauritius. This work will use 30 years of re-sightings data to investigate the potential to improve the monitoring by: (1) identifying variables responsible of impacting survival and viability, and (2) reaching a minimum dataset that provides enough information about the population.

### Plant Growth-Promoting Rhizobacteria: Microbial dynamics in wheat rhizosphere across different growth stages

Asmae Boumezgane[1], , Samantha McLean[2], Diana Di Gioia[2],
Mauro De Feudis[2], and Marcello Di Bonito[1,3]

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Rhizobacterial inoculants can boost plant growth amidst environmental stress and presents a promising strategy for the promotion of sustainable agricultural practices. However, many aspects of the complexity and dynamism of the rhizosphere microenvironment remain unclear. This study will examine crop-microbe interactions in the spring wheat rhizosphere during three growth phases: tillering, stem elongation, and spike formation. The analysis will be conducted on two fields with different cropping histories, one of which has been fallow for the past two years. Comparing the two fields will enhance our understanding of the influence of agricultural management on interspecific variation in the bacterial community.

## The Ecology and Evolution of Myrmecophily in the Silver-Studded blue butterfly (*Plebejus argus*)

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The Silver-Studded blue (*Plebejus argus*) has declined in range across the UK by 80% since the early 19th century. It is nationally threatened; this may be related to their symbiosis with ants. They are mutualistic myrmecophiles, meaning their caterpillars have a mutually beneficial relationship with ants they depend on. This study uses mesocosm experiments to examine how ant colony health (nutrition) affects the fitness of associated Silver-Studded blue. This will be combined with studies on how environment affects ant foraging and the butterfly's oviposition to inform land management for the species.

## Meeting Global Biodiversity Targets: The Argument for Zoos as Greenspace

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Here we evaluate the contribution of zoos to Target 12 of the Kunming-Montreal Global Biodiversity Framework by assessing the extent to which they make up urban greenspace. Digitising zoo perimeters and comparing their areas with urban land use data found that UK zoos cover 0.02%(±0.04%) of urban areas and 1.74%(±2.16%) of urban greenspace. Individual zoos cover larger areas than other greenspaces and are accessible to many people due to their correlation with population size. However, variation in how international datasets classify zoos may be underrepresenting their contribution. Future work will compare these patterns across Europe and explore cost accessibility.

## Investigating the maximum inclusion of BSFL supplemented with microalgae and enzymes in modern-day broiler

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The global population is projected to reach 9 billion by 2050, significantly increasing the demand for poultry meat and exerting pressure on available resources. Soybean meal (SBM), the primary protein source in poultry diets, is associated with environmental issues such as deforestation and pollution. Black soldier fly larvae (BSFL) (*Hermetia illucens*) as a sustainable alternative offer high protein content (37-63% DM) and can convert organic waste into protein-rich biomass. This study investigates the optimal BSFL inclusion level in broiler diets, supplemented with microalgae and enzymes, to improve broiler health, growth performance, and carcass quality. Findings will support BSFL as a sustainable protein source, maximizing organic waste's nutritive value and promoting sustainable poultry production.

## Use of passive acoustic monitoring to evaluate restored and degraded tropical savannah ecosystems in Africa

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Bioacoustics, an innovative tool for conservation, provides insights into species interactions, community structure, and ecosystem functioning. We aim to determine the feasibility of using passive acoustic monitoring (PAM) to assess the success of active restoration and measure the level of ecosystem degradation in savannahs. Using PAM we will characterise soundscapes made by the sounds of birds, bats and invertebrate communities at two spatial scales: 121 ha of degraded land under active restoration and the surrounding 10,000 ha of savannah. This project will develop a novel methodology for synthesising large-scale recordings into meaningful patterns to monitor restoration success and ecosystem health.

## Effect of enzyme cocktail in rye-based broiler grower diets on short chain fatty acid production

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In a mature broiler chick, 90% of caecal microbiota is dominated by Firmicutes and Bacteroidetes. These phyla become predominant at day 7 reaching 40-45% by the 3rd week of age. These bacteria preferentially utilize carbohydrates and small molecules to ferment. Added exogenous xylanase helps breakdown fibres into oligosaccharides that are also directly fermented by bacteria to increase their genera and to produce more SCFAs. This study investigated the effect of an enzyme cocktail on the rate of SCFA production in broilers fed a rye-based diet from day 10 of life.

## Is bigger better? How resolution and scale affect the accuracy of Species Distribution Models

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Species Distribution Models (SDM) are important tools in providing an understanding into environmental drivers and to simulate ecological suitability. A prevalent modelling tool is MaxEnt, which uses the 'maximum entropy' paradigm to find the probability distribution derived from species occurrence data and a set of environmental variable constraints. This project investigates the accuracy of model predictions across different spatial scales and resolutions. This work contributes to national conservation strategies and provides evidence to support a movement from site-level mitigation to landscape-scale conservation. This shift is of the upmost urgency to ensure that the national decline of water voles is halted.

## Characterising the taxonomic diversity of microbial biofilms in winterbourne chalk streams using amplicon sequencing

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Winterbourne chalk streams are temporary systems that periodically cease to flow resulting in drying of riverbed sediments. Little is known about the biofilms which coat riverbed sediments despite the fact they dominate microbial life in streams, underpin ecosystem function and regulate biogeochemical cycling. Biofilms are diverse, multitrophic communities representing all three domains of life. This project aims to characterise biofilm diversity by measuring both prokaryote and eukaryote diversity and how this community changes between wet and dry phases. This will improve our understanding of biofilm resilience and changes in temporary stream ecosystem and function in response to environmental change.

## Seaweed biostimulants: increasing abiotic stress resistance in crops

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Seaweed biostimulants alter the growth and development of crops, increasing yields and crop quality under abiotic stress. These effects are variable and poorly understood. What are the mechanisms underlying the physiological and morphological effects of seaweed biostimulants on tolerance of abiotic stress? Growing trials, changes in physiological mechanisms, tolerance to abiotic stress and quality of crops have been examined. Phenotypic data shows increased digital biomass, increased chlorophyll and improved stress tolerance. This research adds to the understanding of mechanisms underlying biostimulant mode of action, essential for enhancing food security and promoting crop growth in the face of climate change.

## The Conservation Management of Wetland Terrestrial Insect Biodiversity within Glencairn Vlei, Western Cape Province

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The wise use of wetlands and the identification of Wetlands of International Importance is a core part of South Africa's commitment to the Ramsar Convention. Glencairn Vlei is situated in the Western Cape Province, encircled by mountain ranges classified as endangered ecosystems by SANBI in 2018. The sites flora and fauna has never been systematically studied and its total biodiversity and conservation importance is unknown. This project aims to map the distribution and diversity of plants and terrestrial insects, select bio-indicators and recommend future conservation strategies. The sites eligibility against Ramsar criteria will be determined and further research needs identified.

## Cross-Kingdom Effects of Herbicide Applications on Soil Microbial Communities

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Sustainable food production must balance economic, environmental, and social elements, in alignment with the One Health agenda to optimize the health of people, animals, and the environment in one cohesive approach. This study aims to investigate the effects of herbicide actives on soil microbial communities, focusing on blackgrass abundance in UK wheat fields as a model cropping system. Objectives include, 1) assessing herbicide impacts on bacterial survival in both controlled settings and real-world conditions, 2) determining their role in driving antimicrobial resistance, and 3) enhancing our understanding of herbicide-induced selection pressures and the broader ecological implications.

## Wildlife-friendly gardens: assessing public willingness and barriers to intervention engagement in residential gardens.

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As urbanisation increases in the UK, with high-density housing and smaller, enclosed, and "tidy" gardens, conservation efforts are increasingly encouraging wildlife-friendly gardens. Although, conservation initiatives are often broad and lack an understanding of the feasibility of public engagement. Therefore, understanding the changes that the public are willing to make to their gardens and the barriers they face is key to designing effective garden biodiversity enhancement strategies. This study will use questionnaires from more than 100 respondents across the UK to assess the public's willingness to implement specific changes in their gardens. By applying the COM-B Model for Behaviour Change, it will also explore the various barriers to making these changes. The findings will offer recommendations on realistic interventions and suggest potential approaches to overcome barriers. Thereby expanding the options available to households for enhancing their gardens for wildlife.

## The diet of the red fox (*Vulpes vulpes*) in Cyprus

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The diet of the red fox (*Vulpes vulpes*) has been well studied in many countries, but there is limited information about its feeding habits on the island of Cyprus. Cyprus has a unique range of fauna and flora with the red fox being the only native non-domestic terrestrial carnivore, albeit this species is subject control as a result of human-wildlife conflict. This presents an unique opportunity to study how a generalist meso-predator has adapted its feeding ecology with limited conspecific competition and a unique suite of potential food items. This project studied the spatial and temporal variation in fox diet by analysing the stomach contents of 230 individuals from different habitats, collected during fox control measures between 2022 and 2024. This poster will present early results from this study and discuss how the diet of the red fox varies spatial and temporally in Cyprus, as well as comparing the data to other countries.

## Going for the gold? In search of the most efficient way of monitoring hedgehogs

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The West European hedgehog (*Erinaceus europaeus*) population in the United Kingdom is undergoing a historic decline. Robust data is necessary to understand the reasons for this decline. Density estimation is considered the 'gold standard' in wildlife monitoring but obtaining such robust estimates is associated with significant costs. This project will compare the costs and ability to detect population change of two different approaches to monitoring hedgehog populations using camera traps: (1) density estimation using the Random Encounter Model and (2) presence absence data using occupancy analysis. This work will help to inform the most efficient way of monitoring hedgehog populations size.

**Do bears display different movement behaviours towards humans depending on the region they live in?**

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The geographical and historical context of a region has great importance in the way species respond to external factors. Wild animals tolerance to human presence may be related to levels of pressure experienced in the past, as a sign of local adaptation to given conditions. We used GPS data from 108 brown bears collared in three European countries to examine movement patterns across different scenarios of human alteration. The results presented in this poster underline the need to consider contextual factors for understanding brown bears movement ecology and discuss conservation implications of bears habituation to humans in the study areas.

**Spotting the perfect property: Modelling habitat preferences of leopards using social media tourist data**

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Long-term studies clarify links between landscape and population dynamics. This work used tourist images of female leopards and cub to model habitat suitability. Spatial occupancy modelling with seven years of data integrates water availability, road networks, topography, and vegetation indices. This approach will map fine-scale patterns of reproductive success and cub productivity. The finding will inform conservation management by identifying critical denning habitats and area needed management or restoration to support leopard populations.

## An Assessment of Peatland Erosion in Ireland and the Impact of Anthropogenic and Environmental Pressures

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Peatlands are globally important ecosystems and erosion due to natural and anthropogenic pressures, such as grazing poses a threat to blanket bogs, and there is a need to establish the extent and causes of erosion. This project will investigate peat erosion across various blanket bogs in Ireland by (1) Measuring the annual and seasonal peat surface change rates at a high resolution and by (2) quantifying peat erosion rates associated with deer and sheep activity. These results will aid in enhancing restoration measures and provide evidence-based insights to improve peatland management practices.

## Peatland Fires: A Systematic Review

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Fire is becoming an increasingly studied topic within peatland research, comprising of 20% of all peatland studies in 2023. Here, the findings of a systematic review that answers the question "what is the current understanding of peatland fire events?" are presented. In total, 1797 articles, conference papers, and book chapters were screened and characterised by peatland type, fire type, location, and topic studied, to assess temporal and spatial trends in the current research. It is suggested that recent increased media attention in the tropical haze events and Canadian wildfires have been the driving force behind the increase in popularity.

## I like to move it move it: Do lemur walkthrough exhibits enhance visitor wellbeing?

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Human health and wellbeing (HWB) is an emerging role of zoos and has been identified as an area of focus for zoo-based research. Walkthrough exhibits are becoming increasingly popular and have potential for human health and wellbeing benefits due to typically being naturalistic environments with the opportunity for human-animal interactions to occur. This study aimed to assess the human HWB implications of interacting with a lemur walkthrough exhibit, utilising a mixed-method approach measuring salivary cortisol, heart-rate variability and self-reported questionnaires. Data will be presented discussing changes in human HWB parameters and implications for future research and societal role of zoos.