Ento26

8 – 10 September

Cardiff University, Wales

Contents

Tuesday 8 September

- Medical Entomology

Large Chemistry Lecture Theatre | Chair: Micah Flores, BioMonde

10:45 – Talal AL Yazeedi, Khalifa centre for genetic engineering and biotechnology, United Arab Emirates University

The metabolic resistance blueprint: Genomic dissection of DDT resistance in historical kdr-free East African *Anopheles gambiae*

Insecticide resistance in *Anopheles gambiae* poses a significant threat to malaria control and eradication efforts across sub-Saharan Africa. While target-site resistance mechanisms are well-characterised, the evolutionary origins of metabolic resistance remain poorly understood.

We employed bulk segregant analysis (BSA) using unique historical genetic crosses established in the late 1990s between a DDT-resistant ZAN/U strain (Originally from Zanzibar) and a susceptible strain to map the genomic architecture of early metabolic resistance. Critically, the ZAN/U strain exhibited DDT resistance without kdr mutations, providing an ideal genetic background for isolating glutathione S-transferase epsilon (GSTe)-mediated resistance mechanisms that evolved during the DDT control program era. BSA analysis revealed a major quantitative trait locus on chromosome 3R spanning the GSTe gene cluster (GSTe1-8). BSA identified 20 significant amino acid substitutions distributed across all eight GSTe genes, in addition to variations in the promoter region of GSTe2 and GSTe3, which were previously determined to be overexpressed in the ZAN/U strain.

East African field-collected samples from the MalariaGEN Ag1000G project confirmed that many of these mutations are under long-term selection pressure in natural populations. This work provides a characterisation of the GSTe cluster's role in establishing the metabolic resistance foundation that continues to compromise vector control efforts today. Additionally, BSA analysis was performed on progeny from crosses established in early 2000s between a permethrin-resistant RSP-ST strain originating from Western Kenya and a susceptible strain, identifying expected target-site resistance at the vgsc locus.

Other Authors: Talal Al-Yazeedi[1,2] | Marion Morris[1] | Abdullahi Muhammad[1] | Omer S. Alkhnbashi[3] | Naomi A. Dyer[1] | Hilary Ranson[1]

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11:00 – Kate Barnes, University of Derby

Environmental and seasonal influences on blow fly flight and oviposition activity in the East Midlands; supporting more accurate interpretation in forensic investigation

Forensic entomologists use knowledge of blow fly development rates to estimate the time at which they colonise a body, enabling the estimation of the minimum post-mortem interval (minPMI) for forensic investigations.

Season and environment will affect the availability and ability of blow fly species to colonise. Therefore, information on these drivers and how they influence colonisation is fundamental to supporting the work of forensic entomologists in estimating minPMI. However, this information is limited for blow flies in the UK.

Data from baited traps utilised on 108 occasions over multiple years between 2014 and 2024 in a sheltered, urban location in the East Midlands were used to assess environmental influences on blow fly flight and oviposition activity. Additionally, provisional data from baited traps in the same location sampled weekly 72 times from January 2025 until June 2026 are explored to assess seasonal influences.

In particular, we examine interaction effects between broad-scale environment (differences between years and within seasons) and local small-scale environment on blow fly abundance and behaviour.

This work increases our understanding of the influencing factors on species specific flight and oviposition activity enabling practitioners to more accurately interpret colonisation windows in forensic investigation.

Other Authors: Mark Bulling, University of Derby

11:15 – Arun Prakash, University of Edinburgh

Beyond pathogen clearance: Immune regulation, disease tolerance and immune priming in *Drosophila*

Host defense against infection depends not only on eliminating pathogens but also on limiting infection-induced damage and maintaining health. While pathogen clearance mechanisms are well studied, the processes underlying disease tolerance remain less understood. Using *Drosophila*, this thesis investigated how immune regulation, tissue damage control, and immune priming shape infection outcomes.
Genetically manipulated flies were used to examine the effects of disrupting key immune and damage-control pathways during bacterial infection. Reduced regulation of the IMD (immune deficiency) pathway and altered Jak/Stat (Janus kinase/signal transducer and activator of transcription) signalling significantly impaired disease tolerance during systemic bacterial infection, demonstrating that negative immune regulators help prevent immunopathology. Additional work showed that gut barrier integrity, damage signalling, tissue repair, and oxidative stress control contribute to tolerance during enteric infection, with several effects exhibiting sexual dimorphism.
The thesis also addressed immune priming, a form of enhanced protection following pathogen exposure. Using CRISPR/Cas9 transgenic lines, I demonstrated that long-lasting priming against *Providencia rettgeri* requires IMD-dependent regulation of the antimicrobial peptide Diptericin in the fat body. Furthermore, priming reduced pathogen shedding, suggesting a role in limiting disease transmission.
Together, these findings demonstrate that disease tolerance and immune priming are integral components of host defense that shape infection outcomes beyond pathogen clearance.

Other Authors: Katy Monteith, University of Edinburgh | Pedro F. Vale, University of Edinburgh

11:30 – Beth Jetson, Durham University

A Novel Primer Set for Mosquito DNA Metabarcoding and Applications to Larval Food Webs

Current vector control relies heavily on insecticide-based interventions, yet increasing resistance threatens their long-term effectiveness. Larval source management (LSM) offers supplementary approaches by targeting immature mosquito populations. However, broad scale implementations are constrained by difficulties in identifying larval habitats and an understanding of the wider ecological communities in breeding.
DNA metabarcoding of environmental DNA offers a sensitive and high-throughput tool for characterising aquatic habitats. By capturing genetic material shed by organisms

into the environment we can detect of malaria vectors and sympatric species at high taxonomic resolutions. While effective for surveying aquatic communities, the application of eDNA to malaria vectors is limited by taxonomic complexities of the *Anopheles gambiae* complex and *Anopheles funestus* group.

We evaluated the potential of eDNA metabarcoding to identify malaria vectors and associated arthropod communities in aquatic habitats. A preliminary mock community study confirmed that our novel ITS2 primer can identify key malaria vectors to species with no amplification of off target taxa. In collaboration with the Ifakara Health Institute, we validated the approach in artificial breeding pools. Each pool had densities of either 2, 4, 8, 16, 32 or 64 larvae and water was sampled across 8 days of development. The methodology was subsequently applied to field collected water samples from potential breeding pools in the Kilombero Valley, Tanzania.

An optimised eDNA methodology could increase the scale and efficiency of vector surveillance. With the emerging threat of *Anopheles stephensi* in East Africa, eDNA could provide early warning for the establishment of populations in new areas. It will also guide more informed LSM approaches through insights into the species interactions across aquatic habitats such as biological control by natural predators

Other Authors: Andreanna Welch, Durham University | Heather Fergusson, University of Glasgow | Emmanuel Kaindoa, Ifakara Health Institute | Herieth Mahenge, Ifakara Health Institute | Martha Ndaikeje, Ifakara Health Institute

11:45 – Charles Arokiyaraj, Centre for Climate Change Studies | Sathyabama Institute of Science and Technology (Deemed to be University)

Phenotypic plasticity and a transcriptomic osmotic threshold underpin salinity adaptation in *Aedes aegypti*

Saltwater intrusion into coastal freshwater habitats is an emerging consequence of climate change, with potential to expand the breeding range of *Aedes aegypti*, a major arbovirus vector. We reared *Ae. aegypti* across nine generations (F0–F8) under a salinity gradient (0–9 ppt, prepared from natural coastal seawater) to track adaptive responses across life history, morphology, and gene expression. Colonies failed to establish at 12 and 15 ppt, marking the upper survival limit.

Surviving lineages showed shifts in life history traits, and FE-SEM morphometrics revealed structural changes consistent with osmoregulatory adjustment. RNA-seq of F8 larvae across 0, 3, 6, and 9 ppt identified 47 core differentially expressed genes shared

across all comparisons, implicating membrane lipid remodelling, ER stress and proteostasis, ion transport (including NHE9B2), cytoskeletal reorganisation, and digestive enzyme regulation. Strikingly, the transcriptomic response showed a switch-like threshold near 6 ppt, indicating a defined osmotic tipping point rather than a gradual shift. Together, these results show that *Ae. aegypti* has substantial capacity for salinity tolerance, and identify a molecular threshold that could help predict vector range expansion into brackish habitats as coastal environments change.

Other Authors: S. Sreelakshmi | C. Ishwarya | Krupakar Parthasarathy | Amit Kumar (Corresponding Author)

12:00 – Ellie Jameson, Bangor University

Synergy between bacteriophages and larval alimentary product as antimicrobials

The power of medical maggots is well understood in the treatment of chronic wounds, but has a restricted shelf life and can be unpalatable. Larval Alimentary Product (LAP) is an alternative to live maggots and shows promise as an anti-biofilm treatment for chronic wound infections. We isolated bacteriophages to evaluate their compatibility with Larval Alimentary Product (LAP).

Staphylococcus aureus which has been reported as the most prevalent pathogen detected in 40-50% of chronic wound infections, and few phages have previously been isolated against these bacteria. Using clinically relevant antimicrobial resistant strains of *Pseudomonas aeruginosa*, and *Staphylococcus aureus* we isolated and characterised novel phages. We selected lytic phages that produced high titres and good killing of bacteria. Combining phage and LAP proved that although LAP showed no antimicrobial activity on its own it worked synergistically with phages to enhance bacterial killing. Furthermore, when combined phage did not negatively impact the anti-biofilm activity of LAP indicating that these two biologics have potential as a combined treatment against chronic wound infections with both strong antimicrobial and anti-biofilm properties.

Other Authors: Alistair Witheford, Bangor University | Marika Bilska, Bangor University | Ellie Jameson, Bangor University

- IPM & Pest Control 1

Small Chemistry Lecture Theatre | Chair: Daniel Leybourne, Liverpool University & The Agri-Food and Biosciences Institute

10:45 – Frankie Amanesih, University of Greenwich, Natural Resources Institute | National Institute of Agricultural Botany

Fungal-derived technology for control of the invasive pest, *Drosophila suzukii*

First recorded in the UK in 2012, *Drosophila suzukii* (Matsumura), also known as Spotted Wing Drosophila (SWD), is a significant invasive worldwide pest, threatening horticultural production in the UK, Europe, and the US. Currently, control of SWD primarily involves insecticide spraying of fruit crops and labour-intensive hygiene practices. Laboratory studies have established that entomopathogenic fungi (EPF) can kill SWD, but current fungal formulations have not been effective in field trials.

We combine fundamental study of fly behaviour with aspects of fungal ecology and chemical ecology to understand how *D. suzukii* resists EPF infection with the aim of developing new sustainable technologies for crop pest control.

We have established EPF infectivity by conducting a series of mortality assays using four commercial EPF products previously proven effective against SWD in the laboratory. The fungal formulations with the most promising results were used in a series of behavioural assays, consisting of two parts: identifying the interactions of SWD with fungal species and discovering their species-specific behaviours following fungal infection. Finally, the volatile organic compound (VOC) profiles of the fungal species were characterised to evaluate the role of fungal-derived chemical cues in mediating SWD behavioural responses and infection avoidance.

Other Authors: Mandela Fernández-Grandon - University of Greenwich | Christina Vimala Supramaniam - University of Greenwich | Steven J. Harte - University of Greenwich | Sarah Arnold - National Institute of Agricultural Botany | Daniel Bray - University of Greenwich

11:00 – Raimondas Mozūraitis, Laboratory of Chemical and Behavioural Ecology, the State Scientific Research Institute Nature Research Centre

Aggregation pheromone for managing the fruit fly *Rhagoletis batava*, a sea buck-thorn berry pest

The sea buckthorn fly, *Rhagoletis batava Hering* (Diptera: *Tephritidae*), is a pest of economic importance to sea buckthorn (*Hippophae rhamnoides* L., Rosales: Elaeagnaceae) berries. The plantation area of *H. rhamnoides* is expanding in many

countries due to the multiple ecological and medicinal benefits of sea buckthorn, thus creating suitable conditions for the rapid expansion of *R. batava*. The aim of the study was to identify a pheromone for environmentally friendly control of *R. batava* flies. Laboratory studies showed that only males emitted (S)-(−)-δ-heptalactone. A gas chromatography-electroantennographic detection analysis of both stereoisomers revealed that only (S)-(−)-δ-heptalactone elicited electrophysiological responses, whereas (R)-(+)-δ-heptalactone proved to be inactive in fruit flies of either sex. In a field assay, traps baited with (S)-(−)-δ-heptalactone caught significantly more fruit flies compared with the unbaited traps. The low proportion of (R)-(+)-δ-heptalactone did not affect attractiveness of (S)-(−)-δ-heptalactone, but higher proportions, i.e., 20% and 50%, significantly reduced (S)-(−)-δ-heptalactone efficiency. Our results are the first to demonstrate the attractiveness of (S)- (−)-δ-heptalactone as a bait for trapping *R. batava*. Because (S)-(-)-δ-heptalactone elicits attraction in both male and female flies, it is classified as an aggregation pheromone, the first reported for the genus *Rhagoletis*.

Other Authors: Laima Blažytė-Čereškienė, the State Scientific Research Institute Nature Research Centre; Sandra Radžiutė, the State Scientific Research Institute Nature Research Centre; Violeta Apšegaitė, the State Scientific Research Institute Nature Research Centre; Rasa Čepulytė, the State Scientific Research Institute Nature Research Centre; Vincas Būda, the State Scientific Research Institute Nature Research Centre

10:15 – Elena Krimmer, Kyoto University

A customized flower mixture to enhance natural pest control by *Orius* in vegetable production

Species-rich flower mixtures can enhance natural pest control in conventional agricultural systems by providing habitat, plant-derived food, alternative prey, and oviposition sites for natural enemies. However, not all flowering plants benefit all natural enemies equally. To optimize flower mixtures for specific cropping systems, plant species should be selected to match the functional requirements and preferences of target natural enemies. In our study, we investigated which flowering plant species are most suitable for the minute pirate bug *Orius* (Hemiptera: Anthocoridae) that feed on vegetable pests such as thrips but also utilize plant-derived resources.

In laboratory assays in which their longevity and oviposition were assessed, *Lobularia maritima* and *Fagopyrum esculentum* increased *Orius* longevity, whereas *Centaurea cyanus, Coriandrum sativum*, and *Trifolium incarnatum* were frequently used for oviposition. In the field experiments, eggplants adjacent to flower mixtures at times

supported higher *Orius* abundance, lower thrips pressure, and reduced fruit damage compared with those adjacent to *Tagetes patula* alone. Across both study years, higher *Orius* abundance was observed early in the season next to the flower mixtures, and fruit damage was reduced for several weeks, although thrips numbers were temporarily higher. Our findings highlight the importance of selecting flower species tailored to specific natural enemies and demonstrate the advantage of diverse flower mixtures compared to single-species insectary plants for improving pest control in vegetable production.

Other Authors: Takahiro Maki, Kyoto University | Norihide Hinomoto, Kyoto University

11:30 – Lucas dos Santos Silva, Universidade Federal de Goiás (UFG)

Effects of *Metarhizium humberi* conidia formulated with micronized carnauba wax on self-grooming behaviour by *Aedes aegypti* adults

Aedes aegypti, a major vector of arboviruses in tropical regions, is susceptible to infection by entomopathogenic fungi. However, the role of mosquito self-grooming in removing conidia remains poorly understood. We investigated self-grooming behaviour in adult *A. aegypti* exposed to *Metarhizium humberi* conidia formulated or not with micronized carnauba wax (MCW). Grooming reduced the number of non-germinated conidia and early germinating stages on the cuticle up to 24 h after exposure to fungus-treated surfaces. Exposure to conidia, conidia + MCW, or MCW alone increased spontaneous self-grooming.

Mosquitoes used their first pair of legs to scrape the proboscis, antennae, and wings, while the third pair scraped each other, the anterior legs, and the gonapophyses. Immediately after exposure, fungal propagules and/or MCW were concentrated on tarsi, tibias, femurs, gonapophyses, antennae, proboscis, and wings. In active adults, conidial numbers decreased approximately fivefold within 24 h, mainly during the first 6 h, whereas losses in cold-immobilized mosquitoes were lower or insignificant. MCW did not enhance conidial retention on the cuticle. These findings highlight the importance of considering mosquito self-grooming when developing fungal formulations for biological control of *A. aegypti*.

Other Authors: Christian Luz, Universidade Federal de Goiás (UFG) | Juscelino Rodrigues, Universidade Federal de Goiás (UFG)

11:45 – Rory Jones, RSK ADAS

Insecticide resistance monitoring 2025-26

Identifying cases of insecticide resistance is essential for the continued sustainable use of insecticides. alongside other IPM approaches. The Defra funded Insecticide Resistance Monitoring project collects data to determine the levels of insecticide resistance within selected invertebrate pests of arable and horticultural crops in England and Wales. Using a combination of sampling techniques, both reactive and proactive, and utilising bioassays and molecular diagnostics, ninety-two samples were screened for insecticide resistance between August 2025 and February 2026. For *Myzus persicae*, reduced sensitivity or resistance was detected for acetamiprid and lambda-cyhalothrin, but not spirotetramat, flonicamid, or sulfoxaflor. Three *Nasonovia ribisnigri* samples were screened for resistance to spirotetramat. None showed reduced sensitivity or resistance and one sample had reduced sensitivity to lambda-cyhalothrin. Of the *Rhopalosiphum padi* and *Sitobion avenae* samples screened against lambda-cyhalothrin, four *R. padi* and two *S. avenae* had reduced sensitivity, and five samples of *S. avenae* were resistant. Molecular testing identified resistance in most *Psylliodes chrysocephala* adults tested; only five out of 66 adults collected across 11 sites had neither the kdr or super-kdr mutation. This project increased knowledge of insecticide resistance, and supports the development of a framework for long-term monitoring.

Other Authors: RSK ADAS: Rory Jones, Nasamu Musa, Harry Benford, David Motley, Keith Bishop, Ben Madison, Chris Dyer, Mark Ramsden, Duncan Coston | University of Exeter: Mark Mallott, Chris Bass | Harper Adams University: Laura Martinez-Chavez, Tom Pope, Joe Roberts | Rothamsted Research (retired): Steve Foster | Dewar Crop Protection: Alan Dewar

12:00 – Anusha Mohan Kumar, Rothamsted Research

Semiochemical - Based Alternative Concepts for the Management of Wireworms

Wireworms (*Agriotes spp.),* the larvae of click beetles (Coleoptera: Elateridae), are polyphagous soil pests of vegetable and cereal crops across Europe and North America. They cause 10-37% seedling mortality in cereals by feeding on the crown and roots[1]. Stringent pesticide regulations and a shift towards sustainable practices, including minimal tillage, have inadvertently increased wireworm infestations. Thus, sustainable pest management strategies, including using semiochemicals, are necessary.

Semiochemicals are compounds produced by organisms that elicit a physiological or behavioural response in individuals of the same or a different species. Soil herbivores

use root-emitted volatile organic compounds (VOCs), a type of semiochemical, as cue to find suitable host[2]. In nature, VOCs are influenced by biotic stresses[3]. Hence, the aim is to identify novel VOCs and understand how changes in VOCs affect wireworm host-finding behaviour.

Different wheat varieties were tested under belowground (wireworms), aboveground (aphids) and dual herbivory conditions in olfactometer assays. Wireworms exhibited a behavioural preference for certain wheat varieties, while others were not attractive. Additionally, wireworms showed a preference for plants damaged by conspecifics over healthy plants but exhibited no such preference for plants under aboveground or dual herbivory. VOC extracts collected from roots through air entrainment showed that root damage by wireworms induced VOCs that were absent in healthy and aboveground herbivore-damaged plants, indicating qualitative changes specific to belowground herbivory. Further, wireworms were attracted to synthetic blend mimicking the VOC extract from wireworm-damaged roots in laboratory assays.

Future research will focus on testing the synthetic blend in semi-field conditions. These compounds could be used in slow-release formulations for wireworm population monitoring in farmlands and attract and kill strategies for crop protection.

Other Authors: Anusha Mohan-Kumar[1,2] | Gareth Thomas1, John C. Caulfield[1] | Ben De Lacey Costello[2] | Benedikt Kurtz[3] | Pete Maxfield[2] | Jozsef Vuts[1]

1. Rothamsted Research, Harpenden, UK | 2. University of The West of England, Bristol, UK | 3. Syngenta Crop Protection AG, Stein, Switzerland

- SYMPOSIA: Approaches in Entomology: Methods, Ethics and Philosophies

Sir Stanley Thomas Lecture Theatre | Chair: Jordan Cuff, Newcastle University

10:45 – Jordan Cuff, Newcastle University

Approaches in entomology: accelerating innovation, interdisciplinarity and insight through dissemination of advances to methods, philosophies and ethics across insect science

Insect science is a dynamic and continually evolving field, driven equally by the methods we develop, critique and use, and the philosophies that guide our investigations, interpretations and applications. Advances in technologies and techniques allow us to study insects at unprecedented spatial, temporal and

molecular scales, revealing deeper insights into the mechanisms by which they shape our ecosystems, society and human health. At the same time, evolving philosophical perspectives are continuously advancing how we design our experiments, consider our animals, infer new phenomena, and share our findings.

Together, methods, philosophies and ethics form the critical foundations of insect science from which progress across entomology ultimately arises. Sharing and reflecting on these approaches is essential for innovation in entomology to extend beyond individual laboratories and subdisciplines to benefit the wider scientific community. These interdisciplinary advances are, however, typically scattered across journals, disciplines and informal exchanges, often struggling to find a suitable home, limiting their visibility and impact. To address this need, the Royal Entomological Society has launched a new journal dedicated to methods and philosophies across insect science. Approaches in Entomology: Methods, Philosophies and Ethics provides a dedicated forum for the dissemination, evaluation and development of innovative approaches across the full breadth of insect science with a particular emphasis on methods, philosophies, and ethical dialogues.

11:00 – Meghan Barrett, Indiana University Indianapolis

Feeding adult black soldier flies their preferred foods increases mating activity, egg output, and longevity

The black soldier fly (BSF; *Hermetia illucens*; Diptera: Stratiomyidae) is a novel mini-livestock species now reared in the trillions annually around the globe. As BSF farming continues to grow, research on how to protect these animals' welfare in farmed settings is also essential. Currently, industry standard practice involves not feeding BSF adults and providing only water due to a misconception that BSF adults cannot eat. However, BSF adults have functional mouthparts and digestive systems, gravitate towards and consume food when it is provided, and live longer when provided with food. Therefore, current industry practices, where only water is provided, do not keep BSF adults free from hunger. In order to address this welfare concern, we studied the carbohydrate and protein preferences of BSF adults as well as their preferred protein to carbohydrate ratio and overall carbohydrate concentration.

We assessed three carbohydrates (honey, white sugar, and molasses) and three proteins (yeast, agar, and casein). Using the maximally preferred diet (1:8 ratio of yeast to molasses, with molasses concentration set to 5%), we assessed BSF adult mating behaviour, egg mass, and sex-specific longevity on the diet vs in the water-only conditions that are currently standard in the industry. We found that BSF were observed to mate more frequently, laid more eggs on days 2-5 post-eclosion, and lived 4-6 days longer when given access to their preferred diet. Our data suggest that feeding adult BSF their preferred diet could improve animal welfare (by keeping the

animals free from hunger and allowing for natural feeding-related behaviors) while also improving the number of eggs laid per day.

11:15 – Junho Yoon , Lund University

From Visual Symptoms to Quantitative Endpoints: Computer Vision Approaches in Insecticide Toxicology

Computer vision is increasingly transforming entomology by enabling automated detection, classification, and tracking of insects from images and videos. However, applications to quantitative behavioral analysis, particularly in insecticide toxicology, remain comparatively limited. This presentation introduces the principles of computer vision and convolutional neural networks, followed by major applications in entomological research. Markerless pose estimation is then presented as an approach for extracting quantitative behavioral features from insect movements.

Examples using the cotton aphid, *Aphis gossypii*, and the house fly, *Musca domestica*, demonstrate how extracted body-part coordinates can be converted into measures of antennal movement, locomotion, and rotation, as well as previously qualitatively defined symptoms such as tremor, convulsion, and incoordination.

These quantitative behavioral phenotypes can be used to train classification algorithms to distinguish insecticide modes of action. The presentation concludes with key methodological considerations and future directions for computer vision–based behavioral toxicology.

11:30 – Graziella Iossa, University of Lincoln

Integrating microclimate into field studies of fertility

Heatwaves, and other climate extremes, impact ectotherm survival. Critical thermal limits are established viability thresholds when studying the impact of climate change on natural populations. Thermal fertility limits of species have been proposed alongside critical thermal limits, to better assess the sublethal effects of rising temperatures on species persistence. However, mounting evidence shows that extreme temperatures produce variable effects on reproductive traits depending on species and context.

To explain this variation, and understand how sublethal effects affect ectotherms, we need to integrate physiology, ecology and evolution to be able to predict future species persistence under climate change. Here, we point towards the key role of microclimate ecology in driving this variability. Temperature extremes may affect

fertility in nature interacting with microclimates, sexual selection and conflict in insects and, in turn, affecting population growth and persistence.

11:45 – Fred Windsor, Cardiff University
Emerging methods for detecting ecological interactions and ecosystem functions

Whilst it may appear that constructing ecological networks is easier than ever, capturing the actual functional outcomes of interactions remains a significant challenge. Traditional methods such as visual observations frequently rely on proxies for actual processes (i.e., visitation as an indicator of pollination or nectar/pollen feeding) and are constrained by high labour costs. Furthermore, they are often limited in their spatial and temporal resolution, and/or scale. When you combine these core limitations with the fact that many insects are small and cryptic, we have a real challenge on our hands to bridge the monitoring data gap and provide critical ecological data and information to scientists, practitioners, land managers and policymakers.

To address some of these challenges, we have been investigating the opportunities afforded by a range of emerging technological solutions from RNA metabarcoding to computer vision. Different methods offer great potential and can provide deeper insights into the context and drivers of ecological interactions, as well as measure functional endpoints. While challenges remain, these innovative methods appear to be a powerful addition alongside established techniques, enabling more accurate, scalable representations of ecological processes.

- Agriculture & Agroforestry

Large Chemistry Lecture Theatre | Chair: Michael Garratt, University of Reading

14:15 – Cerian Webb, Forest Research
Using atmospheric dispersion modelling to assess potential origins of *Ips typographus* incursions into Great Britain

In late 2018 a breeding population of the larger European spruce bark beetle, *Ips typographus* - the number one killer of spruce in continental Europe, was detected in the UK for the first time.

Reactive pheromone trapping within 100km of the site captured small numbers of adult beetles across the region. However, follow-up investigations found no evidence of breeding or emergence in 2019 or 2020 at any of the trap locations (Blake et al. 2024).

Before these detections, entry was assumed to occur mainly via infested wood or cargo, supported by regular interceptions at ports and sawmills. However, the widespread trap captures within the demarcated area suggested an alternative explanation: wind assisted long distance dispersal from northern France and Belgium.

Further support for wind-assisted dispersal came from a trapping study across France, Belgium, and southern England in 2021–2022 (Inward et al. 2024), which showed beetle abundance declining with distance from continental outbreak centres. Here we use the UK Met Office NAME model to explore the potential pathways for wind-assisted dispersal from continental Europe.

NAME provides a realistic representation of dispersal dynamics, enables estimation of minimum travel times and identification of potential source areas. I will present examples showing how NAME air history "footprints," filtered by temperature and host distribution, can refine inference on dispersal pathways and support outbreak investigation.

Other Authors: Max Blake, Forest Research | Jacob Smith, University of Cambridge | William Thurston, UK Met Office | Chris Gilligan, University of Cambridge

14:30 – Leah Vogelfänger, Ulm University

Silvicultural heterogeneity enhances functional diversity of beetles, bees and spiders after disturbance

Climate change alters disturbance regimes in temperate forests, potentially leading to reduced microclimatic buffering and threatening shade-adapted arthropod species. Pre-disturbance management of advance regeneration and post-disturbance salvage logging can modify the availability of cool, shaded, small-scale microclimatic refuges and thereby shape arthropod communities through shifts in thermoregulatory traits. We investigated how disturbance, disturbance management, and resulting solar insolation affected colour lightness, body size, and forest affinity of beetle, bee, and spider communities. Shifts in community-weighted mean trait values were often accompanied by increased trait diversity, indicating functional expansion rather than severe loss of specialized species.

However, some trait shifts reflected environmental filtering. Solar insolation was the key driver of multifunctional community composition across disturbed plots. Our findings demonstrate that both pre- and post-disturbance management influence the functional composition of arthropod communities following forest disturbance. Promoting silvicultural heterogeneity can foster functionally distinct communities and enhance functional diversity, potentially increasing the adaptive capacity of forest arthropod communities under future disturbance regimes.

Other Authors: Thomas Knoke, Technical University of Munich | Lukas Lehnert, LMU Munich | Wolfgang Obermeier, LMU Munich | Sebastian Seibold, Ulm University

14:45 – Anastasia Uglow, Forest Research

Host Responses and Potential Diagnostic Tools for Emerald Ash Borer in European Ash

Early detection of invasive wood-boring insects remains a major challenge in forest biosecurity, as visible symptoms often appear only after substantial damage has occurred. The emerald ash borer (EAB), *Agrilus planipennis* Fairmaire, poses a significant threat to *Fraxinus* populations across Europe and the UK. This study investigated host responses and potential early diagnostic indicators of EAB infestation in *Fraxinus excelsior* under UK conditions.

Trees of varying ages, along with cut logs, were inoculated with EAB eggs under controlled conditions and assessed following lesion formation or fluid exudation. A consistent purple discolouration of phloem tissue (purple reactive zone, PRZ), was observed in most inoculated trees. PRZ presence and intensity were strongly influenced by tree age, with older trees exhibiting larger and more pronounced responses. This response was associated with reduced larval success and limited lesion development.

Lesion-associated tissues were analysed using culture-based and metabarcoding approaches. Pathogenic microbes were detected; however, fungal growth was reduced within PRZ regions, suggesting localised antifungal activity. The PRZ also appeared to constrain larval feeding and limit development.

These findings highlight host-associated visual and microbial indicators with potential for improving early detection of EAB, while providing insight into host defence mechanisms in European ash and guide mitigation strategies to protect UK ash populations.

Other Authors: Julia Cumberland, Forest Research | Lionel Hill, John Innes Centre

15:00 – Marie Joy Beltran, University of Stirling

How do pest natural history, habitat heterogeneity and management strategy affect resistance evolution? A simulation study in the mango cecid fly

The cecid fly is a pest of mango causing 70-100% yield loss despite widespread insecticide use in mango production. Chemical control is no longer effective, partly due to evolution of resistance to commonly-used insecticides. Identifying management strategies to delay resistance evolution and prolong chemical control effectiveness is therefore important. We used agent-based modelling to explore how different management strategies interact with the natural history of the fly and the spatial arrangement of its habitat to influence the course of resistance evolution.

We were particularly interested in how the number of generations of the pest per season influences resistance evolution because farmers independently induce mango flowering at any time from November to February, which could result in variable numbers of pest generations per cropping season. We also investigated how habitat structure mediates the spread of resistance because cecid flies have traits predicting low gene flow between local populations: weak flying ability, short generation times, short adult lifespan, short mating windows, and population dynamics linked to seasonal mango availability. Hence, habitat features such as the spatial arrangement of host plants (e.g., adjacent vs. distant) and management strategy (e.g., different landscape-level pesticide rotation regimes) should be critical in the spread of resistance. We present resistance evolution results (population dynamics, spatial distribution and resistance traits) in the context of habitat heterogeneity, pest generations, and management strategy.

Other Authors: Rebecca Boulton, University of Stirling | Bradley Duthie, University of Stirling

15:15 – Neelendra Joshi, University of Arkansas Fayetteville

Impact of Pasture Management Practices on Bee and Beneficial Insect Communities in Livestock Pasture Systems

Livestock pastures and rangelands comprise nearly 45% of U.S. agricultural land and have considerable potential to support pollinators and other beneficial insects. However, grazing and other pasture management practices may alter floral resource availability and influence insect communities.

In a multi-year field study, we assessed the effects of pasture management, including organic versus non-organic establishment practices and animal grazing, on bee and

non-bee insect abundance, diversity, and community composition in pastures seeded with native forbs, legumes, and grasses.

A diverse assemblage of pollinators and beneficial insects was documented in this study. Bee and insect abundance, diversity, and evenness were consistently greater in non-grazed plots, whereas species richness did not differ among treatments. Similarly, organic and non-organic management practices resulted in comparable levels of bee richness and community composition, suggesting that herbicide applications during pasture establishment did not adversely affect pollinator diversity later in the season.

These findings demonstrate that livestock pastures can support diverse insect communities when adequate floral resources are available and highlight the importance of strategic grazing management and successful establishment of native flowering plants to enhance pollinator conservation and biodiversity in livestock pastures.

Other Authors: Roshani Sharma Acharya, University of Arkansas Fayetteville | Timothy Leslie, Long Island University, NY

15:30 – Abigail Enston, Aberystwyth University

Designing Traps from the Beetle Up: Evaluating Achromatic Brightness and UV Reflectance in Bark Beetle Monitoring

Bark beetles are economically important forest pests. Monitoring typically relies on baited traps, which are traditionally black because darker traps (i.e. black) are reported to catch more beetles than brighter ones (e.g. white). Bark beetles possess ultraviolet (UV) and green-sensitive photoreceptors, yet UV reflectance of traps has rarely been quantified and can be low in some materials that are white to a human eye. Consequently, it is unclear whether bark beetles are truly attracted by achromatically darker traps, or whether attraction is affected by UV wavelengths as a brightness or colour feature.

We developed experimental traps with systematically varying achromatic brightness (i.e. covarying reflectance in UV and green regions) and UV reflectance alone (i.e. UV reflectance varying independently of green), to separately evaluate their effects on bark beetle attraction. Black traps caught more beetles than human white traps with low UV reflectance, agreeing with previous work. However, human white traps with high UV reflectance (i.e. white to the beetle eye) were more attractive than black traps. These findings highlight the central importance of insect perception in trap design,

and support optimising traps for more effective monitoring, especially in visually complex environments such as ports or wood processors.

Other Authors: Roger Santer, Aberystwyth University | Max Blake, Forest Research | Gareth Griffith, Aberystwyth University

- Urban Entomology

Small Chemistry Lecture Theatre | Chair: Wendy Harris, Swansea University

14:15 – Yanan Liu, The University of Sheffield

NOx disrupts tree performance and insect development in urban ecosystems

Vehicle exhaust emissions are a dominant feature of urban environments and are widely believed to negatively affect plants and insects, yet the combined effects on both remain less understood. We investigated the effects of NOx at concentrations representative of UK highway emissions (~55 ppb) on the physiology and secondary metabolism of four common urban tree saplings using a fumigated chamber system. Saplings grown under elevated NOx showed reduced stem height, fewer leaves, and altered secondary metabolism, resulting in more drought-stressed and unhealthy foliage compared to those under clean-air conditions (~10 ppb). Larvae of Spodoptera spp. feeding on these leaves also exhibited adverse outcomes: higher mortality, lower body mass (mean mass reduced by ~55%), and delayed development, with significantly fewer individuals progressing to later instars under NOx exposure. Together, these findings demonstrate that realistic levels of vehicle-derived NOx can simultaneously impair urban vegetation and directly hinder herbivorous insect performance, highlighting a potential pathway by which traffic pollution affects urban ecosystems.

14:30 – Matthew Sparks, Swansea University

I Spy with My Compound Eye: Modelling Fly Vision to Rethink Urban Fly Control

Urban environments with abundant food, warmth, and oviposition sites favour filth flies such as *Musca domestica*, a key vector of over 100 pathogens affecting human and animal health.

Much research focuses on trap design and the species' visual ecology, but little bridges these areas or explores how visual information affects fly behaviour in urban settings. I discuss my work using current methods in visual ecology to model fly vision,

including colour, polarisation and spatial information using panoramic full-spectrum photography.

These methods are used to create images that approximate how flies perceive indoor and outdoor urban environments, as well as natural environments. Using these images, this work aims to reveal how visual information is structured in urban habitats, how it differs from natural environments, and how these differences can be used to design more effective traps.

This fly-eye-view of the environment is then used to investigate how the appearance of fly traps can be optimised, with behavioural tests demonstrating how trap salience (how much the trap stands out) affects its attractiveness to flies.

Findings improve our understanding of flies' visually guided behaviour in urban areas and how manipulating environmental cues may influence behaviour and pathogen spread.

Other Authors: Matt Green, Rentokil-Initial | Tariq Butt, Swansea University | William L. Allen, Swansea University

14:45 – Moshe Gish, University of Haifa

Fatal Attraction: Outdoor Bug Zappers Capture Few Mosquitoes While Indiscriminately Killing Diverse Non-target Insects

Electric insect killers ("bug zappers") are widely marketed as eco-friendly mosquito-control devices, yet their mosquito-control efficacy and impacts on non-target insects remain poorly substantiated by empirical evidence. We evaluated the catch composition of commercial, unbaited outdoor bug zappers (both fluorescent-tube and LED-based devices) operated continuously for 72h in a Mediterranean landscape. Samples were visually sorted and weighed by order, and the unsorted fraction of each sample, containing numerous tiny insects and insect fragments, was analyzed using PCR to detect *Culex* and *Aedes* mosquitoes and DNA metabarcoding to assess broader insect diversity. Both zapper types captured few mosquitoes, averaging 2.49±0.43 mosquitoes per trap per night. In contrast, they killed a remarkably diverse assemblage of non-target insects.

Metabarcoding identified 13 insect orders, 216 families, and 751 genera in the unsorted material. Sample composition differed significantly among villages, indicating that bug zappers act as broad-spectrum insect killers whose bycatch composition may vary substantially by location. Our findings reinforce long-standing concerns that bug

zappers provide negligible mosquito control while causing unnecessary, indiscriminate mortality among non-target insects, thereby challenging common "eco-friendly" marketing claims. Future studies quantifying effects on local non-target insect population sizes could facilitate regulatory action to restrict bug zapper sale and use.

Other Authors: Tali S. Berman, Tel-Hai University of Kiryat Shmona in the Galilee

15:00 – Stephanie Glendinning, The University of Sheffield

Abiotic urban stressors and plant-pollinator interactions: a multi-year field experiment

Urban environments pose numerous challenges for pollinating insects. While the impacts of reduced habitat availability are well-established, fewer studies have investigated how abiotic stressors, including pollution, drought and the urban heat island effect, indirectly influence pollinators by affecting the availability and quality of floral resources. We established a multi-year manipulative field experiment to investigate how floral resource quality and pollinator diversity and abundance are affected by urban stressor intensity, using patches of wildflower turf established in pairs of high-stress (main road) and low-stress (minor road) grass verge sites across Sheffield, UK, while controlling for variation in local landscape quality.

Diversity and abundance of bees, hoverflies and non-syrphid flies (from observation counts and pan traps) were significantly lower on main compared to minor roads, which, alongside assessments of floral establishment, soil moisture and NO2 pollution concentration, supports the hypothesis that urban stresses associated with road type affect pollinator visitation as a result of changes to floral resources. Our findings suggest that interventions to support pollinating insects in urban environments should consider the impacts of urban stressors on the quantity and quality of the floral resources they provide.

Other Authors: Jill Edmondson, University of Sheffield | Jessica Stokes, Royal Entomological Society | Luke Tilley, Royal Entomological Society | Stuart A. Campbell, University of Sheffield

15:15 – Isma Maqbool, University of Eastern Finland

Floral volatiles of a keystone generalist plant support pollinator-community even in traffic-polluted environments

Pollinators enable plant reproduction and help sustain ecosystems. Olfactory cues in the form of volatile organic compounds (VOCs) is one of the key signal modalities

needed for plant-pollinator communication. Plants adopt different pollination strategies, including rewarding or deceptive systems with variable degree of specialization or generalization. Generalist plants interact with many pollinators and can act as keystone species. Air pollution disrupts plant-pollinator interactions by degrading floral VOCs signals.

Angelica sylvestris (Apiales, Apiaceae) is a generalist species, that can play potential role as a keystone species. Before making ecological recommendations, it is essential to understand how traffic influences VOCs during the staminate phase and how VOCs vary between functional stages, given that pollinator attraction peaks at staminate stage. Here, we analyzed floral VOCs (n=70) of *A. sylvestris*, measured heavy metal concentrations in soil and flower umbels, collected and identified insect communities. Female-phase flowers (n=15) were also analyzed to compare VOCs profiles between functional stages. Traffic significantly affects VOCs composition overall, but plants retain 96% of its core VOCs profile, maintaining a stable signal for pollinators. Increased emissions of some monoterpenoids and GLVs indicated underlying abiotic stress without substantially altering key pollinator attractant compound. Soil heavy metals (HM) drive limited, site-specific VOC shifts mainly for GLVs, alkanes and alkenes. Umbel HM had minimal effect. *A. sylvestris* exhibited pronounced sexual dimorphism, with clear qualitative differences. Staminate stage dominated by benzenoids and aldehydes likely serve as signals attracting both generalist insects and specialist pollinators (muscid and syrphid flies). Pistillate stage profile dominated by energetically less expensive monoterpenoids continue to attract generalist insects, along with substances such as heptadecane (rich in sugar wax) which may facilitate resource reallocation toward seed development. Insect pollinators also remained stable under traffic.

Overall, *A. sylvestris*' chemical resilience under traffic along with its sexual dimorphism enabling maximum reproductive efficiency with stage-specific attraction of different pollinator groups make it an ideal candidate as keystone species in urban roadside habitats.

Other Authors: Isma Maqbool, Wendy Moya, Delia Pinto-Zevallos, Oksana Skaldina
All authors are affiliated with the University of Eastern Finland, Department of Environmental and Biological Sciences, Yliopistonranta 8, 70210 Finland

15:30 – Shannon Keenan, The University of Strathclyde

Longer calls, shifted ears: urban soundscape effects in *Omocestus viridulus*

Urban grasslands support acoustically signalling insects, but whether urban soundscapes alter male signals and female auditory mechanics remains unresolved. This

study examines *Omocestus viridulus*, using rural reference populations and additional Glasgow populations spanning mapped noise, vegetation and microhabitat gradients.

Current pilot surveys verified *O. viridulus* at five sites. In field observations, rural sessions produced more audible call events than urban sessions: 16.75 ± 18.06 versus 8.00 ± 7.90 calls per 30 min, with 9.25 ± 8.88 versus 4.27 ± 3.72 individuals per session. Focal recordings showed a different signal-level pattern: when urban males called, their detected calls were longer, with median duration around 14–15 s compared with around 6 s in rural recordings. Urban calls also showed lower dominant frequency and spectral centroid.

Female tympanal mechanics were measured using laser Doppler vibrometry across five membrane regions. In urban females, the Thick region responded at higher characteristic frequency than the Thin region, 6.19 versus 4.64 kHz, with stronger vibration velocity. In rural females, this reversed: the Thin region responded at 11.65 kHz compared with 7.70 kHz at the Thick region.

Together, these results suggest urban soundscapes are associated with fewer field call events but longer male calls, alongside region-specific redistribution of female tympanal frequency response.

Other Authors: Dr. James Windmill & Dr. Lara Diaz Garcia, The University of Strathclyde | Dr. Davide Dominoni, The University of Glasgow

- SYMPOSIA: Advisory and Diagnostic Services

Sir Stanley Thomas Lecture Theatre | Chairs: Anna Platoni, Forest Research and Josie Stuart, RHS

14:15 – Chris Malumphy, Fera Science Limited
Insect plant pests moving in trade

This presentation outlines how the Entomology Team at Fera Science identifies thousands of insect samples each year submitted by the Plant Health and Seeds Inspectorate (PHSI), using a mix of morphological and molecular methods. Fera Science is one of the UK National Reference Laboratories for Plant Health, providing diagnostic services for pests and diseases, scientific evidence to protect crops and the wider environment, and supporting official regulatory controls. The PHSI target quarantine pests, regulated non-quarantine pests, and suspected non-native plant

pests during inspections of imported plants and plant products and during surveys in England and Wales. Between four and five thousand samples (interceptions and surveillance) are received annually by Entomology team at Fera, consisting of about a thousand taxa.

Most samples belong to five insect orders (Coleoptera, Diptera, Hemiptera, Lepidoptera, Thysanoptera); the most frequently intercepted taxa are tobacco whitefly *Bemisia tabaci* and *Liriomyza* leaf miners; and some of the recent notable interceptions are highlighted. Insect taxonomy is based mainly on adult morphology, however, it is usually immature stages that are intercepted, and Fera has developed unique expertise over decades to enable rapid identification of these stages. There has recently been a significant increase in the use of molecular methods in combination with morphological identification.

14:45 – Anna Platoni, Forest Research

Forest Research Insect Surveillance: From Routine Monitoring to Rapid Response

Entomologists at Forest Research (FR) coordinate and support many UK-wide monitoring programmes for forest insects. Our monitoring programme includes surveillance trap networks in the wider environment and at high-risk locations such as at ports and wood-processing plants. We also monitor tree pests using citizen science as part of a free advisory service called “TreeAlert”. Our surveillance alerts authorities and scientists to new pests of UK concern at borders and inland, prompts outbreak response and directly informs national plant health policy. This presentation will introduce current insect monitoring at FR and present some recent significant findings and their potential impact to GB tree health security.

Other Authors: Anna Platoni, Chris Berman, Imogen Cavadino-Phillips, Molly Davidson, Sarah Facey, Tom Kendall, Amirah Nigoumi, Sonja Steinke, Jason Sumner-Kalkun, Alice Walker, Max Blake

15:00 – Ben Brough, Royal Horticultural Society

From discovery to distribution: a gardening diagnostic service enables rapid monitoring of a novel aphid-plant interaction

The Royal Horticultural Society’s Gardening Advice Service (GAS) provides >600,000 members access to horticultural advisors including botanists, entomologists and plant pathologists. In the last 15 years, RHS entomologists answered over 37,000 enquiries from members. From this, we gain insight into the status of plant health and

biodiversity in a wide range of UK gardens, which collectively cover 959,800 hectares. Findings regularly include reports of new or regulated species, changing distributions of invasive species and altered ecological interactions.

A current example of how RHS entomologists go from discovery to distribution is that of a recent novel plant-insect interaction observed on *Buddleja*. Reports of unusual distorted and discoloured growth on *Buddleja* began in 2023 and continued in 2024. During this period RHS entomologists worked with the Rothamsted Insect Survey to obtain a tentative identification of melon-cotton aphid (*Aphis gossypii*).

To track the distribution of this phenomenon, the RHS launched an online survey in May 2025. This has the facility for recorders to upload photographs and select whether active aphid colonies are associated with the symptoms. The survey also allows samples to be requested from the recorders, gathering aphid material for identification and future bio-type work.

More than eight thousand reports were received in 2025, indicating the aphid presence and symptoms on *Buddleja* is now very widely distributed in the UK. Utilising this data the RHS, in collaboration with ESRI UK, created a publicly available interactive digital map which visually demonstrates the current distribution of this phenomenon.

Other Authors: Ben Brough (Royal Horticultural Society), Alex Greenslade (Rothamsted Research), Hayley Jones (Royal Horticultural Society)

15:15 – Lewis Armstrong, CABI

Supporting Pest Risk Assessment with Dynamic Data: a case study of *Bactericera cockerelli*

We discuss how critical information on the high-risk pest *Bactericera cockerelli* is developed and maintained within CABI Compendium, and how this supports risk assessment and decision-making frameworks.

Species are prioritised for CABI Compendium using a combination of metrics, including user engagement data, and editorial expertise, alongside external evidence such as priority pest lists and emerging research trends. Once identified, subject experts are commissioned to write or update detailed datasheets.

The *B.cockerelli* datasheet continuously integrates multiple data sources, including distribution data, host associations, pathways of introduction, and economic and environmental impacts. Since 2022, the datasheet has been downloaded over 4,500 times and cited in 11 publications.

As a vector of *Candidatus* Liberibacter solanacearum, *B. cockerelli* poses a potential threat to UK and European agriculture due to climatic suitability and the availability of host crops. As such, it is included in the EPPO A1 Quarantine Pest List and UK Plant Health Risk Register. The comprehensive data provided by CABI, including current distribution, host range, and impact evaluation, can be used to help evaluate introduction pathways, inform pest surveillance strategies, and guide mitigation planning.

This example demonstrates the Compendium's role in providing continuously updated, evidence-based species profiles to support management of emerging and invasive pest threats.

Other Authors: Gareth Richards | Lucinda Charles | Hannah Fielder | James Cullum (CABI)

15:30 – Carolyn Mitchell, James Hutton Institute

Monitoring and control of the Spotted Wing Drosophila in Scotland – development of an integrated pest management system

The Spotted Wing Drosophila (SWD*), Drosophila suzukii,* is an invasive fruit fly which originated in Japan and has since spread globally, first being detected in Scotland in 2014. It is a pest of soft and stone fruit, using its serrated ovipositor to lay eggs in ripening and ripe fruit of many species. Monitoring SWD abundance advances our understanding of the role that meteorological conditions and habitat composition have on annual variation in its population size, enabling targeted control of the adults before they start egg laying. However, current control options are limited and therefore additional control measures are being developed. We will show how understanding the role of berry volatiles in attraction, testing varietal differences in susceptibility to SWD, and the use of dead-end hosts in parallel with the monitoring and modelling of abundance will help growers combat the potential extensive financial losses due to infestation.

Other Authors: Yogeswari Rajarathinam, James Hutton Institute | Pete Skelsey, James Hutton Institute | Jacqui Brandt, James Hutton Institute | Nicola Dempster, James Hutton Institute | Eve Kermally, James Hutton Institute | Roman Arguello, Queen Mary University of London | Alison Karley, James Hutton Institute

- Conservation & Diversity

Large Chemistry Lecture Theatre | Chair: Benjamin Jarrett, Bangor University

16:15 – Christopher Williams, Liverpool John Moores University
Sciomyzidae (Diptera) assemblages in constructed and natural wetlands: implications for constructed wetland design

Constructed wetlands enhance biodiversity in the locations in which they are placed. The results of the present study show that NWs have significantly greater species richness, abundances and diversity of Sciomyzidae flies than CWs. However, although the N and P concentrations were significantly greater in CWs than in NWs, over one third of Irish species of Sciomyzidae was present at CWs. Moreover, seven of the eight CWs hosted species of Sciomyzidae that are listed as "scarce" and "threatened" in Britain by Falk (1991). This conclusion is based only on Irish CWs, but there is no reason to believe that the general trends may not be applicable globally to CWs in general.

These results show that CWs are critical in providing habitat to invertebrates such as Sciomyzidae flies, habitats that may be otherwise absent from the surrounding landscape in which CWs are commonly situated. However, Sciomyzidae species richness was shown to increase as the surrounding area of semi-natural habitat increased. Therefore, in future design of CWs, the incorporation of areas of semi-natural habitats such as wet grasslands and wet woodland habitats immediately adjacent to the CWs is advised to enhance Sciomyzidae assemblages which are known bioindicators of dipteran communities in wetlands.

16:30 – Hugh David Loxdale, School of Biological Sciences, University of Cardiff
Positive & Negative Ecology, with special reference to butterflies

Animal populations, even among common species, often exhibit demographic heterogeneity, particularly in systems with metapopulation-like structures. In such cases, geographically distinct subpopulations may experience varying levels of inbreeding due to limited exchange, despite apparent dispersal ability.

A related phenomenon, termed "negative ecology," describes situations where species show fragmented distributions within small geographic areas (<20 km²) even when suitable habitat exists. These patterns differ from classical metapopulation dynamics because even highly mobile species, such as birds, should be able to move between

patches. Similar distributional gaps occur at larger spatial scales (>100 km²), as observed in birds and butterflies, indicating that underlying abiotic or biotic constraints structure these patterns.

Understanding these constraints is critical for conservation, particularly for species reintroductions. The concepts of positive (extant) and negative (locally absent or extinct) ecology suggest that historical presence does not ensure successful recolonization. Environmental conditions, species interactions, or other limiting factors may prevent persistence in habitats that appear suitable.

This talk explores the implications of negative ecology, focusing on British butterflies, where species may fail to persist in locations they once occupied or still inhabit nearby. Comparable patterns have independently been described in plant communities as "dark diversity, e.g. in Nature, May, 2025.

16:45 – Lydia Thompson, University College Dublin
Genomic insights into rarity and resilience: population structure and genetic diversity in two threatened Irish bumblebees

Pollinators are experiencing widespread declines globally, yet the genetic consequences of population fragmentation remain poorly understood for many species of conservation concern. In Ireland, the Great Yellow Bumblebee, *Bombus distinguendus*, and the Moss Carder Bee, *Bombus muscorum*, are important components of coastal grassland ecosystems but face ongoing pressures from habitat loss, land-use change, and environmental stressors. Understanding patterns of genetic diversity and connectivity within and among populations is essential for informing effective conservation management.

This study uses population genomic approaches to investigate genetic variation across populations of *B. distinguendus* and *B. muscorum* in western Ireland. Samples were collected from multiple locations, including the Mullet Peninsula, Achill Island, and mainland Mayo. Genomic DNA was extracted and sequenced to generate genome-wide markers for population genetic analyses. Planned analyses include assessments of genetic diversity, population structure, genetic differentiation, relatedness, effective population size, and connectivity among populations.

By comparing genomic patterns between a rare specialist species and a more widespread coastal species, this research aims to provide new insights into the processes shaping population persistence in fragmented landscapes. The findings will contribute to the conservation of threatened pollinators in Ireland and improve our understanding of how species respond to environmental change at the genomic level.

Other Authors: Julia Jones, University College Dublin | William Nash, University of East Anglia | Dara A. Stanley, University College Dublin

17:00 – Heather Campbell, Harper Adams University
Promoting insect conservation through primary school teaching

Conservation outcomes are strongly influenced by public perceptions of insects, and education may play an important role in promoting positive attitudes and conservation behaviours. However, there is limited understanding of how insect diversity and conservation are incorporated into primary education in the UK, and what barriers teachers face in delivering these topics. We used an online questionnaire and semi-structured interviews with primary school teachers to examine the use of insects in classroom teaching. Two-thirds of teachers reported using fewer than four insect taxa in their teaching, with bees, bumblebees, butterflies, moths and caterpillars being the most frequently represented groups. Insects were primarily used to teach topics including habitats, life cycles and food chains, although approximately half of teachers referred to insects less than once per month. Teachers generally expressed positive attitudes towards insects and recognised their value as educational tools and as a focus for conservation engagement. The principal barriers identified were limited curriculum time, insufficient training, lack of funding and curriculum restrictions. We provide recommendations to support greater integration of insects into primary education and strengthen insect-focused conservation engagement among young learners.

Other Authors: Daniela Tomasovicova, Harper Adams University

17:15 – Kelly Jowett, Rothamsted Research
Capturing biodiversity in farmland: informing better practice

Biodiversity trading, environmental requirements for farm subsidies, and increasing interest in 'regenerative' agriculture are driving demand for indicators that show the impact of agricultural interventions on biodiversity. Building on this momentum is important, both to inform scientific knowledge and build mutually beneficial solutions – but also to champion insects as ecosystem service providers and promote their conservation.

Ecologists may work with single farmers, clusters, networks, industry partners, or wider society. Technology is opening doors to revolutionise techniques as well as ways to share and assess data – the problem lies in knowing what is appropriate and effective. This talk will showcase work with farmers on innovative approaches, new protocols,

and citizen science approaches – feeding into the debate on capacity of monitoring to deliver meaningful data for both adaptive management and wider assessment of interventions.

More meaningful than this perhaps is the assessment of attitudes and behaviours that govern practice. Our social science findings show potential for the motivations of farmers to leverage monitoring for more positive change. Therefore, the measurement of biodiversity will be set in the context of outcomes, changes in practice that start with capturing hearts and minds – as well as insects.

Other Authors: Jon Storkey, Rothamsted Research | Sam Cook, Rothamsted Research

17:30 – Alice Walker, University of Edinburgh

Habitat condition assessments poorly capture hedgerow quality for wild pollinators

To tack progress towards biodiversity goals and guide local management, there is an increasing need for ecological monitoring which is effective but also simple and cost-effective. Standardised metrics, termed here as habitat condition assessments, aim to address this demand. However, despite the uptake of habitat condition assessments by governments and the financial industry, studies investigating their effectiveness for key taxa, such as wild pollinators, are limited.

This study examines whether wild pollinator groups are adequately represented by three UK assessments: England's Biodiversity Net Gain (BNG) statutory biodiversity metric and NatureScot's Basic and Advanced habitat assessments in Scotland.

Focusing on hedgerows in Scotland's farmland, we found these assessments generally failed to reflect hedgerow quality for wild pollinators: no relationships were found with the abundance or species richness of foraging bumblebees, butterflies or floral resources, and only weak positive associations were detected for foraging hoverflies.

Our findings add to growing evidence that habitat condition assessments may not reliably capture key invertebrate groups, and for the first time extend these concerns to hedgerow habitats and pollinators groups across various habitat assessments. Based on the results presented in this study, we suggest improvements including integrating floral resource metrics or conducting complementary pollinator surveys.

Other Authors: Dr Lorna Cole, SAC Consulting | Dr Gail Jackson, University of Edinburgh | Dr Hannah Wauchope, University of Edinburgh

- IPM & Pest Control 2

Small Chemistry Lecture Theatre | Chair: Helen Roy, UKCEH and University of Exeter

16:15 – Helen Roy, UKCEH and University of Exeter

Predicting and mitigating pest insects on the horizon: case study from small island nations

Invasive alien species (IAS), which includes some pest insects, are a major and growing threat to people and nature. Target 6 of the Global Biodiversity Framework (GBF) commits nations to reduce the introduction of IAS by 50 percent and minimize their impact. Effective biosecurity, and specifically preventing the arrival of IAS, is critical to achieving Target 6. Collaborative horizon scanning studies, combining impact assessments and expert elicitation, are used to inform biosecurity by predicting which species might be the most likely to arrive and impact biodiversity and ecosystems. We have applied this approach to inform prioritisation of preventative actions for IAS in Britain and across the UK Overseas Territories. Here we provide an overview of the invasive alien insects that are considered to be amongst the high-risk species in different contexts including islands.

We highlight the importance of early warning and rapid response for mitigating the impacts of IAS. We call on everyone to contribute information about alien species rapidly through national and regional information systems. Enhancing information and data flows leads to improvements in predictions to inform prioritisation and action. Curbing the threat of INNS, including pest insects, is urgent but achievable.

Other Authors: Aileen Mill (University of Newcastle) | Wayne Dawson (University of Liverpool) | Rhiannon Austin (RSPB) | David Roy (UKCEH) | Emily Williams (UKCEH) | Kelly Martinou (Joint Services Health Unit, Cyprus) | All the partners across the Caribbean UK Overseas Territories

16:30 – Lauren Diepenbrock, University of Florida Citrus Research and Education Center

Exploring a novel management tool for Chilli thrips, *Scirtothrips dorsalis*

Insecticide-treated netting offers a promising Integrated Pest Management (IPM) strategy by excluding or killing pests through immediate contact and/or sublethal effects. LLINs (Long-Lasting Insecticidal Nets) have been effective in reducing malaria vectors for over two decades and have been more recently explored in agriculture to

protect crops. This study aims to assess the efficacy of four commercially available LLINs against adult chilli thrips (*Scirtothrips dorsalis*), a major greenhouse pest in the USA. Chilli thrips were directly exposed to each net type using Munger cells with cotton leaves as host plant tissue, with mortality assessed after 1, 3, 5, 7, and 10 days of exposure.

The results showed that PermaNet® 3.0 (Blue net, deltamethrin + PBO), PermaNet® 45 (Black net, deltamethrin + PBO), and PermaNet® Dual (White net, deltamethrin + chlorfenapyr) treatments were the most effective, achieving near-total mortality (near 100%), while Carifend® (Alpha-cypermethrin) and control groups had lower but variable mortality. Mortality also increased consistently with longer exposure times, indicating that both treatment type and duration are critical determinants of treatment success.

This research provides valuable insight into the potential of insecticide-treated netting as a pest management tool to combat the detrimental effects of chilli thrips on economically important crops.

Other Authors: Zahra Torkaman, University of Florida | Megan Dewdney, University of Florida

16:45 – Junho Yoon, Lund University

Synergistic transition from type-I-like to type-II-like symptomology in a pyrethroid mixture and its impact on knockdown–mortality relationships in *Musca domestica L.*

Knockdown effect, especially in pyrethroid-based household and public insecticides, is often considered a practical indicator of insecticidal efficacy. However, whether faster knockdown implies lethality remains uncertain because the relationship between the two effects has not been systematically explored. This study examined whether knockdown speed is associated with mortality across type-I pyrethroids, type-II pyrethroids, and organophosphate insecticides in housefly. For type-I pyrethroids, faster knockdown did not predict higher mortality. Not all houseflies knocked-down relatively early did not exhibit lethality. In contrast, type-II pyrethroid and organophosphate insecticides showed a positive knockdown-mortality relationship, with most lethal individuals being knocked-down early.

In the mixture study, d-phenothrin was additive to prallethrin but synergistic to tetramethrin, although three compounds are type-I pyrethroids. Computer vision–based analyses using a convolutional neural network of symptomology revealed synergistic shift in intoxication phenotype from type-I-like to type-II-like symptoms in

the synergistic d-phenothrin and tetramethrin mixture. In conclusion, Knockdown speed should not be used as a proxy for lethality for type-I pyrethroids, highlighting class- and mixture-dependent dynamics between knockdown and mortality. These findings support regulatory and operational decisions that consider knockdown and mortality as distinct performance endpoints, particularly when substantiating claims such as “quick kill” or “kills on contact” for pesticide registration.

Other Authors: Jun-Hyung Tak, Seoul National University

17:00 – Elsa Heywood, University of Oxford
Environmental experience shapes innate parasitoid behaviour

Parasitoid wasps are important biological control agents which offer a sustainable alternative to chemical pesticides, yet they often fail to achieve effective pest suppression in the field. Because parasitoids are typically mass-reared under simplified laboratory conditions that differ substantially from the complex environments encountered after release, adult environmental experience (or lack of it) may contribute to differences in behavioural performance.

Whether experience of sensory and structural complexity affects innate parasitoid foraging behaviour is unknown. Here, we exposed aphid parasitoids *Aphidius ervi* and *Aphelinus abdominalis to* environments varying in structural and olfactory complexity and assessed subsequent host-searching and parasitism behaviour.

Prior environmental experience significantly influenced behaviour, although responses differed between species. Plant-associated odours reduced host-approach and attack times in *A. ervi* only, while structural complexity consistently increased parasitism success and number of offspring in both species.

Our results demonstrate that adult environmental experience can shape innate parasitoid foraging behaviour and suggest that structural enrichment may improve the performance of biological control agents.

Other Authors: Supervised by Ailsa McLean, Irem Sepil, and Geraldine Wright, University of Oxford

17:15 – Abhinav Maurya, Apex Bait Technologies, Inc.

OliveGard: a reduced-risk attract-and-kill liquid bait for olive fly (*Bactrocera oleae*) management

Olive fly remains a major pest of olive production, and current management programs rely heavily on broad-spectrum insecticide sprays. We developed OliveGard, a novel liquid attract-and-kill bait designed to improve olive fly control while reducing non-target exposure. The formulation combines a palatable bait matrix and a proprietary three-component olive fly attractant blend identified from olive-associated volatiles. OliveGard contains a reduced-risk toxicant to eliminate the attracted olive flies.

Laboratory and semi-field assays showed that the OliveGard bait base was consumed significantly more than honeydew, a natural sugar source for olive flies. Incorporation of the volatile attractant blend significantly increased olive fly attraction and trap catch compared with the bait base alone. OliveGard containing 5% boric acid was 2.5-fold more attractive than Torula yeast solution and 10-fold more attractive than GF-120® bait in choice assays. Field evaluations further indicated that the olive fly-specific attractant blend did not increase the attraction of non-target pests.

These results support OliveGard as a promising, selective, and IPM-compatible liquid bait for sustainable olive fly management.

Other Authors: Saravan Parepely, Apex Bait Technologies Inc. | Dangsheng Liang, Apex Bait Technologies Inc.

17:30 – Amy Bateman, University of Bristol

Sublethal effects of a novel 'bee-friendly' pesticide on a beneficial parasitoid (*Aphidius ervi*) and biological control efficacy

Insect populations have experienced significant declines in recent decades, threatening ecosystem stability and the delivery of key ecosystem services. Pesticide use is considered a major driver of these declines due to neonicotinoids and other broad-spectrum pesticides causing lethal and sublethal effects in beneficial insects. Restrictions to neonicotinoid use have led to the introduction of "safer" replacements including flupyradifurone.

However, studies, largely focused on bees, suggest that many of these replacements may also have detrimental impacts on non-target organisms. The current study investigated the sublethal effects of flupyradifurone on a beneficial non-bee Hymenopteran, *Aphidius ervi,* and its capacity to perform biological control services. Females were exposed orally to sucrose solutions containing either 1.6ppm or 4.3ppm

of flupyradifurone and the effects on longevity, parasitism rate, egg load and egg volume were assessed.

By evaluating the impacts of this novel insecticide on a non-bee hymenopteran biological control agent, this research will determine if flupyradifurone (Sivanto Prime) is safe to use in integrated pest management alongside *Aphidius ervi* in the control of aphid infestations on sugar beet crops.

Other Authors: Harry Siviter, University of Bristol | Lucy Alford, University of Bristol

- SYMPOSIA: Direct & indirect effects of anthropogenic global change on insects

Sir Stanley Thomas Lecture Theatre | Chairs: Shannon Murphy, University of Denver and Sheena Cotter, University of Lincoln

16:15 – Mariana Abarca, Smith College

Host expansions and resilience: Can a wetland butterfly venture into drier habitats?

Baltimore Checkerspot butterflies (*Euphydrias phaeton*) have a native (white turtlehead, *Chelone glabra*) and an introduced (English plantain, *Plantago lanceolata*) oviposition host that differ in nutritional quality. The native host allows for increased larval resilience to thermal stress and larger pupal mass than the introduced host. Global change drivers have resulted in scarcity of the native host, which is a wetland specialist, and the proliferation of the novel host, which can grow both in wet and dry environments.

We performed a field experiment to investigate whether *E. pheateon* would be able to survive under the drier conditions that allow for the persistence of its novel host. We deployed 800 larvae at a naturally occurring humidity gradient including the range of conditions that allow for establishment of the novel host and assessed their overwinter survival and performance. Caterpillar survivorship varied across sites from 24% to 31% regardless of soil humidity levels. By contrast, plant survivorship at drier conditions was only 60% while at the wetter sites it ranged from 90% to 100%. Our results show that while larvae are capable of surviving at drier conditions, their persistence in these areas could be hampered by host plant quantity and quality.

Other Authors: Caroline Curtis

16:30 – Luke Crosby, University of Lincoln

Direct and indirect effects of climate change on insect reproduction

Rising temperatures have negative consequences on animal reproduction, including for insects. Evidence of negative effects span across reproduction, from pre-copulatory traits such as mate choice, mate competition, and copulation to post-copulatory traits, such as sperm competition and fertilisation success.

Here we review how insect reproduction is being disrupted by average temperature increases and heatwaves both directly and indirectly via carryover effects. Using the large white butterfly, *Pieris brassicae*, as a case study, we show how even in this warm-adapted species, both survival and reproduction are affected.

Other Authors: Stuart Humphries | Sylvain Pincebourde | Graziella Iossa

16:45 – Mayra Vidal, University of Massachusetts Boston

Quantitative synthesis of the effects of drought on community composition and species interactions in terrestrial ecosystems

Droughts are expected to intensify globally and can strongly affect organismal survival and population dynamics, potentially altering terrestrial communities and ecosystems. Understanding how drought influences communities is therefore critical for predicting and mitigating its impacts. Here, we conducted two meta-analyses that evaluate two components of communities: community composition and species interactions. By synthesizing experimental and observational studies across terrestrial ecosystems, we show that while drought consistently restructures community composition, its effects on species interactions are more heterogeneous, revealing a decoupling between community reorganization and interaction dynamics.

Specifically, we found negative effects on species richness, and on plant and arthropod community composition, and predation and decomposition were more likely to be negatively affected by drought. Additionally, community composition was most altered in grasslands and boreal forests, whereas trophic interactions in forests consistently weakened under drought, reflected as reduced rates of predation, herbivore attack, and litter consumption. Although we consistently found negative effects, we also identified cases where drought had no overall effect, suggesting the potential resilience of some communities and trophic interactions. Overall, our meta-analyses demonstrate that drought can disrupt ecological communities on a global scale and underscores the importance of targeted monitoring of drought effects in terrestrial ecosystems.

Other Authors: Mattheau S. Comerford, Kate Nash, Averie St. Germaine, Colin Andrews, Tyler S. Barr, Jonathan Dain, Alyssa Gonçalves, Amy, Jones, Cooper Kimball-Rhines, William Maguire, Alexander Richards, Emma Schneider, Alexis Wilkes

17:00 – Daniel Leybourne, Liverpool University and The Agri-Food and Biosciences Institute

The structure and functioning of the agricultural landscape can influence the formation of microbial partnerships in herbivorous insects

Many insects form intimate associations with microbial partners, spanning a continuum from obligate mutualisms to transient associations. These microbial partners confer a range of functional benefits, including protection from natural enemies, detoxification of plant secondary metabolites, and improved fitness.

The prevalence and abundance of microbial symbionts can vary between insect populations, indicating that the insect-microbe relationship is influenced by external factors. However, little is known on the factors that determine the assembly, structure, and composition of the microbiome of herbivorous insects.

We posit that the factors influencing the insect-microbe relationship occur at the landscape-scale, acting through a combination of bottom-up, top-down, and indirect effects between plants, herbivores, and their natural enemies. We test this in two agro-ecosystems by sampling individual insects from three sap-feeding and one leaf-chewing species.

Our results explicitly show that habitat configurational complexity and the proportion of host-plant crop in the landscape, combined with natural enemy abundance, can act as direct and indirect drivers of microbial symbiosis in herbivorous insects. This highlights the wider implications landscape change and

Other Authors: Dr Sharon Zytynska (Manchester University, UK) | Prof Emily Martin (Giessen University, Germany)

17:15 – Sofia Gripenberg, University of Reading (School of Biological Sciences)

Aphid and parasitoid responses to drought: A role for bacterial endosymbionts?

As the climate changes, many regions are likely to experience more frequent and severe droughts. While drought-mediated changes in plants can affect both herbivorous insects and their parasitoids, the potential for bacterial endosymbionts to influence insect responses to drought remains largely unexplored. We investigated

how drought experienced by host plants (*Vicia faba*) affects the survival and fecundity of aphids (*Acyrthosiphon pisum*) and their susceptibility to parasitism by *Aphidius ervi* (Braconidae).

Our experiments included aphid lines carrying facultative bacterial endosymbionts as well as their non-symbiotic counterparts. There were no clear and consistent effects of studied endosymbionts (*Hamiltonella defensa*, *Regiella insecticola* and *Serratia symbiotica*) on aphid survival and fecundity under drought. In the absence of endosymbionts, parasitism rates by *A. ervi* were lower on aphids from drought-stressed plants than on aphids from well-watered control plants, while endosymbiotic aphids showed extremely high levels of parasitoid resistance on both well-watered and drought-stressed plants.

Our results suggest that the responses of aphid populations to drought are likely to be driven primarily by altered (lower) rates of parasitism in endosymbiont-free lines, and that endosymbiont-mediated protection against parasitism persists under drought. Further work is needed to confirm the generality of these findings.

Other Authors: Jetta David | Rusdi Hidayat | Ailsa McLean, Glyn Barrett

17:30 – James Gilbert, University of Hull

Multi-faceted effects of climate warming upon mason bee reproduction

Heatwaves and extreme weather events are increasing in frequency and intensity. Understanding how climatic stressors disrupt species' reproduction is crucial, particularly for ectothermic insects. Wild bees provide important ecosystem services - but are impacted by human-induced changes in temperature and land use. *Osmia bicornis* (red mason bee) larvae develop inside cavities during early summer, and rely solely on pollen gathered by their mother, leaving them vulnerable to heat and nutritional stress.

First, we subjected *O. bicornis* larvae to a simulated 3-day 40°C heatwave, and assessed fertility in overwintered adults. Males suffered a 33% drop in sperm numbers and a 50% drop in sperm viability compared to controls developing without a heatwave. Thus, extreme weather events during development can have lasting effects that carry across into adults. Second, we investigated how nest temperature affected parental provisioning.

We analysed the plant species and macronutrient composition of pollen loads gathered by females provisioning nests held at ambient temperature or heated to two climate-projected temperatures. Females maintained stable macronutrient ratios

across nest temperatures, but provisioned heated nests faster and with different plant species compared to ambient nests. Thus, climate warming may modify the pollination services wild bees provide, with consequences for wild and agricultural ecosystems.

Other Authors: Jamie Smith, Elisa Gomes, Eliza Miller, Elizabeth Duncan, Elizabeth Nicholls, Jeremy Niven

Wednesday 9 September

- Interactions

Large Chemistry Lecture Theatre | Chair: Shannon Murphy, University of Denver

11:00 – Rosy Christopher, Newcastle University

Friend, Foe or Freeloader: Using molecular methods and community science to investigate the ecological outcomes of a potential arachnid-plant commensalism

Non-trophic interactions contribute significantly to ecosystem functioning and may be positive, neutral or negative for either of the interacting parties. Commensalisms are interactions in which one party, the commensal, is benefiting from the interaction, and the other party, the host, is neutrally affected. Despite significantly impacting ecosystem functioning and service provision, commensalisms are scarcely incorporated into wider studies of ecological networks.

Flower crab spiders (*Misumena vatia*) use flower heads as platforms from which to predate flower visitors attracted by the rewards offered by the flower. We can predict the outcome to the flower visitor, but how does this impact the flower, if at all?

Using a combination of spider dietary metabarcoding to detect trophic interactions, surface eDNA from flowers to detect recent visitors and nectar macronutrient analysis to determine nutrient provision, ecological and nutritional networks will be constructed. Alongside community science data and public records of spider-flower-prey interactions, we are investigating the nature, diversity and drivers of the potentially commensal interactions between flower crab spiders and their flowers, and the implications of and for their prey.

Using this model system, we will determine the ecological outcomes of commensalisms, approaches for their integration into wider ecological networks and their implications for ecosystem service provision.

Other Authors: Dr Beatrice Dale (Northumbria University) | Dr Fredric Windsor (Cardiff University) | Dr Darren Evans (Newcastle University) | Dr Jordan Cuff (Newcastle University)

11:15 – Matthew Greenwell, University of Reading
Pre-dispersal insect seed predation patterns in a tropical forest

Specialised natural enemies help maintain the extraordinary diversity of plants in tropical forests by eliciting negative density-dependent recruitment. Previous research has focused on small-scale seed and seedling densities post-dispersal, creating a mismatch between study scales and the spatial scales at which key processes likely operate.

Here, we examine large-scale patterns of insect attack on seeds before dispersal. Host-specific, seed-feeding insects cause significant seed mortality in tropical trees, and if predation rates depend on surrounding conspecific tree densities, pre-dispersal seed predation may be an important, understudied driver of local tree diversity.

To investigate this, we used remote sensing to map reproductive canopy trees across Barro Colorado Island (BCI), Panama. We collected fruits from over 500 trees across six species and reared over 20,000 insects to assess predation rates across host density gradients. We found substantial variation in insect seed predation across BCI, though the effect of adult tree density on predation rates varied between species and levels of insect host-specificity.

Our findings suggests that seed-feeding insects may contribute to tropical diversity enhancement and represents a novel scale for examining the role of natural enemies in maintaining tropical plant diversity.

Other Authors: Matthew Greenwell, University of Reading | Patrick Cannon, University of Reading | Conny Hernandez, Smithsonian Tropical Research Institute | Owen Lewis, Oxford University | Helene Muller-Landau, Smithsonian Tropical Research Institute | Marleny Rivera, Smithsonian Tropical Research Institute | Joseph Wright, Smithsonian Tropical Research Institute | Sofia Gripenberg, University of Reading

11:30 – Junchen Deng, Natural History Museum, University of Copenhagen, Copenhagen, Denmark

Contrasting and convergent patterns of replacements of ancient heritable symbionts by *Ophiocordyceps* fungi in three clades of sap-feeding hemipteran insects

Sap-feeding insects in the order Hemiptera often maintain stable relationships with heritable nutritional endosymbionts for hundreds of millions of years. However, recent replacements of these ancient symbionts by fungi of the genus *Ophiocordyceps*, which contain mostly entomopathogenic strains, have been reported independently in multiple hemipteran clades.

To study how often pathogenic *Ophiocordyceps* fungi become symbiotic and how they evolve with hemipteran hosts, we screened ~450 metagenomic datasets from three Hemiptera clades – planthoppers (Auchenorrhyncha: Fulgoromorpha), cicadas (Auchenorrhyncha: Cicadomorpha), and scale insects (Sternorrhyncha) – representing much of the described diversity, and conducted phylogenomic and functional characterisation of identified fungal strains.

We showed that *Ophiocordyceps* fungi have colonised each Hemiptera clade multiple times independently in different families. Following the original colonisation and adaptation to a symbiotic lifestyle, the fungal symbionts often co-diversified with hosts, although multiple cases of subsequent replacements by other *Ophiocordyceps* strains were also observed.

Regarding the function, fungal symbionts seem to have taken over the nutritional responsibilities of the replaced bacterial symbionts, as indicated by the encoding of sets of essential amino acid biosynthesis genes in their genomes. Our data highlight the evolutionary significance of transitions along the pathogen-symbiont continuum in shaping the evolution of Hemiptera insects with nutrient-limited diets.

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Technology Graduate University, Okinawa 904-0495, Japan | Piotr Łukasik, Institute of Environmental Sciences, Faculty of Biology, Jagiellonian University, Kraków, Poland | João P. M. Araújo, Natural History Museum, University of Copenhagen, Copenhagen, Denmark

11:45 – Leo Carroll, University of Reading

Investigating the impact of drought conditions on aphid pastoral interactions with the black garden ant *Lasius niger*

Aphid-ant interactions have been well documented with many ant species benefitting from the provision of honeydew excreted from aphids, in return defending the aphids from potential predators. This study utilises the aphid rearing ant, *Lasius niger* and black bean aphid, *Aphis fabae* to investigate the impact of drought conditions on these relationships as well as the underlying effect on aphid fecundity and honeydew quality.

This was assessed via the propagation of aphid colonies on fava bean plants undergoing drought protocols and collecting resulting honeydew for chemical analysis and ant preference experiments.

Preliminary results have found that ant preferences align with honeydew derived from well-watered plants, with chemical analysis findings indicating slightly lower overall sugar levels in drought affected samples. Aphid fecundity has ranged sporadically between both sets of treatments; with sharp periods of growth/decline most notable in drought affected plants as well as production of alates. In conclusion, drought conditions may inhibit aphid honeydew quality and resulting ant preferences.

This raises potential implications for pest management as increased alate production may lead to congregation of ant tended aphid colonies on irrigated cropland, limiting the effectiveness of natural pest control measures.

12:00 – Benjamin Midgley, Nottingham Trent University

The effect of heathland habitats on the oviposition of the Silver-studded Blue butterfly (*Plebejus argus*) and the health of associated ant mutualists

The Silver-studded Blue butterfly (*Plebejus argus*) is nationally threatened and has suffered a drastic range decline. There is interest in developing heathland management to promote the species, particularly for reintroductions. To examine their habitat requirements, this PhD project studied the oviposition preferences of *P. argus* using a field survey. *P. argus* is reliant on a mutualism with *Lasius niger* ants, which it

must lay its eggs nearby. Little is understood about how the size of mutualist ant colonies affects this relationship and if *P. argus* can assess for host quality. This has implications for conservation which typically focuses on ant nest density, not health or maturity.

Thus, the study was set out to answer two questions; 1) how are the drivers of oviposition prioritised at different stages of decision making? 2) can *P. argus* select for the quality (ant nest size) of the host? A second field study was carried out to examine how the environment shapes the foraging preferences and size of *L. niger* nests. The results were synthesized to understand the overlap in conservation needs of butterfly and ant. This PhD project highlights the importance in conservation of considering habitat variation in the outcomes of mutualistic interactions.

Other Authors: Dr Helen Hicks, Nottingham Trent University | Dr Alex Dittrich, Nottingham Trent University | Dr Adam Bates, Nottingham Trent University

12:15 – Lucy Morley, University of Oxford

Spatiotemporal Variation in Tree Phenology and Caterpillar Phenology, Abundance, Diversity and Productivity on Individual Host Oak Trees (*Quercus robur*)

Synchrony between phytophagous Lepidopteran larval emergence and host plant budburst is a key determinant of individual fitness, population dynamics, and ecosystem functioning. While associations between tree and caterpillar phenology are well-documented at broad scales, most studies implicitly assume individuals within a site experience a uniform environment, neglecting fine-scale heterogeneity that may substantially alter trophic interaction outcomes. We quantified spatiotemporal variation in tree and caterpillar phenology, abundance, diversity, and herbivory across individual oak (*Quercus robur*) trees at Wytham Woods, UK, over three consecutive springs (2023–2025), using drone-derived NDVI to estimate tree phenology and water trap sampling to characterise caterpillar communities. Substantial spatiotemporal variation existed within the site, but at different scales for each trophic level: tree phenology varied strongly among individual trees, while caterpillar phenology and abundance varied more at broader spatial scales within the woodland. Across years, mean phenology of both trophic levels advanced by approximately two weeks, though the strength of trophic relationships at the individual level differed among years. Fine-scale variation in microclimate and canopy composition explained additional variation in both trophic levels. These results suggest that individual-level heterogeneity in host tree phenology shapes local trophic interactions and may buffer consumer populations against climate-driven phenological mismatch.

Other Authors: Ella Cole, University of Oxford | Ben Sheldon, University of Oxford

12:30 – Anna Wright, Royal Botanic Gardens, Kew

Shedding light on the causes of bumblebee mortality under silver lime trees

With observations dating back to the 16th century, the phenomenon of bumblebees, specifically *B. terrestris*, dying under lime trees continues to fascinate the scientific community. Multiple hypotheses have been proposed, including starvation and poisonous nectar; however, research has suggested these unlikely. Unexplored explanations include the effects of silver lime floral volatiles and weather conditions, notably temperature, as higher mortality is observed on warmer days. To better understand this phenomenon, we aimed to investigate the effect of lime floral scent chemicals and temperature on bumblebee behaviour. For this, in temperature-controlled environments, bees were individually placed into glass treatment chambers with volatile dispensers containing different single chemicals (e.g. limonene, linalool, β-ocimene, terpinolene, phenylethyl alcohol, etc.). Our results showed that the type of volatile, concentration, and temperature affected bumblebee behaviour, inducing paralysis.

More specifically, we identified that bumblebees exposed to high concentrations of β-ocimene and terpinolene get 'paralysed', which suggests that some lime floral volatiles have psychotropic effects in bumblebees. Moreover, temperature seems to amplify the effects of floral volatiles on bumblebees, including the likelihood of increased mortality. We hope this research will provide insight into this unanswered phenomenon, which continues to impact our valuable pollinators.

Other Authors: Melina Domínguez-Olivares, Royal Botanic Gardens, Kew | Philip C. Stevenson, Royal Botanic Gardens, Kew | Carlos Martel, Royal Botanic Gardens, Kew

12:45 – Michael Bennett, UK Centre for Ecology and Hydrology (UKCEH) and University of Reading

Metagenome-Resolved Metabolic Dependencies in Honeybee Microbiomes Across Environmental Gradients

Honeybees represent an important model for understanding global pollinator declines, particularly in relation to interacting environmental stressors. A key component of host health is the gut microbiome, which can be influenced by both biotic and abiotic factors, including disease, pesticide exposure, and diet. However, most studies have been conducted under controlled laboratory conditions, limiting insight into how these factors interact at field-relevant scales. This study investigated the metabolic roles of bacterial taxa within the honeybee gut microbiome and how

environmental stressors influence these interactions. Using molecular, metagenomic, and statistical approaches, we analysed bee and honey samples collected from 80 hives across Great Britain.

Metagenome-resolved analysis using SMETANA revealed distinct patterns of metabolic dependency, identifying *Tatumella sp.* as a major metabolite provider and the putative pathogen *Spiroplasma melliferum* as primarily metabolically dependent. Multivariable modelling indicated that pyrethroid exposure and dietary indices were strongly associated with shifts in microbial metabolic dependencies. These findings suggest that environmental factors can alter not only microbiome composition but also functional interactions within microbial communities. This work provides a field-based framework for studying pollinator microbiomes and highlights the importance of environmental context in shaping microbial function and host health.

Other Authors: Susheel Bhanu Bhusi, UKCEH | Lindsay Newbold, UKCEH | Ben Woodcock, UKCEH | Soon Gweon, University of Reading

- Methods, Management & Monitoring

Small Chemistry Lecture Theatre | Chair: Lucy Alford, University of Bristol

11:00 – Laura Sharp, Scotland's Rural College (SRUC)

Turning down the heat: does reduced-intensity prescribed burning have conservation potential for moorland moths?

Moorland moths have undergone substantial declines, yet the drivers remain poorly understood. Across UK uplands, heather moorland is extensively managed for grouse shooting through prescribed burning (muirburn), a disturbance regime that alters vegetation structure and composition across a habitat that supports over 100 Lepidoptera species. Despite growing scrutiny of muirburn for its wider ecological impacts, empirical evidence linking burning regimes to moth community responses remains limited.

From June to September 2025, vegetation structure, plant community composition, and moth assemblages were compared in burned and unburned heather moorland across Cairngorms National Park using a paired-plot design. Preliminary results indicate that moorland moths may benefit from the de-intensification of prescribed burning practices. Building on these findings, fieldwork in 2026 will quantify how burn intensity and time since burn influence moth abundance, diversity and community structure.

This study represents one of the first field-based efforts to assess how burning intensity shapes moorland moth assemblages and to examine the potential conservation implications of less intensive, adaptive burning regimes in managed upland ecosystems.

11:15 – Will Dawson, Newcastle University & Fera Science Ltd.
Noisy Eaters: Integrating ecoacoustics and DNA metabarcoding to construct soil invertebrate trophic networks for scalable and context-rich biomonitoring

Monitoring soil invertebrate trophic networks remains difficult despite its importance for assessing ecosystem resilience. Ecoacoustics is increasingly used to monitor soil invertebrate communities and interactions but poorly resolves species' identities. Molecular methods like DNA metabarcoding can accurately identify species but lack context. Integrating the contextual information from ecoacoustics with taxonomic resolution from metabarcoding could enable accurate and streamlined monitoring of soil trophic networks.

This presentation will demonstrate how ecoacoustics can be integrated with molecular methods to construct soil trophic networks for scalable and context-rich biomonitoring. Using soil ecoacoustics, eDNA metagenomics and dietary DNA metabarcoding, we are constructing soil trophic networks to investigate the effect of fertiliser intensity on soil invertebrate interactions, and the complementarity of these methods for network construction.

Year-round monitoring data from a long-term fertiliser experiment will demonstrate how fertiliser impacts soil invertebrate communities, and if ecoacoustics and metagenomics can be used together for network inference.

We will also share initial insights from this experiment and wider conceptual advances from the project.

Integrating ecoacoustics with molecular methods presents unprecedented potential for monitoring soil invertebrate communities. Our data presents a unique opportunity to demonstrate this potential and enhance our understanding of land management impacts on soil invertebrate trophic networks.

Other Authors: Primary Supervisor Dr Jordan Cuff (Newcastle University)
Other supervisors: Prof Darren Evans (Newcastle University) | Dr Carlos Abrahams (Nottingham Trent University) | Dr Larissa Collins and Dr James Kitson (Fera Science Ltd.)

11:30 – John Bloomfield, University of Reading

Citizen science records reveal how insects have responded to a warming climate in Britain over the last 45 years

Unstructured occurrence records, often from citizen science, offer great potential to understand the impacts of climate change on insect species, but patterns can be obscured by changes in sampling. We demonstrate a simple sub-sampling scheme to reduce temporal biases in citizen science observations resulting in data suitable for analysis of climate-driven phenological change. We then apply this scheme to two complementary case studies. In the first, we show that earlier and shorter flight periods of the Dark-edged Bee-fly (*Bombylius major*) correlate with climate warming and that maximum rather than average monthly temperatures are more influential on the phenological changes. In the second case study, we describe how spring emergence and autumnal onset of dormancy for 17 species of British ladybird have changed under climate warming.

We describe how they have tracked (or not) their thermal and daylength niches associated with these life events and show how this tracking is partitioned between a combination of phenological change and poleward migration. We end by briefly discussing the potential for the application of the data sampling approach to a wider range of citizen science insect observation datasets and research questions.

Other Authors: Diana E Bowler[2] | Sofia Gripenberg[1] | Martin C Harvey[2] | Robin Hutchinson[2] | Helen E Roy[2]
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11:45 – Alicja Witwicka, Wellcome Sanger Institute

BIOSCAN UK: Scaling up spatio-temporal insect diversity monitoring through specimen-level DNA barcoding

Insects are critical for sustaining ecosystems and supporting agricultural productivity. However, habitat loss and climate change have driven alarming declines in insect diversity and abundance. Existing monitoring frameworks lack the spatio-temporal coverage and taxonomic resolution needed to characterise these declines and devise appropriate conservation strategies.

BIOSCAN addresses these challenges by pioneering a large-scale biomonitoring network for flying insects. Through standardised monthly sampling at dozens of sites

across the UK, BIOSCAN generates specimen-level COI barcodes using non-destructive DNA extraction, ensuring accurate abundance measurements and specimen preservation for future phenotypic integration. As of June 2026, we have data from over 1000 24-hour trapping events across 101 Malaise traps, yielding COI barcodes for over 250,000 insects classified into 13,144 unique operational taxonomic units.

Using these data, we show how temperature variation and land cover configuration modulate the taxonomic and functional diversity of insects across the UK. We further demonstrate BIOSCAN's value in enriching COI reference databases, especially for poorly represented taxa, generating reference genomes, and producing population genomic data. Together, these results highlight the versatility of BIOSCAN in addressing ecological and evolutionary questions, and offer a blueprint for leveraging large-scale biodiversity datasets to inform conservation in a rapidly changing world.

Other Authors: Lyndall Pereira da Conceicoa, Wellcome Sanger Institute
Mara Lawniczak, Wellcome Sanger Institute
Wellcome Sanger Institute BIOSCAN Collective
UK BIOSCAN Partner Consortium

12:00 – Jamie Alison, Aarhus University
Insect monitoring without pitfalls: seven steps for robust insect sensing systems

Data shortages fuel controversy about an ongoing insect biodiversity crisis. Insects are immensely diverse and functionally critical for ecosystems, yet data on their trends remain patchy and biased. Sensors, ranging from camera-equipped light traps to weather radar stations, as well as AI models, are set to transform data collection in entomology. However, deployment of sensing systems is not well co-ordinated, and the risks of relying on AI are overlooked or understated.

In this presentation, we trace a seven-step path towards an effective transnational rollout of insect sensing systems. Step (1) reviews strengths, weaknesses and synergies across visual, acoustic, radar and photonic sensors; (2) confronts species determination, suggesting how to improve identification and make use of uncertain data; (3) promotes creating and sharing standardised, labelled data for ecological insights and AI development; (4) ensures AI is used to complement other approaches, both human and digital; (5) highlights how and why AI models can fail, calling for shrewd approaches to model training and evaluation; (6) aims to break barriers to wider uptake of technologies. Finally, (7) concludes that any revolution in insect monitoring must be grounded in good sampling design and established monitoring schemes.

Other Authors: Luca Pegoraro, Swiss Federal Institute for Forest Snow and Landscape Research; Jarrett Blair, Aarhus University; Yuval Cohen, University of Haifa; Birgen Haest, Swiss Ornithological Institute; Jacob Idec, University of Florida; Jacob Kamminga, University of Twente; Jenna Lawson, UKCEH; Meng Li, Lund University; Leandro Aparecido Do Nascimento, Map of Life; Charlotte L. Outhwaite, Zoological Society of London; Benjamin Rutschmann, Agroscope; Maximilian Sittinger, Helmholtz Centre for Environmental Research, German Centre for Integrative Biodiversity Research; Mariana Abarca, Smith College; Tom August, UKCEH; Quentin Geissmann, Aarhus University; Rob Guralnick, University of Florida; Guillaume Mougeot, Aarhus University; Valentin Ștefan, Helmholtz Centre for Environmental Research, German Centre for Integrative Biodiversity Research, Martin-Luther University Halle-Wittenberg; Kim Bjerge, Aarhus University; Mikkel Brydegaard, Lund University; Toke Thomas Høye, Aarhus University; Eva Knop, University of Regensburg, University of Zurich; William Kunin, University of Leeds; Moritz Lürig, University of Florida; David Roy, UKCEH; Asger Svenning, Aarhus University; Roel van Klink, German Centre for Integrative Biodiversity Research, Martin-Luther University Halle-Wittenberg

12:15 – Beulah Garner, Natural History Museum, London

The future of entomological databases

For much of the history of entomology, the priority was simple: generate more data. As field surveys expanded, specimen collections grew, and digitisation and genomics accelerated, decades of morphological records, georeferenced observation, DNA barcodes and phylogenetic datasets accumulated at scale. These data were then deposited in dedicated databases, each designed for different purposes, leaving biodiversity knowledge fragmented across incompatible systems; each perform an important role, yet they remain only partially connected.

The challenge now is integration around a unifying framework of biodiversity research based on evolutionary principles. This talk will describe a strategy for moving beyond the scattered, independent databases (genomics, barcodes, digital geographic records, images, taxonomy) towards an unified species level tree-of-life. We introduce the SITE-100 database, designed to address this integration challenge, encompassing samples of entire insect communities from high biodiversity tropical sites. These samples are imaged, selectively sequenced for genomes and mitogenomes, and full communities are (meta)barcoded. This provides a scaffold for integration of data from other sources (iNaturalist, BOLD, NCBI, GBIF, ENA, Open Tree of Life, taxonomy databases), displaying phylogenetic trees and associated geographic maps in a user-friendly interface. The combined maps and phylogenetic trees provide the elusive taxonomic integration for entomological research and conservation.

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12:30 – Gideon Gywa Deme, TCSMT, University of Turku and University of Jos

Importance of digital ecology for improved insect species conservation efforts in the tropics

Species occurrence records on conventional databases have arguably become important tools in assessing biodiversity. However, the exciting research opportunities presented by these conventional databases have resulted in biased, unintended records, which can impact our insect biodiversity assessments and global conservation efforts. Analysing the insect records on GBIF using generalised linear mixed models, with continents as explanatory variables to understand the differential global insect occurrences as represented in GBIF. Insect species abundance and richness as recorded on GBIF were higher in continents found in temperate regions, with few insect species found in the tropics.

However, in another study with colleagues, we found that insect records from the tropics on social media, such as Facebook, increased occurrence records by 35%, and the proportion of social media data was higher in countries poorly represented in GBIF. Interestingly, we were able to obtain new distributional information for the rapidly range-shifting butterfly, the tawny coster (*Acraea terpsicore*). The combined implication of these two studies showed that digital ecology may be an unexplored area for global evidence-based conservation of insects, particularly for the understudied biodiversity-rich tropical countries.

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12:45 – Filipe Machado França, University of Bristol (UoB) and Federal University of Pará (UFPA)

Six taxa, three continents: lessons from building a pan-tropical insect monitoring network

Insects comprise most of the described species and underpin ecosystem functioning and human well-being. Tropical forests are global hotspots for insect diversity and increasingly threatened by land-use and climate change. While mounting evidence points to insect declines, tropical data remain sparse and poorly replicated, limiting our ability to draw global conclusions. Our PanTropIn project addresses this gap through standardised sampling of ant, butterfly, dung beetle, moth, sarcosaprophagous fly, and stingless bee communities within 145 sites across Amazonian, Ghanaian and Malaysian forests – directly tackling the grand challenge of establishing a global insect monitoring network.

This ambition brings real challenges: (1) taxonomic impediments in hyperdiverse systems, met through close partnership with local taxonomists; (2) avoiding colonial research dynamics, by recognising local scientists as intellectual partners rather than data collectors and investing in capacity-building for future entomologists; (3) navigating the Nagoya Protocol and national legislation governing sampling, transport, and import/export of biological material; (4) integrating multiple disciplines to understand insect biodiversity changes, and (5) securing funding at a scale that matches the ambition. Overcoming these barriers is essential not only logistically, but to ensure monitoring data that are scientifically robust, equitably produced, and genuinely actionable for tropical conservation efforts and policy.

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- SYMPOSIA: Celebrating 200 Years of Entomology (Part I)

Sir Stanley Thomas Lecture Theatre | Chairs: Jane Hill, University of York and Chris Lyal, Entomological Club

11:00 – Chris Lyal, The Entomological Club

The Entomological Club: Entomology over 200 years and beyond

The oldest functioning entomological society in the World is 200 years old this year. The Club has included in its membership (limited to 8!) amateurs, professionals, researchers of national and international status, and across all entomological disciplines. For all this time they have met socially to share insights and enthusiasm.

The topics of their conversations have moved from simple collecting and observations, though the novel theory of evolution to phylogenetic systematics, and to diversity studies, ecology, physiology, conservation, human insect vectors, and the

whole range of studies and priorities we see today. As membership changes over time so does the conversation, and so do the projects the Club supports and in which members engage. Two hundred years ago it might have been possible for individual entomologists to be knowledgeable about all aspects of the subject and maybe predict future developments. Today this would be a significant challenge. However, with diversification of the subject it becomes increasingly important for us all to have some awareness of developments and future prospects, and the possibilities of synergy between different areas.

11:15 – Charles Godfray, Oxford University
200 years of entomology and what comes next

In this opening talk of the session celebrating 200 years of the Entomological Club I will explore how insect science has changed over that time, discussing topics such as the expansion and funding of the subject, and the evolving interplay between the citizen and professional entomological communities.

I will then look ahead and argue that entomology will be very different 20 let alone 200 years hence, driven by accelerating advances in the digital and molecular worlds, and that the transformation will (probably!) be for the good.

11:45 – Tiffany Ki, University of Cambridge
Examining two centuries of change in insects

Specimen collections began as cabinets of curiosities, but proliferated and became more specialised in the 18th and 19th century with advances in taxonomy, botany and zoology. Museum collections today are a vault of historical biodiversity data and, when combined with modern records, allow the reconstruction of biodiversity information spanning more than a century of anthropogenic change. Integrating these long-term records with historical environmental datasets through novel approaches, allows species distribution and composition shifts and morphological change to be revealed.

In this talk, I will draw on examples from recent research on changes in UK and tropical insects over the past two centuries, as well as insights into the future impacts of environmental change.

12:00 – Liam Crowley, University of Oxford

The Darwin Tree of Life Project: How and why we are attempting to sequence a complete regional flora and fauna

The Darwin Tree of Life project is an ambitious attempt to sequence the complete genome of every species of Eukaryotic organism in Britain and Ireland. The project sits at the leading edge of biodiversity genomics and incorporates exciting research and development aspects. The unprecedented number and quality of genomes being produced provides an exciting opportunity for research, with applications across a wide range of areas including genomics, evolution, physiology and conservation. Arthropods in particular provide an especially interesting opportunity for genome-enabled research due to the huge taxonomic and biological diversity of the group.

This talk will give an overview of the project, including aims, process and progress to date. The Wytham Genome Project will be used as an example of a key component of the wider project. We will also explore examples of ongoing genome-enabled research using DToL arthropod genomes, such as investigating the evolution of homeobox and opsin genes in Lepidoptera.

Other Authors: Peter Mulhair (University of Liverpool) | Owen Lewis (University of Oxford) and Peter Holland (University of Oxford).

12:15 – Sam Cook, Rothamsted Research

Back to the Future? Management of insect pests in agriculture: past, present and future

Agriculture is as old as civilization and insect pests have been a constant problem since humans started growing food plants en-masse. I will give a brief history of insect pest management though time and will offer a glimpse of the future. Traditional farming methods and reliance on natural enemies for regulation of insect pests has been gradually replaced with synthetic chemical toxicant insecticides. However, due to resistance, and public pressure for withdrawal following a greater understanding of their unintended consequences, we are now starting to enter the 'post-insecticide' era. Our ability to manage insect pests is being revolutionized by automated methods for identification and monitoring, models for prediction of outbreaks in time and space as well as molecular methods for targeted control. As for natural enemies - we are going 'back to the future' in terms of our reliance on them, but we need to be armed with greater knowledge of the ecological interactions needed to optimize their efficacy.

12:30 – Sarah Meredith, Royal Entomological Society

The impacts of advancing insect science and knowledge on the conservation of Large blue butterfly (*Phengaris arion*) over the past 200 years

Over the last 200 years the UK has witnessed the decline and extinction of the iconic butterfly *Phengaris arion,* but detailed ecological research over the past 60 years has enabled *P. arion* to be re-introduced. Advancements in scientific knowledge has enabled the successful conservation of this species in two landscapes.

P. arion was first documented in the 1790s by William Lewin, all knowledge about its life history and distribution came from collectors. In the early 1900s Purefoy, Frohawk and Chapman made the groundbreaking discovery that *Myrmica* ants were involved in *P. arion*'s lifecycle. *P. arion* continued to decline and by 1972 only two sites had *P. arion* present.

The 1970's saw another vital stage in the scientific research of *P. arion*, Professor Jeremy Thomas was asked to try and discover the demise of the *P. arion*. Jeremy made the breakthrough discovery that *P. arion* only survived in nests of *Myrmica sabuleti*. This discovery came too late to save *P. arion* from extinction. From the 1980's armed with the extra scientific knowledge and conservation tools *P. arion* was re-introduced to the UK. Our understanding of the butterfly's ecology has made it an excellent species to investigate the impacts of extreme weather and this is now where our research is focused.

Other Authors: David Simcox, Royal Entomological Society | Professor Jeremy Thomas, University of Oxford

12:45 – Erica McAlister, Natural History Museum, London

Friend or Foe - Our Engagement with Entomology

The interaction between humans and insects was there at the beginning. We knew them as food, as pests, as pretty, and those were the dominant drivers to finding out more about them. But then we got curious, we wanted to know how many there were, where they lived, what they got up to, but we were/are still bias with our thoughts and preconceptions towards the different taxa within the Insects. Nowadays though there are many organizations that provide information about the diversity seen with Insects.

The Entomology Club is the oldest extant Entomology Society in the world, celebrating its 200-year anniversary this year. A club limited to its membership of just 8, it was founded on the want to share experiences and knowledge of insects amongst this group, but also opening this up to a supper for all to exchange and share knowledge

about their chosen taxa. In this talk I aim to discuss my perspective on how our ability to share our knowledge with the greater community has changed over this period, the pro's and con's of dealing with the most important taxa on the planet

- Anatomy & Physiology

Large Chemistry Lecture Theatre | Chair: Cecilia Tamborindeguy, Texas A&M University

16:00 – Hollister Herhold, American Museum of Natural History
Tracheae and Hemoglobins: Morphological and molecular adaptations for respiration in insects

Insects are arguably the most successful terrestrial lifeforms. One of the most distinctive features of insects is their mechanism of respiration: tracheae, a system of chitinized ectodermal tubules, delivering oxygen directly to tissues. Respiratory adaptations likely played a significant role in the ability to fly, which appeared first in insects. The supposed adequacy of tracheae for insect respiration led to the assumption for decades that respiratory proteins like hemoglobin, essential in vertebrate respiration, were not needed. Our comprehensive transcriptomic survey, however, unexpectedly revealed the widespread presence of insect hemoglobin.

To add to this comparative study of insect respiration and uncover evolutionary patterns and functional constraints, I performed high-resolution morphological analyses of the tracheal system using micro-CT scanning. Previous tracheal studies were limited to a few taxa at most due to the use of time-consuming manual dissections. However, micro-CT can provide detailed visualization of internal structures. Robust assessments of tracheal homology using 30 scans of 13 orders from the earliest diverging lineages were used to develop a unified nomenclature of structures and a 3D tracheal atlas. Sixty taxa from 12 more orders informed the role of air spaces in flight, revealing strong correlations between wing area, flight ability, and respiratory capacity.

16:15 – Sofia Samoylova, University of Bristol
Effects of Reproductive State and Sex on Thermal Tolerance in a Viviparous Ectotherm

Ectothermic organisms rely on environmental conditions for temperature maintenance, adapting their metabolism and physiological processes accordingly. While most research has focused on how heat affects survival, less is known about its sublethal impacts, particularly changes in reproductive activity. As temperatures rise

globally, understanding how thermal stress affects reproduction has become increasingly important. Pregnancy is a particularly vulnerable time, during which thermal stress can alter maternal physiology and offspring development. *Diploptera punctata*, also known as the Pacific beetle-mimic cockroach, is a viviparous ectotherm, making it a compelling model for studying the effects of elevated temperatures on reproductive outcomes.

In this project, we analyse the effects of heat on the thermal tolerance and reproductive outcomes of *D. punctata*. Specifically, we investigated how reproductive state and sex influence thermal tolerance (CTmax). We compared CTmax among males and females (non-pregnant, early and late-stage pregnant) and found increased thermal tolerance in pregnant females. Body composition analysis suggests this tolerance is partially driven by weight with potential involvement of lipid content of pregnant females, indicating further physiological changes could be involved.

This work highlights the impact of how reproductive state can influence thermal tolerance, providing insight on how viviparous ectotherms may react to globally increasing temperatures.

16:30 – Lucy Alford, University of Bristol

Rethinking plant diversification schemes: leveraging insect physiology to enhance insect support and ecosystem service provision in a changing climate

Rising global temperatures and increasingly frequent climatic extremes threaten beneficial insects that underpin agricultural productivity. Enhancing the resilience of these species is critical for sustaining agroecosystem function under changing climatic conditions. Floral nectar, rich in sugar, may offer supplementary nutrition to enhance survival and performance of nectar-feeding insects under thermal stress. However, the effects of nectar sugar composition on thermal resilience and ecosystem service delivery remains poorly understood.

Utilising the economically important aphid parasitoid *Aphidius ervi* as the study insect, we investigated how the principal constituent sugars of nectar (sucrose, fructose, glucose) influence thermotolerance and key life-history traits central to the ecosystem service provision of biological control under simulated heatwave and low-temperature conditions. Dietary sugar composition significantly influenced thermal tolerance and life-history traits, with sucrose consistently improving all measured indices under both temperature extremes. We suggest that sucrose may enhance thermal stress resistance through effects on water balance and supercooling capacity.

Our findings indicate that targeted provision of nectar resources, for example through strategically designed flower strips, could improve parasitoid persistence and biological control under climatic extremes. Ultimately, this research highlights the potential for optimising floral resource composition as an ecological strategy to enhance the climate resilience of beneficial insects.

Other Authors: Emily Ballara, University of Bristol

16:45 – Madeline Park, Newcastle University

Characterising novel nutrient transporter proteins from *Bemisia tabaci*

Many sap feeding insects are global crop pests. This includes *Bemisia tabaci*, commonly known as the tobacco or silverleaf whitefly. *B. tabaci* is found in over 165 countries and can feed on over 900 plant species, including important crops such as tomatoes, cotton and cassava. Whilst this species is not present in the UK, there are concerns that it could be introduced on infected plant material. *B. tabaci*, and other obligate sap feeders, thrive despite plant sap being an unbalanced food source, whereby it is rich in certain nutrients (sugars, some non-essential amino acids) but deficient in others (essential amino acids).

Little is understood as to the molecular mechanisms involved in *B. tabaci* nutrient acquisition. Here we describe the function of novel *B. tabaci* amino acid transporter proteins. Functional characterisation was performed using radiolabelled amino acid flux measurements in a heterologous protein expression system. Striking differences in substrate specificity were identified for proteins from within the same transporter gene family. These differences may reflect distinct roles in both dietary amino acid uptake and nutrient exchange between the insect and its intracellular symbiotic bacteria. Further understanding of nutrient transport mechanisms may underpin the development of novel biocontrol mechanisms. Funded by BBSRC.

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17:00 – Daniel Estiven Quiroga Murcia, Université Côte d'Azur, INRAE, ISA F-06903 Sophia Antipolis

The leg, a site for xenobiotic detoxification?

Xenobiotics are chemical compounds foreign to an organism, including naturally occurring plant metabolites and insecticides. These substances enter the organism

through different routes of exposure and can potentially disrupt physiological homeostasis. In response, organisms developed detoxification pathways whose activation depends on the route of xenobiotic entry. Following cuticular exposure, detoxification is primarily mediated by the fat body and Malpighian tubules. The detoxification machinery generally consists of cytochrome P450 monooxygenases, carboxylesterases, glutathione S-transferases, glycosyltransferases, and ATP-binding cassette transporters. Insect legs are a critical first barrier against contact exposure.

The presence of detoxification enzymes expressed in the legs raises the hypothesis that the detoxification processes can initiate locally before the toxic compounds spread systemically. To address this hypothesis, we explored the detoxification capacity of insect legs by multiple techniques as transcriptomics and biochemical assays. *Drosophila* was used as a model system, and contact insecticides were employed as xenobiotics.

As an initial step, aiming to compare a model species with a major pest, the LD50 values of selected insecticides were determined in *Drosophila melanogaster* and *D. suzukii*. These data provided the basis for subsequent experiments and enabled the identification of candidate detoxification enzymes for further functional characterization.

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17:15 – Carlos Martel, Royal Botanic Gardens, Kew

Pollen and sterol content differentially affect solitary bee development

Sterols are essential micronutrients for bees. To obtain them, bees collect pollen from specific plants. However, how sterols affect development in solitary bees has not been previously addressed. Here we investigated the effects of pollen with different sterol composition or supplementation on the development of solitary red mason bees, *Osmia bicornis*, comparing bee-provisioned pollen, with chestnut pollen containing campesterol, a key *Osmia* sterol, a sterol supplemented chestnut pollen, a polyfloral pollen from which the key campesterol and cholesterol sterols were almost absent, and a combination of polyfloral and chestnut pollen.

Pollen diet significantly affected the larval final weight, larval development time and development over time. Larvae fed chestnut pollen supplemented with sterols developed significantly faster over time compared to those from the other treatments, including the chestnut pollen with no sterol supplementation. Despite sterol composition being distinctive among pollen diets, sterol profiles were more similar among bees

from different pollen foods than between bees and their pollen foods. Moreover, bees fed on polyfloral pollen had much higher relative concentrations of campesterol and cholesterol than the pollen itself, addressing the possibility that bees are highly efficient in sterol-selective accumulation or possible transformation of sterols.

Other Authors: Joseph Kreidt, Royal Botanic Gardens, Kew | Philip C. Stevenson, Royal Botanic Gardens, Kew

- Climate Change

Small Chemistry Lecture Theatre | Chair: Tom Rhys Bishop, University of Cardiff

16:00 – Joseph Ibrahim, School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow

Integrating Phenological and daily temporal patterns to optimize butterfly monitoring effort in the West African Savannahs

Butterflies are widely recognised as sensitive indicators of environmental change because they respond rapidly to habitat shifts, are easily detectable and widely distributed, and are well suited to large scale monitoring, including citizen science initiatives. Although long-term community monitoring in Europe and North America has revealed clear phenological shifts linked to climate and land-use change, comparable data remain scarce in sub-Saharan Africa.

Year-round butterfly activity in savannah ecosystems complicates the development of standardised monitoring protocols, yet continuous activity does not imply uniform species presence. We analyse four years of systematic butterfly monitoring on the Jos Plateau in north-central Nigeria to identify optimal survey periods for West African savannahs. The dry season (mid-November to March) showed the lowest species richness, abundance, and evenness, and no species occurred exclusively during this period. Thus, dry-season monitoring can be reduced without loss of ecological information. We also found strong diurnal patterns, with richness and abundance peaking earlier in the day than in temperate regions. These findings indicate that monitoring guidelines developed for European contexts require adaptation to maximise efficiency and data quality in West African butterfly monitoring schemes.

Other Authors: Sofie Spatharis, University of Glasgow | Oskar Brattstrom, University of Glasgow

16:15 – Craig Macadam, Buglife - The Invertebrate Conservation Trust
Ain't no mountain high enough: Saving the Upland summer mayfly

Climate change is one of the major long-term threats to biodiversity. Most recent predictions are that temperatures will rise as a result of climate change and there will be changes to precipitation patterns - these will inevitably have an impact on invertebrate populations. Freshwater invertebrates are particularly at risk, firstly because warmer water holds less of the dissolved oxygen that they need to survive, and secondly because changes to rainfall, evapotranspiration and flow rates will profoundly affect habitat continuity and availability.

Indeed with the majority of species having relatively short life cycles and good powers of mobility they are likely to be one of the first groups to show the impact of a changing climate. Cold-loving species will retreat northwards and uphill, while warm-loving species will increase their range in the UK. This talk will explore the vulnerability of aquatic insects to climate change, considering effects on eggs, larvae and adults and will showcase work in Scotland to understand the threat to the Upland Summer Mayfly (*Ameletus inopinatus*) and other freshwater species, and the action that we can take to help save them from extinction.

16:30 – Alycia Lackey, University of Louisville
Responses to climate warming: repeatable direction but species-specific magnitudes of effects on phenology and survival

Responses to climate warming are influenced by life history complexity, plasticity, and local adaptation. While earlier phenology and reduced survival are common responses to warming, the extent to which such responses are repeatable—across species or even within species—is a key open question. We address this question using two fly species, *Rhagoletis pomonella* and *R. suavis*, which diverged ~3mya and differ in host use, genomic background, and life-history trait optima.

Despite these differences, the species overlap in geographic ranges and experience similar climatic and seasonal selection gradients. Critically, the transition from overwintering pupae to reproductive adults is highly sensitive to environmental conditions, making their complex life cycles a key mediator of climate responses. Using a realistic simulated warming experiment, we tested the repeatability of phenological and survival responses across species.

Both species emerged earlier under warming, but *R. pomonella* showed a larger shift than *R. suavis*. However, this greater phenological plasticity did not buffer *R. pomonella* from higher costs compared to *R. suavis*.

Our results highlight how species facing similar selection pressures can show divergent responses to warming. Improving climate response predictions will require a deeper understanding of the roles of plasticity, evolutionary history, and physiological constraints in response.

Other Authors: Sophia Anner, University of Louisville | Shayna Rosenbloom Earl, University of Louisville

16:45 – Lewis Hawksworth, University of Chester

Damsels in Distress? Will damselflies in the UK, North West, be able to withstand the thermal pressures of climate change?

Temperature stresses, stemming from climate change, have raised conservation concerns about Odonata species. These concerns may manifest as the inability to function or survive under altered temperature regimes, which could affect population sizes and distributions. The investigation of critical thermal limits (CTLs) is an efficient method to determine how ectothermic species, like Odonata, are being impacted by climate change. This is achieved by determining the critical thermal maximum (CTmax) and minimum (CTmin) of individuals to identify the temperature range they can withstand before they lose motor function. In this study, I assessed the CTLs in a variety of different Odonata species across several sites within Cheshire and Merseyside, UK, to determine which species are living close to their CTLs, and if environmental factors, such as the type of water body, impact their CTLs.

The CTLs of the collected Odonata larvae were assessed using the standardised methodology of ramping temperatures (+/- 1C every four minutes). Data collection is still underway for this study, but preliminary results have already shown significant differences in thermal limits of different species collected from the same site. Upon completion of this research, a greater scope into how shifting climates impact Odonata species will be consolidated, creating a set-up for future research projects and conservation action plans tailored to the species identified as a cause for concern with regards to climate change.

Other Authors: Dr Matt Geary | Dr Candice Owen

17:00 – Sacchi Shin-Clayton, University of Cambridge
Insect Responses to Early-Stage Riparian Restoration in Oil Palm Landscapes

Rapid agricultural expansion across the tropics has transformed natural ecosystems at unprecedented scales, leading to losses in biodiversity, ecological function, and climate-buffering capacity. As these landscapes continue to intensify, there is a growing need for tractable restoration approaches that can reinstate habitat complexity and support the recovery of key ecological communities. The Riparian Ecosystem Restoration in Tropical Agriculture Project (RERTA) is a large-scale Before–After Control–Impact experiment conducted within oil palm plantations in Riau, Indonesia. We compared passive restoration (natural regeneration) with active restoration (enrichment planting with six native tree species) to evaluate early changes in vegetation structure, microclimate, and insect assemblages.

Active restoration, particularly in areas with remnant palms, enhanced vegetation complexity and improved thermal buffering, but did not produce distinct shifts in insect community composition. This pattern may reflect limited connectivity between restored riparian habitats and remaining natural forest, highlighting the importance of landscape-scale linkages in supporting ecological recovery. Climate projections for 2045 and 2085 indicate that restoration-driven habitat complexity will promote insect persistence and functional stability under future warming. Overall, our early results indicate active restoration may be the most tractable restoration approach in agricultural landscapes. If we get the treatments correct, then we could improve the area within the tropics and determine the impact it could have.

Other Authors: Sarah C. Luke, University of Nottingham | Damayanti Buchori, IPB University | Jean-Pierre Caliman, SMART Research Institute | Anak Agung Ketut Aryawan, SMART Research Institute | Andrew J. Bladon, University of Cambridge/ University of Reading | Edgar C. Turner, University of Cambridge

17:15 – Robert Bradley, University of Bristol
Cross-trophic transfer of cold tolerance in a host-parasitoid system

Invertebrates across temperate regions are experiencing warming winters due to global warming, leading them to overwinter in an active morph and reduce their entry into diapause. This phenological shift heightens the risk of their exposure to increasingly common, lengthy and sudden extreme cold temperature events, something that favours invertebrates able to adapt to these changes. Rapid cold hardening (RCH) is a phenotypic plasticity that allows an organism to survive rapid declines in temperature,

typically denoted in insects by an accumulation of cryoprotectants that maximise the supercooling point of their haemolymph. This response is demonstrated by the grain aphid *Sitobion avenae*.

The present study aims to find evidence for a mechanism whereby a parasitoid wasp oviposited into an RCH aphid gains a conferred cold tolerance benefit from their hosts. To do this, mortality rate of control and RCH-reared *Aphidius ervi* Haliday wasps was measured over 48h following a 2h exposure to an experimental subzero temperature plunge. This data was used to produce and compare the LT50 values of wasps in each group. Additionally, the metabolomes of wasps in each group were processed through a GC-MS to identify conserved cryoprotectants driving this transfer.

Other Authors: Dr Lucy Alford | Dr Callum McLellan

- SYMPOSIA: Celebrating 200 Years of Entomology (Part II)

Sir Stanley Thomas Lecture Theatre | Chairs: Helen Roy, UKCEH and Ed Turner, University of Cambridge & Cambridge University Museum of Zoology

16:00 – Edgar Turner, University of Cambridge, Museum of Zoology
Championing a greater role for insects in education and public engagement

In the past, insects and smaller taxa were often overlooked in projects aiming to engage the public in natural history or biology, perhaps because they were thought to be less appealing or charismatic than larger taxa. However, their sheer abundance, diversity, and ubiquitousness in terrestrial environments can make insects particularly tractable for engagement at public, school and university-level.

For similar reasons, some insect groups are also well-represented in citizen science monitoring schemes and in museum collections, making insects valuable sources of information for understanding and engaging people with long-term biodiversity change. Drawing on examples from the University Museum of Zoology, Cambridge, this talk will explore some of the ways that insects can be used to engage and educate a wide range of audiences about the nature world, long-term environmental change, and research. This will include approaches to engage a greater diversity of audiences with insects, such as through the use of novel school-level interventions and 3D printed models of insect specimens.

Other Authors: Tiffany Ki, Matthew Hayes, Rosalyn Wade - University Museum of Zoology, Cambridge

16:15 – Christopher Hassall, University of Leeds

Weather radars for national-scale entomological research and monitoring

Radar entomology has evolved from opportunistic observations of biological echoes to a powerful, quantitative approach for studying insect abundance and movement at landscape to continental scales. Early work established radar as a means of detecting high-altitude insect migration, but technological and analytical limitations constrained its ecological application. Here, we present advances emerging from the BioDAR project, which integrates weather radar networks, entomological validation, and modern data science to characterise aerial insect biomass, phenology, and dispersal dynamics in unprecedented detail. By leveraging operational radar infrastructure, BioDAR enables continuous, large-scale monitoring of insect activity, revealing spatial and temporal patterns that are otherwise inaccessible through traditional sampling methods. We provide brief highlights of how these data contribute to understanding landscape-scale patterns of insect abundance across land use types and through time, as well as the meteorological correlates of large-scale insect movements. Looking forward, we discuss challenges in taxonomic resolution, integration with ground-based observations, standardisation across radar networks, and interdisciplinary environmental research.

Other Authors: Mansi Mungee, Azim Premji University | Maryna Lukach, Royal Meteorological Institute of Belgium | Reuben O'Connell Booth, University of Cambridge | Tommy Matthews, University of Leeds | Samuel Hodges, University of Leeds | Elizabeth Duncan, University of Leeds | Bill Kunin, University of Leeds | Lindsay Rhodes, National Centre for Atmospheric Science | Freya Addison, National Centre for Atmospheric Science | James Bell, Keele University | Ryan Neely, University of Leeds

16:30 – Grace Slade, UK Centre for Ecology & Hydrology / University of Reading

New Approaches to Understanding Insect Change: Learning from the Past, Monitoring for the Future

Rapid changes in insect populations worldwide raise concerns for ecosystem health and food security, yet understanding how populations are changing remains a major challenge. Monitoring has historically been limited geographically, temporally, and taxonomically. Addressing these limitations requires making better use of existing evidence and developing new approaches to data collection.

Here, I present two complementary approaches. First, I discuss research from the GLiTRS project, which combines multiple lines of evidence to improve understanding of insect biodiversity change. Using a meta-analysis of the impacts of invasive alien species on insects, I show how evidence synthesis can reveal broad patterns while highlighting variation among taxa and contexts.

Second, I explore how advances in automated monitoring and machine learning are transforming insect research by providing high-resolution data at scale. Systems such as the Automated Monitoring of Insects (AMI) combine UV and white lighting with high-resolution imagery and machine learning to detect and classify moths. Drawing on lessons learnt from the development and deployment of AMI, the next-generation LepiSense system offers a smaller, lighter, more cost-effective, and user-friendly device.

Together, these approaches demonstrate the evolution of insect monitoring by improving what can be inferred from existing evidence and expanding capacity to collect new data.

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Thursday 10 September

- Pollinators

Large Chemistry Lecture Theatre | Chair: James Gilbert, University of Hull

09:45 – Isaac Badu, University of Edinburgh

The relationship between honeybee abundance and wild pollinator communities in heather moorlands

The introduction of managed honeybees into natural habitats has raised concerns about impacts on wild pollinator communities, particularly in floral resource-rich ecosystems such as heather moorlands. Although previous studies have reported mixed

effects of honeybee abundance on wild pollinators, these interactions likely depend on hive density, resource availability, and species-specific ecological traits. This study examined relationships between honeybee abundance and the abundance and species composition of wild bees and hoverflies across moorland sites in Scotland.

Overall, honeybee abundance was positively associated with the abundance of both wild bees and hoverflies. However, species-level analyses revealed contrasting responses among four focal species. While some species showed positive associations with honeybee abundance, others exhibited weak negative trends. Analysis of species composition further showed that honeybee abundance was associated with changes in hoverfly assemblages, but not with changes in wild bee communities. These compositional shifts indicate that increases in honeybee abundance may influence the relative occurrence of individual species even where overall pollinator abundance increases. The findings support other studies suggesting that the effects of beekeeping on wild pollinators are context-dependent, mediated by honeybee density, and can be species-specific.

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10:00 – Philip Donkersley, Lancaster University
Glyphosate disrupts bumblebee circadian rhythms

Bees are vital pollinators underpinning both biodiversity and global food security, yet declining populations threaten ecosystem resilience. While research has extensively examined how pesticides disrupt foraging-related cognition, the nest environment, where bumblebees spend roughly 75% of their lives, remains poorly understood.

Here, we use BeeBox to undertake unobtrusive, long term ethologic and bioacoustic monitoring of Bombus terrestris. Over a 30 day period, we exposed colonies to dietary glyphosate and continuously recorded in-nest behaviour via infrared camera and AudioMoth microphone. Video analysis quantified activity, while audio analysis isolated specific behaviour-associated frequencies.

Colonies exposed to field-realistic glyphosate levels exhibited significant reductions in overall activity, disrupted circadian rhythms (characterized by delayed torpor onset without altered wake time) and decreased wingbeat and buzzing frequencies critical for thermoregulation and intra colony signalling. These findings reveal that even sublethal herbicide exposure profoundly alters in nest behaviour, with implications for colony development and pollination services.

By shifting focus to nest life and leveraging integrated video acoustic methods, this study provides a novel framework for assessing the sublethal impacts of agricultural chemicals on pollinator health.

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10:15 – Charlie Hackforth, University of Bristol

The role of nocturnal moths in pollen transport in the central Congo peatland forests

The contribution of nocturnal settling moths to pollination services has been increasingly appreciated in temperate ecosystems, but no community-wide studies are reported from tropical forests. In this talk, I present the results of pollen load analysis from nocturnal settling moths in the world's largest tropical peatland complex in the Central Congo Basin.

Working across three forest types, I use pollen transport networks to examine the consequences of moth and plant diversity patterns for this important aspect of ecosystem functioning. I find extensive, generalised, low-volume pollen transport across a wide proportion of species and higher moth groups.

Across all samples, 31% of individual moths were found to carry pollen, comprising 283 morphospecies, or 38% of the sampled richness. I find evidence that tree flowers are a key resource for a diverse range of settling moth species, suggesting that understory-focussed methodologies may drastically underestimate the extent of adult moth floral feeding behaviour in tropical forest. Significant uncertainty remains in the true pollination services these generalised flower visiting moths provide in unmodified tropical forest ecosystems.

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10:30 – Mae Uniacke, Royal Botanic Gardens, Kew

Pollination success in two orchid genera with distinct pollination mechanisms varied over the last 200 years

Orchids are one of the most diverse plant families in the world. Unfortunately, more than half of orchid species are endangered due to habitat loss, climate change, and

the decline of pollinator populations, in addition to their extraction for commercial purposes. While low pollination rates are known for most orchid genera with specialised pollination mechanisms, such as those using deceptive mechanisms, it is unknown whether those rates were similar in the past or have changed over long periods of time.

To get a better understanding of this, we used herbarium specimens from the Royal Botanical Gardens, Kew, to assess pollen exportation (i.e., assessing pollinarium removal) in two orchid groups with distinct pollination systems: the sexually deceptive bee orchids (genus *Ophrys*), and the food-deceptive lady slipper orchids (genera *Cypripedium, Phragmipedium,* and *Paphiopedilum*).

We found that pollinarium removal significantly increased over time in the bee orchid, whereas it strongly decreased in the lady slipper orchids. This research reflects global trends in orchid diversity and shows how different pollination methods could be associated with population decline in orchids. Our study also stresses the importance of maintaining collections to better understand ecological interactions and how they have changed over long-time periods.

Other Authors: Carlos Martel, Royal Botanic Gardens, Kew

10:45 – Gugulethu Tarakini, University of KwaZulu Natal

Pollinator Governance in Developing Countries: Lessons from Zimbabwe's Policy Framework

Pollinators are vital to biodiversity, agriculture, and food security, yet global evidence indicates alarming declines. In developing countries many crops depend on animal pollination, hence effective pollinator policies are essential for sustaining food security. This study assessed the extent to which pollinator conservation has been mainstreamed within Zimbabwe's legislative and policy framework using the African Pollinator Initiative (API) recommendations as an analytical benchmark. Findings revealed partial integration of pollinator conservation across biodiversity, forestry, climate, and environmental policies, with the National Biodiversity Strategy and Action Plan (2025–2030) and the Bees Act (2016) providing the strongest recognition.

Key gaps included the omission of pollinators from agricultural policies, the absence of research and monitoring provisions, and limited recognition of wild pollinators. Despite substantial policy support for apiculture, important issues remained unaddressed, including honey bee carrying capacity to prevent resource competition, mechanisms for managing human-honey bee conflicts, and the Bees Act's narrow definition of

"bees" as *Apis mellifera*. These shortcomings equate apiculture with pollinator conservation and risk overlooking broader ecological needs. Strengthening governance will require broadening the Bees Act to include solitary bees, integrating specific pollinator objectives into sectoral policies, establishing research and monitoring systems, and promoting awareness of pollinators beyond honey production.

Other Authors: Gugulethu Tarakini

11:00 – Clare Boyes, Harper Adams University
Pollen foraging as a route of microplastic foraging in solitary bees

There is increasing evidence of microplastic fibre contamination in terrestrial ecosystems, and it has been confirmed that microplastic fibres can be transported by honeybees during foraging, yet exposure routes for wild pollinators remain poorly understood. Solitary bees are generally hairier than honeybees which may make them more likely to collect microplastic fibres, yet no studies have examined microplastic accumulation in their pollen loads.

This study investigates whether two solitary bee guilds with contrasting nesting strategies, cavity-nesting *Osmia bicornis* and ground-nesting *Andrena* spp., accumulate microplastic fibres during pollen foraging. Pollen loads deposited in glass tubes by temporarily immobilised foraging *Andrena* females, and pollen provisions collected from *O. bicornis* trap nests were examined using light microscopy and fluorescence microscopy to confirm that detected fibres were microplastic; polymer characterisation was not possible without FTIR.

Microplastic fibres were detected in 47% of *Osmia bicornis* provisions and 70% of *Andrena* spp. pollen loads. Fibre prevalence was higher in *O. bicornis* provisions from rural than urban sites. Possible adhesion routes include electrostatic attraction and lipid-mediated binding via pollenkitt. This study provides novel evidence that foraging behaviour represents a significant but underexplored pathway of microplastic exposure in wild bees, with implications for ecotoxicological risk assessment.

Other Authors: Dr Heather Campbell, Harper Adams University

- Evolution & Behaviour

Small Chemistry Lecture Theatre | Chair: Sheena Cotter, University of Lincoln

09:45 – Emily Gilford, University of Exeter

Do sublethal pesticides alter antipredator behaviour in wild insects?

Pesticide exposure has been proposed as a major driver of global insect declines, yet most evidence for sublethal effects on ecologically relevant behaviour comes from controlled laboratory studies. We tested whether exposure to a sublethal dose of chlorantraniliprole, an insecticide with long environmental persistence, alters anti-predator behaviour in wild field crickets (*Gryllus campestris*). Adult crickets were treated with either pesticide or a sham control and tested repeatedly in the wild after simulated predator attacks. Escape speed into the burrow and latency to re-emerge were measured. We found no consistent effects of pesticide exposure on either behaviour.

Escape speed did not change across repeated tests, while re-emergence latency increased over successive days in both treatment groups. Individuals showed greater variability in re-emergence latency than escape speed, consistent with its role as a flexible, context-dependent risk-assessment behaviour. These results challenge assumptions from laboratory assays that sublethal pesticide exposure universally impairs insect behaviour and highlight the importance of evaluating effects in ecologically realistic conditions.

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10:00 – Shannon Murphy, University of Denver

Local adaptation in herbivorous insects: a meta-analysis

Local adaptation, wherein populations are adapted to local biotic and abiotic conditions, is a common outcome of natural selection and a driver of diversification. There are two criteria to detect local adaptation: 1) the home-away criterion compares the fitness of a population in their home environment to their fitness in a different environment, and 2) the local-foreign criterion examines differences in fitness between local and foreign populations when experiencing the local environment. We conducted a meta-analysis synthesizing empirical evidence of insect herbivores' local adaptation to their host plants using both criteria to assess how diet breadth, distance among

populations, and herbivore taxonomy impact the likelihood of detecting local adaptation. Overall, we found evidence for herbivore local adaptation using both the home-away and local-foreign criteria.

Contrary to theory about factors that should promote local adaptation, herbivore diet breadth, taxonomy, and distance between herbivore populations did not affect the likelihood of finding local adaptation. However, the likelihood of finding evidence for local adaptation varied with herbivore clonality, response variable measured, taxonomic distance among host plants, and study design. Our results allow us to understand how local adaptation functions in the most diverse group of multicellular life on Earth, herbivorous insects.

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10:15 – Jon Richardson, University of Glasgow

Too hot to care: Competition exacerbates the effects of heatwaves in the burying beetle *Nicrophorus vespilloides*

Heatwaves, which are becoming more common and intense due to climate change, often negatively affect insect growth, survival, and reproduction. However, insects also face other stressors, including competition for resources. To better understand the full impacts of climate change, it is important to determine whether the negative effects of heatwaves are exacerbated by additional stressors. I examined the combined effects of temperature and competition on reproductive success in the burying beetle *Nicrophorus vespilloides*.

Burying beetles breed on small vertebrate carcasses, which are rare, ephemeral resources that attract intense competition. Parents must defend their brood from intruders, which will kill resident larvae and take over the carcass for themselves. I exposed breeding beetles to either a simulated heatwave (25°C) or control conditions (20°C) and introduced either a size-matched intruder or no intruder for 72-hours.

Heatwaves did not affect competitive outcomes as takeovers were equally like under both temperatures. However, competition intensified the negative effects of heatwaves on larval growth and survival. Beetles exposed to both stressors produced significantly fewer and smaller larvae than those exposed to either stressor alone. These

results show that competition can exacerbate the effects of climate change with combined stressors producing disproportionately negative consequences for reproductive success.

10:30 – Jan Kreider, Lund University
The emergence of sociality and division of labour during the evolutionary transition to eusociality

Eusocial insects, such as ants, termites, some wasps, and some bees, have evolved a division of labour between a reproductive queen and many sterile workers. It is poorly understood how the transition from solitary to eusocial breeding occurred. First, I will present how sociality may have emerged as a plastic response to changing environmental conditions. We exposed the facultatively social bee *Exoneura robusta* to different temperature and predation treatments in climate chambers.

We observed that low temperature triggered the bees to behave more socially. Second, I will present how a division of labour can emerge spontaneously in groups of highly similar individuals. Using individual-based simulations, we show that in the absence of resource sharing, individuals alternate between foraging and tasks inside the nest. However, if non-foraging individuals are fed by other individuals, this delays their onset of foraging and makes individuals who shared resources more likely to forage again. This leads to task specialisation and the self-organised emergence of division of labour. Our findings suggest that sociality and division of labour may have emerged through phenotypic plasticity and exaptation of existing behavioural mechanisms to initiate the evolutionary transition to eusociality.

10:45 – Corentin Jouault, Oxford University Museum of Natural History
Deep-time diversification of insects: testing the roles of biotic interactions and major environmental events

Biotic interactions and major paleoenvironmental events are thought to have shaped the evolutionary success of insects, yet their macroevolutionary effects remain difficult to test because deep-time evidence is fragmentary. This work combines fossil data, molecular evidence and probabilistic modelling to investigate how competition, ecological opportunity, extinction events and environmental change influenced insect diversification. Across several insect lineages, including Hymenoptera, Isoptera, Odonata, Embioptera and Plecoptera, I first reassessed fossil diversity through systematic and taxonomic work, describing new fossil taxa and improving the framework available for evolutionary analyses.

I then used fossil-informed dating approaches, including node dating, total-evidence dating and fossil-based lineage modelling, to estimate the timing of lineage origins, diversification and extinction. Finally, I modelled insect diversification across two major events in Earth history: the Permo-Triassic crisis and the rise of flowering plants during the Angiosperm Terrestrial Revolution. Together, these results show how integrating palaeontological and neontological data can clarify when insect lineages diversified and help identify the biotic and abiotic factors that contributed to their long-term evolutionary success.

11:00 – Joe Rees, University of Lincoln

That's Gonna Leave a Mark: The larval environment drives adult warning coloration in a carrion beetle

The burying beetle, *Nicrophorus vespilloides*, advertises its distastefulness to predators with striking orange stripes across its elytra. The size and shape of these stripes can be quite variable, despite theory predicting that evolution should select for consistency in warning signals. Here we asked whether stressors experienced during the larval stage could drive this variation. Under ideal conditions, adult beetles find and shape a fresh carcass, altering its microbiome and making the ideal edible nest for their offspring. The carcass is buried underground where temperatures are constant and typically cool and parents feed the larvae for at least 48 hours, maintaining the carcass until the larvae are ready to disperse for pupation.

We therefore implemented 3 'stressful' regimes: breeding pairs were provided with varying carcass quality (fresh or aged), temperature (cool or hot), and parental care (full care, reduced care or no care). When the larvae from these regimes emerged as adults, their wing patterns were photographed and the shape analysed using geometric morphometrics. The analyses exhibited significant differences between offspring exposed to extreme conditions and those exposed to control conditions, showing that the shape of the warning signal is phenotypically plastic. The implications for predator-prey communication and evolution is discussed.

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- SYMPOSIA: Vector Competence and Environmental Drivers of Vectorial Capacity

Sir Stanley Thomas Lecture Theatre | Chairs: Marion England, The Pirbright Institute, and Arran Folly, Animal and Plant Health Agency

09:50 – Nick De Regge, Sciensano

Vector competence of indigenous Belgian mosquitoes for West Nile virus under different temperature conditions

Belgium detected West Nile virus (WNV) for the first time on its territory in August 2025 during a monitoring of wild birds. To support risk assessments, we determined the vector competence of two indigenous field-collected Belgian mosquitoes, namely *Culex pipiens* and *Anopheles plumbeus*. Females fed on a WNV-spiked (lineage 1 Israel 98 strain) blood meal were kept for 14 days at 3 different temperature condition: (i) a constant 25°C, (ii) a 25/15°C day/night gradient reflecting current Belgian summers, or (iii) a 25/20°C gradient simulating a climate change scenario. After the 14-day incubation period, abdomens, legs/wings/head, and saliva were collected and tested in RT-qPCR to determine the infection, dissemination, and transmission efficiencies.

The infection efficiencies for both species and temperature conditions were not significantly different and ranged between 24 and 34%, indicating a similar level of viral replication in the gut. Mostly mosquitoes with the highest viral loads in the midgut were found dissemination-positive. Interestingly, statistical significant differences in virus dissemination from the gut to secondary tissues were observed between the different temperature conditions in both species, implying an effect of temperature on either the physical integrity of the midgut escape barrier or on physiological parameters like the mosquito's immune system impacting dissemination. Unexpectedly, the dissemination efficiency in *Culex pipiens* at 25/15°C (28.6%) was higher than in both other conditions and significantly higher compared to 25/20°C (10.4%), indicating that WNV more easily passes the midgut barrier under current Belgian summer temperatures. WNV was clearly more capable to enter the salivary glands of *Culex pipiens* than *Anophelus plumbeus.*

For *Culex pipiens*, the entry of WNV into the salivary glands did not seem to be altered by temperature, as no significant differences were observed between the obtained transmission efficiencies (3.9%, 8.2%, and 1.5% at 25°C, 25/15°C, and 25/20°C, respectively). By performing virus isolations on saliva, we proved that *Culex pipiens* is a competent vector for WNV at 25°C and 25/15°C, while this was not confirmed at 25/20°C. For *Anopheles plumbeus*, WNV was detected only in the saliva of one mosquito (transmis-

sion efficiency of 1.6%) held at the constant 25°C and we were unable to isolate the virus. No WNV was detected in the saliva under the gradient temperature conditions. To conclude, these results demonstrate that *Culex pipiens* is a competent WNV vector at all three tested temperature conditions and will probably play an important role in WNV transmission in Belgium upon (re)introduction or continued circulation. On the other hand, *Anopheles plumbeus* is unlikely to play an important role in WNV transmission in Belgium.

10:15 – Laura Jones, The Pirbright Institute
Environmental drivers of virus transmission by *Culicoides* biting midges

Bluetongue virus (BTV) is the causative agent of bluetongue disease in sheep, cattle and other ruminants and is spread by *Culicoides* biting midges. The emergence of BTV across naive regions, in particular northern Europe and including the UK, has been linked to the influence of climate change on the virus and its vectors. Here we will discuss the influence of temperature on vector competence of *Culicoides* for BTV, the extrinsic incubation period (EIP) and how climate change may have altered the period over which *Culicoides*-borne transmission of BTV can occur in the UK.

Another *Culicoides*-borne virus, epizootic haemorrhagic disease virus (EHDV), emerged in Europe for the first time in 2022. We will describe how virus replication threshold temperature and the EIP within *Culicoides* influence the probability of an EHDV outbreak occurring in the UK.

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10:37 – Calam Bruce, APHA
Multiple species of native mosquitoes may be involved in Usutu virus circulation and maintenance in temperate zones

The introduction of emerging arboviruses into novel regions poses significant challenges for public, animal and ecological health. Usutu virus (USUV), first detected in the United Kingdom in 2020, has since become endemic in Southeast England, and detections as far north as the Isle of Arran. Following the initial detection, the Vector-Borne RADAR (Real-time Arbovirus Detection And Response) project was established to provide enhanced vector and host surveillance for mosquito-borne arboviruses across England.

Through this project, 40,274 mosquitoes representing 21 species were collected from sites across central and southern England between March 2023 to February 2026 (inclusive) and screened for mosquito-borne viruses. Usutu virus (USUV) was detected in 157 of 4,697 (3.34%) mosquito pools across 14 species of five genera. Furthermore, fragments of West Nile virus (WNV) lineage 1a RNA were retrospectively detected in two pools of *Aedes vexans* collected in Nottinghamshire, in July 2023.

Culex pipiens s.l. was the most frequently USUV-positive species, while potential bridge vectors including *Cx. modestus* and *Anopheles claviger* also exhibited notable prevalence. Phylogenetic analysis confirmed co circulation of two USUV lineages, Africa 3.2 and Europe 3, in multiple mosquito species within the same geographic regions. These findings highlight the understudied impact of native mosquitoes on transmission ecology in temperate zones, demonstrating the value of high throughput vector surveillance to improve understanding of the underlying maintenance cycles of arbovirus circulation and better inform future risk assessments.

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10:49 – Scott Tytheridge, APHA

The nutritional landscape is an important modulator of *Aedes albopictus* fitness and vector competence

Mosquitoes must allocate available resources across demands from maintenance, reproduction, and immunity which are important factors in determining vectorial capacity. The quality and availability of these resources can alter the degree and shape of these trade-offs. While the sugar from natural nectar sources can vary in concentration and chemical composition, we lack data on how this variability impacts mosquito fitness and vectorial capacity. To address this, we measured the effect of su-

crose concentration on the survival, fecundity, and vector competence of female *Aedes albopictus*, a competent vector for several zoonotic arboviruses with a relatively high risk of incursion into the UK. Females provided with an ecologically relevant sucrose concentration (40% w/w) and a single bloodmeal survived significantly longer than those provided lower concentration (10% w/w).

This effect did not change depending on the order in which a bloodmeal and sugar were received. However, when offered multiple bloodmeals, the impact of varying sugar concentrations was reduced suggesting individuals were able to reallocate resources across survival and reproduction. To measure how infection plays a role in allocation of resources, females were provided a West Nile virus (WNV)-inoculated bloodmeal, along with the same three sugar treatments. Preliminary data suggest that viral infection and transmission are unaffected by nutritional treatment. Our results thus far indicate that nutritional quality impacts the lifetime reproductive success and may be an overlooked component for understanding vectorial capacity in this important invasive species.

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11:01 – Emilie Pondeville, University of Glasgow

Mosquito Scotland: Assessing the risk of mosquito-borne diseases in Scotland and their response to environmental change

Mosquitoes are among the most important vectors of vector-borne diseases (VBDs), transmitting high-burden human diseases such as malaria and dengue, as well as zoonotic pathogens including Usutu virus and West Nile virus. Environmental change is driving the expansion of mosquito vectors and pathogens they transmit, increasing the risk of VBD in Europe, including the UK. Assessing the risk of mosquito-borne disease establishment in the UK requires an integrated understanding of resident mosquito species, their vector competence, avian reservoir hosts, and how these components may respond to climate change.

To date, mosquito surveillance in the UK has focused largely on England and Wales, with limited data available for Scotland. However, rising temperatures, the presence of migratory bird species, native mosquito populations, and frequent direct air connections with regions where mosquito-borne diseases are present together create a credible risk of disease emergence in Scotland.

In this talk, I will present an overview of 'Mosquito Scotland', a multidisciplinary research programme designed to assess current and future risks of mosquito-borne diseases in Scotland. I will highlight key findings and outputs, including the distribution and diversity of Scottish mosquito species, public engagement through citizen science, pathogen screening in mosquito and bird populations, assessments of vector competence for arboviruses in Scottish mosquitoes, and the development of risk maps. Our findings provide a robust framework to improve surveillance, preparedness, and response strategies for mosquito-borne diseases in Scotland under ongoing environmental change.

Other Authors: Emilie Pondeville1, Heather M. Ferguson2, Jean-Philippe Parvy1, Georgia Kirby2, Buthaina Preston1, Heloise Plante1, Shennice Knight2, Dr Zaydah Rolande De Laurent1, Susanne Krabbendam2, Ryan Carmichael1, Rebecca E. Brown2, Meshach Lee2, Kieran Killen2, Davide Dominoni2, Francesco Baldini2, Juan Morales2, Luca Nelli2, Jolyon Medlock3, Alexander Vaux3, Steven White4, Dominic Brass4, David Kerrigan1, Lily Tong1, Ana Da Silva Filipe1, Richard Orton1, Sara Moutailler5, Clemence Galon5, Liam Reid6, Joseph Heaver6
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11:13 – Eva Heinz, University of Strathclyde

The microbiome's journey through the mosquito developmental cycle

Full abstract TBC

Poster Presentations

P1 - Safinatu Ameen, Natural Resources Institute, University of Greenwich

Hoverfly use for the pollination of commercial soft fruits

Pollination of high-value fruit crops often relies on a single bumblebee species, yet diverse pollinator assemblages can improve fruit quality. Hoverflies show potential for multi-species pollination systems, and their larvae help regulate pests. As managed pollinators are costly, growers require high foraging performance, which can be enhanced with semiochemical lures.

This study developed floral volatile blends to attract hoverflies while minimising pest risk. Volatiles from 14 flower species were characterised using GC-MS and grouped by cluster analysis into five distinct odour profiles, forming the basis for five synthetic blends.

Blends were evaluated using lure-baited sticky traps in soft fruit crops at East Malling. Although hoverfly abundance was low (10 individuals across seven species), blends significantly affected total pollinator captures ($\chi^2 = 15.04$, df = 5, p = 0.01), with blend 5 attracting the most pollinators, particularly solitary bees. Blends also significantly affected pest captures ($\chi^2 = 18.41$, df = 5, p = 0.002), with blend 5 showing low pest counts.

Y-tube olfactometer bioassays and electroantennography confirmed that blend 5 elicited the strongest behavioural and antennal responses in hoverflies. These findings demonstrate that floral blends, particularly blend 5, can enhance attraction to hoverflies and solitary bees while limiting pest populations, supporting the potential for semiochemical lures in commercial soft fruit production.

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P2 - Anjana Anilkumar, Union Christian College, Kerala, India

Unsilencing a Hotspot: First Acoustic Baselines and Microclimate Vulnerabilities of Western Ghats tropical Cicadas

Tropical annual cicadas possess unique acoustic communication but remain critically understudied in the vast Western Ghats biodiversity hotspot. To address this severe taxonomic data gap, we conducted systematic fieldwork beginning in 2024 across 47 diverse locations at various elevations throughout the Kerala Western Ghats. Using a Tascam DR-05X linear PCM recorder for audio and a Kestrel 5500 weather meter for capturing microclimate and spatial parameters, we successfully established the region's first comprehensive baseline acoustic dataset comprising of 16 identified taxa, including *Gaena atkinsoni, Indopurana cheeveeda*, and *Platypleura hampsoni*, alongside three unrecognized species.

We found that microclimatic and biogeographic boundaries heavily dictate species distribution. Specifically, *Ottugea cyanea* is confined to mid-to-high elevations, while *Platypleura polita* emerges strictly during dry summers. Geographically, the Palakkad Gap starkly separates the distribution ranges of *Calcagninus picturatus* in the south from *Calcagninus nilgiriensis* in the north. Significant oviposition preference was observed for *Bridelia retusa* trees. Since these endemic cicadas require highly precise microclimates, habitat degradation poses a severe localized extinction risk to them. This pioneering study proves expanded research is essential for ongoing long-term conservation and global bioacoustics frameworks leveraging LLM AI models, especially in data-scarce regions where basic species identities and baseline sound data currently remain unavailable.

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P3 - Ayman Asiri, GWCT, The Allerton Project

Moth to a Flame, Moth to a Tree: The Value of Silvopasture for Moth Populations

Moths are major components of terrestrial ecosystems, providing crucial nocturnal pollination services and acting as an important food resource for birds, bats and other wildlife. Agroforestry is increasingly promoted within regenerative farming as a nature-based approach that can support biodiversity while maintaining agricultural production by increasing habitat heterogeneity, creating sheltered microclimates and providing additional resources for invertebrates. However, evidence of how moth communities respond to agroforestry remains limited. We compared moth assemblages between a conventional pasture field and a pasture agroforestry system at the Allerton Project, Leicestershire, UK.

Light traps were deployed monthly between April and September 2025, with three traps operated per site during each sampling event. Captured moths were identified to species level where possible. Across the study, 5,295 moths representing 259 species were recorded. The pasture agroforestry system supported greater moth abundance, species richness and diversity than the conventional pasture. Community composition differed only modestly between habitats, but the pasture agroforestry field supported more conservation-relevant species, including four Section 41 species that were absent from the conventional pasture.

These findings highlight the potential of pasture agroforestry to enhance moth biodiversity and support conservation-relevant species within productive farmland.

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P4 – Femi Benny, University College London

The Role of Social Insects in Food Security: A Case Study from Nagaland, India

Insects are a vital source of protein and traditional medicine for approximately two billion people worldwide, the majority of whom reside in the Global South. Social insects are particularly valued for the large quantities obtainable from a single colony harvest, and across Asia, indigenous communities have long incorporated them into their diets, livelihoods, and cultural practices. Yet, their contribution to food systems remains poorly documented, with existing knowledge largely anecdotal and underrepresented in food security discourse.

This study addresses that gap through semi-structured interviews and focus group discussions conducted across 27 villages in Nagaland, India- a region of exceptional biocultural richness. Our findings present an inventory of edible social insects alongside detailed insights into traditional ecological knowledge, folk taxonomy, farming, harvesting and cooking practices, medicinal uses, and shifting patterns in the availability and continuation of these practices.

Our results highlight the broader implications of entomophagy for food security and community livelihoods and present Nagaland as a compelling example of reciprocal human–nature relationship, where generations of close ecological observation have produced rich, place-based knowledge of the natural world.

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P5 – Jacqueline Brandt, The James Hutton Institute

Monitoring Spotted Wing Drosophila – changes in abundance and activity in Scotland since 2013

Spotted wing drosophila (SWD), *Drosophila suzukii*, is an invasive fruit fly, originating in Japan. SWD is a pest of soft and stone fruit and is of particular concern as it lays in eggs in ripening and ripe fruit of many plant species, potentially leading to significant financial losses for fruit growers.

SWD was first observed in the UK in 2012 and monitoring in Scotland started in 2013. SWD is monitored using modified Droso traps with Cha-Landolt bait. Ten traps were positioned in and around fruit crops between 2013-2021, which dropped down to five traps from 2021 onwards.

Data is collected every two weeks. The first SWD was detected in Scotland in 2014, and although numbers remained low (<5 individuals) until 2020, the abundance has increased each year since then, except for a dip in 2024.

Abundance is at its peak between July and November with low to zero individuals caught during the other months of the year. These data are used to analyse how meteorological conditions and habitat composition affect SWD abundance and they are also shared with the soft fruit industry via a British Berry Growers newsletter.

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P6 – Fatma Bursali, Aydin Adnan Menderes University

Priority Effects and Niche Modification in Competing Mosquito Larval Assemblages

Understanding how species interactions shape mosquito communities is critical for predicting invasion dynamics and disease risk. We investigated how arrival order and temporal lags influence larval competition among the invasive *Aedes aegypti*, *Aedes albopictus*, and resident *Culex pipiens*. Using controlled laboratory experiments, larvae

were introduced either simultaneously or sequentially with 3- and 7-day delays to quantify priority effects on survival, development, and adult size.

Simultaneous introduction resulted in intense competition, reducing survival and adult body size across all species. In contrast, early arriving cohorts gained substantial fitness advantages, with significantly higher survival and growth, while late-arriving larvae experienced strong suppression. Competitive hierarchies were not fixed but depended heavily on arrival timing; *Ae. aegypti* showed greater resilience under delayed competition, whereas *Cx. pipiens* and *Ae. albopictus* were more sensitive to both simultaneous and delayed interactions. Conditioned-water experiments demonstrated that these priority effects were largely mediated by chemical and microbial niche modification rather than resource depletion alone. Furthermore, Oviposition assays showed that gravid females preferred conspecific-conditioned habitats and avoided heterospecific cues, reinforcing early colonizer advantages.

Our findings indicate that arrival timing shapes mosquito community assembly and invasion success. Accounting for priority effects may improve predictions of coexistence and guide vector control efforts.

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P7 - Jayapriya C S, Birla Institute of Technology and Science (BITS) Pilani K K Birla Goa Campus

From Biochemical to Functional insights of Ornithine decarboxylase in *Aedes aegypti*

Ornithine decarboxylase (ODC) is the rate-limiting enzyme in polyamine biosynthesis. Polyamines are essential for mosquito survival, reproduction, and disease transmission. Multiple ODC genes are annotated in *Aedes aegypti*, but their functional roles remain uncharacterized. There is limited or no literature on polyamines in the early stages of mosquito development.

Here, we combine molecular cloning, protein expression, and enzyme kinetics to characterize annotated ODC genes in *Aedes* as functional ODC or ODC-like isoforms. We have observed that ODCs exhibit distinct spatiotemporal expression patterns across developmental stages. ODC expression increased sharply during the late larval stage and remained elevated throughout pupal development, coinciding with critical tissue remodeling and reproductive system development. This sustained high expression suggests a continuous requirement for ODC during pupal histogenesis,

implying that ODC disruption from the late larval stage onward might impair reproductive organ formation.

The late larval induction and sustained pupal ODC expression reveal a developmental vulnerability window. Given that ODC knockdown in adult mosquitoes reduces fecundity and delays oviposition. Targeting functional ODC isoforms from late larval through pupal stages might chronically disrupt reproductive system development, providing an extended window for RNAi-based techniques aimed at reducing dengue transmission.

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P8 - Marta Chignola, Free University of Bozen-Bolzano; Laimburg Research Centre
Inside out: characterizing the microbial community of a newly invasive aphid in Europe and its impact on host fitness and defence

The apricot aphid, *Myzus mumecola* (Hemiptera: Aphididae) is a newly invasive species in Europe. Native to Eastern Asia, it was first detected in Italy in 2016 and rapidly spread to neighbouring countries. Despite the imminent threat to apricot cultivation, little is known about the biology and management of this novel pest. Here, we characterize its microbiota community through high-throughput sequencing of individuals from different geographic locations, seasons and morphs. Unexpectedly, we detected the facultative symbiont *Fukatsuia symbiotica* in all *M. mumecola* samples. Prior to this finding, *Fukatsuia* had only been found in other aphid genera where its function for the host was ambiguous, providing both fitness costs and defensive benefits. To determine the effect of *Fukatsuia* infection on host performance and anti-parasitoid defence, we will perform fitness and parasitism assays on the model aphid *Acyrthosiphon pisum*, reared on alfalfa and fava bean. Given the presence of a specialized aphid virus at the time of the experiment, we will also analyse a potential viral effect on aphid fitness. This work will contribute to our understanding of defensive mutualisms in symbiont-aphid systems with the potential to broadly impact pest control for invasive species.

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P9 – Ciaran Clark, Bees for Development

The Bees of Monmouthshire Recording Project: addressing a taxonomic imbalance in recording

Understanding pollinator diversity and distribution on a similar scale to local land management is vital for effective conservation. However, the heterogeneous nature of biological recording complicates the interpretation of spatial and temporal trends, through inherent bias, quality and completeness issues. The true diversity of bees (*Anthophila)* in the UK is largely unknown by the wider public and this is reflected in the poor quality of data on many smaller, less conspicuous solitary species.

This project sought to address this imbalance in bee species recording in Monmouthshire (VC35) by: 1. collating and reviewing available occurrence data (SEWBReC & BWARS) and identifying biases; 2. surveying known localities with diverse bee faunas and records of rare species, along with new localities with suitable habitats; 3. encouraging the increased awareness, knowledge and recording of poorly represented bee taxa, through public engagement in the form of talks, walks and workshops; 4. creating an online resource and publishing a county checklist to inspire and aid local recorders.

The project has directly contributed 59% of total records for solitary bee genera (excl. *Bombus & Apis*) in VC35, a new species for Wales and there is preliminary evidence suggesting an increase in recording effort for these species.

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P10 – Peter Convey, [1]British Antarctic Survey | [2]University of Johannesburg

Accelerating range expansion and habitat occupation by the invading chironomid midge, Eretmoptera murphyi, on Signy Island, South Orkney Islands

Eretmoptera murphyi is a sub-Antarctic fly native to South Georgia, where its palaeoendemic status has made it a key species in reconstructions of Antarctic and Southern Ocean Island biogeography. It is also an invading species, inadvertently introduced further south to Maritime Antarctic Signy Island (South Orkney Islands) in the 1960s. With its small size and cryptic behaviour, it was not immediately discovered and was first observed close to the original plant experimental site almost 20 years later, at that time with a very restricted local distribution and with only slow expansion recorded by the mid-1990s.

While there has been no regular monitoring, an assessment in the mid-2010s documented an acceleration in distribution expansion, although still limited to the

local slopes close to the introduction site. Opportunistic sampling in early 2024 identified several individual occurrence locations beyond this limit, as well as recording abundant larvae in moss habitat not previously noted. Lower intensity sampling across large parts of the island did not identify wider presence. Targeted survey in early 2026 confirmed more widespread presence beyond the previous limits, consistent with unassisted local dispersal of the adult flies. We consider implications for future dispersal, including for the newly-approved Signy Island ASPA.

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P11 – Thomas Dally, Forest Research

Investigating historic patterns in the establishment of invasive plant-associated insects in the UK

The increasing interconnectedness of human society, both in terms of travel and global trade, in concert with the evolving effects of climate change, have created ideal conditions for pest species to expand beyond their native ranges. Concurrently, invasive species, including insect pests, represent one of the primary threats facing the UK forestry sector. We have assembled a comprehensive list of 529 plant-associated insect pest species that have arrived in the UK since 1990, 200 of which directly relate to UK forestry.

Our analysis will explore trends in the likely geographic origin and entry pathways for these species over time, as well as how life history traits, including voltinism, feeding behaviour, and host specificity, influenced species' ability to establish successfully in the UK. Past patterns provide a foundation for horizon-scanning in UK forestry, enabling the anticipation of insect pest threats and the formulation of effective mitigation strategies.

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P12 – Molly Davidson, Forest Research

Evidenced-based impacts of severe weather events on forestry pests in Scotland: a meta-analysis

Climate change is increasing the frequency and severity of disturbance events with important implications for forest insect pest dynamics and forest management in the

UK. A systematic literature review and meta-analysis of plant pest responses to severe weather events (wildfire, drought and windthrow) was conducted following PRISMA guidelines. A Scopus search identified 1,319 articles, of which 8 (containing data from 22 individual studies) provided suitable data for meta-analysis. The meta-analysis took a standardised mean difference approach with robustness analysis to validate results.

Responses to disturbances were variable and context dependent. Wildfire was associated with a small, non-significant reduction in bark boring insect abundance, although wider literature suggested species-specific increases occur following fires. Drought significantly enhanced defoliator larval performance, suggesting an increased risk of outbreaks under warming conditions. Windthrow produced a small to moderate non-significant increase in bark beetle abundance, however there was high variability between studies that was unexplained by the available moderators. Overall, the evidence base was limited by small sample sizes, potential publication bias and inconsistent reporting.

Management should prioritise monitoring, targeted sanitation, and resilience-building (e.g. mixed-species stands) and improved preparedness for drought-driven defoliator outbreaks and potential bark beetle risks following severe weather events.

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P13 – Christopher Davies, Swansea University

Unearthing the ecology of the strandline beetle (*Eurynebria complanata*)

My poster will outline a project to ascertain the ecology of the Endangered strandline beetle *Eurynebria complanata* at Cefn Sidan beach in Pembrey with the possible extension of the project to Pendine and Whiteford Sands. During the project we will be tagging 10% of the population of strandline beetle in Pembrey and Whiteford using PIT tags. The project will try to discover the beetle's range on beaches using Frequency Identification detectors to observe whether the beetles move into the dunes in July as predicted and to ascertain how the beetle disperses from site to site and whether or how it uses its developed wings. We will also use museum samples to sex the beetles as to create methods of sexing beetles in the wild, this will aid in researching whether a captive breeding program is feasible.

The project is in part funded through "A Carmarthenshire County Council, Outdoor recreation Service project - The Pembrey coast SSSI Habitat Improvement Project - funded by Welsh Governments Nature Networks Fund Round 5 in partnership with Heritage Lottery."

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P14 – Sian Davies, Cardiff University

Exploring the thermal tolerances of freshwater invertebrates pre-exposed to acute zinc treatments

Freshwater invertebrates are diverse ectotherms essential for ecosystem functioning and service provisioning, yet they are increasingly threatened by rising water temperatures and anthropogenic pollution. This study investigates how multiple stressors interact to influence invertebrate performance in South Wales rivers, where warming and metal contamination are key pressures. We examine the combined effects of thermal stress and zinc exposure on generalist and specialist taxa using thermal death time (TDT) and critical thermal maximum (CTmax) assays.

Larvae of mayflies, caddisflies, stoneflies, and Gammarus were collected from the River Taff and exposed to acute two-hour zinc treatments (0, 100, or 1000 µg/L) to simulate pollution pulses. Following exposure, individuals were subjected to controlled thermal assays.

TDT experiments quantified survival under constant high temperatures, highlighting interspecific differences in thermal tolerance, whereas CTmax assays evaluated the extent to which prior zinc exposure impacts upper thermal limits.

By integrating physiological experiments with environmental and trait-based modelling approaches, this research will identify vulnerable species and improve understanding of how multiple stressors may drive changes in freshwater community structure and ecosystem services under future environmental change.

P15 – Nicola Dempster, James Hutton Institute (JHI)

Promoting natural enemy activity to control blueberry aphid abundance

Over recent years, Scottish growers have reported increased abundance of aphids on blueberry crops. The blueberry aphid is native to North America but has been introduced to Europe, with the first UK sighting recorded in the 1970s. Blueberry aphid is thought to form a species complex containing *Ericaphis scammmelli* and *Ericaphis fimbriata.*

The main host is *Vaccinium* species (blueberry) with blueberry production in the UK worth £72 million. The main concern about the increasing abundance of this aphid is that it vectors the Blueberry scorch virus. While the virus has not yet been reported in the UK, to future-proof the blueberry sector against potential virus appearance, we investigated varietal differences in aphid infestation and natural enemy activity. Insect surveys were carried out in 2019 and 2023 comparing nine blueberry varieties.

The results reveal differences in variety susceptibility to the blueberry aphid and differences in natural enemy abundance. In 2025 and 2026 wild flowers were added to the tunnel to show how they can promote natural enemy activity. We will indicate how these findings can be used to reduce aphid pest problems in blueberry production.

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P16 – Mariano Devoto, University of Buenos Aires, School of Agronomy (FAUBA)
Pollinators, predators and parasitoids exhibit contrasting refuge and spillover responses to flower strips in the Argentine Pampas

Flower strips are widely promoted to enhance biodiversity and ecosystem services in agricultural landscapes, but their effectiveness may depend on how different beneficial insects respond to these habitats and disperse into crop interiors. We evaluated refuge and spillover effects of flower strips on three groups providing key ecosystem services: Microgastrinae parasitoid wasps, hoverflies (Syrphidae; pollination and biological control), and the predatory lady beetle *Eriopis connexa*. The study was conducted in 12 commercial fields of the Argentine Pampas. Insects were sampled using Malaise traps positioned at field margins and at 10, 50, 100 and 150 m within crops. Analyses were based on 1,450 trap samples and 28,982 beneficial insects collected during three agricultural seasons.

Responses differed markedly among guilds. Flower strips increased Microgastrinae abundance at field margins by 53.1% and generated spillover effects extending approximately 42 m into crop interiors. Hoverflies showed a much stronger refuge response, with abundance increasing by 209.3% and spillover extending approximately 96 m. In contrast, *Eriopis connexa* showed no detectable refuge effect associated with flower strips.

These results show that the same habitat intervention can generate strikingly different ecological outcomes depending on the biology of the beneficial insects involved.

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P17 – Claire Dumenil, University of Padova

E-nose: Invasive pest prevention through technology-guided monitoring and control

The expected increase in plant pests—driven by climate change and intensified food production—challenges the ambitious Farm2Fork goal of reducing EU pesticide use by 50%. Managing new invasions alongside established pests is driving pesticide reliance up instead. Border controls are limited due to a lack of workforce and time to identify insects hiding in the soil and plant canopy. Consequently, novel tools are urgently needed to prevent new pest entries into Europe.

We are developing a sensor system prototype (SSP) that exploits the specific volatile organic compounds (VOCs) released by pests or the plants they attack. This enables timely, non-invasive pest detection for import control and field management. We aim to equip plant inspectors, importers, and nurseries with fast, reliable, and affordable devices. These tools will help locate and eradicate infested plants, thereby drastically reducing the spread of phytopathogens and invasive insects such as the fall armyworm, the brown marmorated stinkbug, the cotton bollworm, and the Japanese beetle. The analysis of infested plant VOC profiles revealed distinct, host-pest-specific volatile profiles as key markers of infestation. This research deepened our understanding of host-pest interactions and identified the chemical signatures the device must recognize to signal pest infestation.

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P18 – Hadil Elsayed, York University

A multifaceted dilemma: The impacts of anthropogenic threats on insects in protected areas since the 1990s

Rapid global declines in insect biomass and diversity are threatening essential ecological functions and many ecosystem services that humans rely on. This global decline is a multifaceted dilemma that is impacted by many threats including land-

use change and climate change. Protected areas act as important habitat refugia for insects in highly human-affected landscapes. With the increasing impacts of anthropogenic threats, these areas are important for the long-term conservation of insects and wildlife biodiversity at large. In the early 1990s, insects were collected using malaise traps at various sites in protected areas within the Long Point World Biosphere Reserve, Canada.

To assess the impacts of anthropogenic threats such as climate change and landscape changes on insects in protected areas, this sampling was replicated from 2021 – 2023 for a comparative analysis of changes in both insect biomass and diversity between the two time periods. An overall decline in insect biomass and diversity was observed between the two periods, mainly driven by climate change. This study shows that even within protected areas, insects are facing large declines as a cause of the increasing impacts of anthropogenic threats.

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P19 – Vianney Foglizzo , Swansea University

Creating and Optimising habitat suitability maps for Wales for the Southern Wood Ant, *Formica rufa*

The southern wood ant (*Formica rufa*) is an ecologically important woodland specialist and ecosystem engineer (Frouz *et al.*, 2016), yet its population is declining throughout Europe, including Wales (Balzani *et al.*, 2022). As a poor disperser, *F. rufa* is unlikely to naturally recolonise suitable but currently unoccupied woodland (Ellis & Robinson, 2014), making reintroduction and translocation efforts essential.

This study will develop a habitat suitability model for *F. rufa* across Wales, following Robinson *et al.* (in print). Occurrence records were compiled from the Bees, Wasps and Ants Recording Society (BWARS), the National Biodiversity Network (NBN Atlas), and additional field surveys. A Canopy Height Model (CHM) was derived from Welsh Government LiDAR data at 2m resolution, with non-vegetation structures removed to isolate forest heights. Forest structure variables, including canopy height, canopy cover, and distances between forest fragments, will be extracted at 30m resolution, combined with past and projected meteorological data (CHESS-SCAPE), and topographic data such as slope and aspect direction. The analysis will be conducted in R using a Maximum Entropy (MaxEnt) modelling framework.

The model will identify suitable woodland habitat across Wales, highlighting candidate sites for *F. rufa* conservation. This work will provide a spatial baseline for wood ant recovery efforts in Wales, complementing ongoing restoration initiatives in England.

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Frouz, J., Jílkova, V., Sorvari, J. (2016). Contribution of wood ants to nutrient cycling and ecosystem functioning. In Red Wood Ant Ecology, Conservation (pp. 267-280). Cambridge University Press.

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P20 – Shannon Goldberg, Northumbria University

Assessing the invasive potential of non-native bumblebees in an endemic island ecosystem

As climate change, tourism and global trade facilitate the movement of insect species northwards, the flora and insect fauna of endemic ecosystems are becoming more vulnerable to accidental and intentional introductions of non-native species.

The Faroe Islands, an isolated archipelago in the North Atlantic, has experienced the introduction of five new bumblebee species, all successively arriving since 2008. There have been no bee species established in the Faroe Islands previously and so the impact of such an event is unknown.

This research aims to construct extensive and cutting-edge ecological network analyses that explore the interactions between flowering plants and both native and non-native insect pollinators. The outcome will be used to help assess whether these bumblebee species are having any impact, determining their invasion potential. This will be done by incorporating a combination of classical pollinator surveys, and molecular diagnostics methods such as droplet digital PCR (ddPCR) and metabarcoding of flower-derived DNA.

This research addresses several of the grand challenges identified by the Royal Entomological Society, spanning the themes of Blue Skies, Methods and Techniques, and Anthropogenic Impacts. The methods used offer significant advancement in both our fundamental and applied understanding of pollinator and invasion ecology.

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P21 – Abdulwahab Hafez, King Saud University

Resistance development, realized heritability, cross-resistance, and detoxification mechanisms of pyridalyl resistance in *Cadra cautella* (Lepidoptera: Pyralidae)

The almond moth, *Cadra cautella* (Lepidoptera: Pyralidae), is a major pest of stored commodities in warm regions worldwide. Increasing insecticide resistance, declining efficacy of conventional insecticides, and concerns regarding human health, food safety, and environmental impacts have highlighted the need for safer and more effective control options. This study investigated the development of pyridalyl resistance, realized heritability, cross-resistance patterns, and associated biochemical mechanisms in *C. cautella*.

During selection, larval survival averaged 41.08% across generations G1–G10 exposed to pyridalyl. Continuous laboratory selection for ten generations increased resistance from 1.11-fold at G1 to 80.88-fold at G10 relative to the susceptible strain (Pyrida-S). Realized heritability (h^2) of pyridalyl resistance in the resistant strain (Pyrida-R; G10) was estimated at 0.16. The Pyrida-R strain exhibited no cross-resistance to fenitrothion (1.27-fold) or emamectin benzoate (1.99-fold), whereas very low cross-resistance was observed to spinetoram (2.13-fold), indoxacarb (4.02-fold), novaluron (2.06-fold), pyriproxyfen (4.03-fold), and bifenthrin (3.95-fold). Activities of glutathione-S-transferase, carboxylesterases, and cytochrome P450 monooxygenases were significantly elevated in Pyrida-R, suggesting their involvement in pyridalyl resistance. These findings provide valuable information for resistance management and support insecticide rotation strategies to preserve pyridalyl efficacy against *C. cautella*.

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P22 – Nimmi Haridas, Kerala Forest Research Institute

Synergistic Microclimate Regulation and Structural Shielding in the Nest Architecture of *Vespa tropica*

The social wasp *Vespa tropica* constructs intricate nests containing multi-tiered internal combs. A distinct outer architecture, known as the envelope, shields these structures from external environment. This envelope functions as a highly specialized physical barrier, protecting internal combs from environmental extremes.

To evaluate this envelope as a biomimetic blueprint for climate-adaptive construction material, the physical and chemical characteristics of *V. tropica* nest specimen was investigated.

Morphological analysis reveals a highly sophisticated, multi-layered air cavity structure. Within these layers, microclimate stabilization is driven by a synergistic mechanism. SEM micrographs show a low-porosity fibrillar network enabling restricted physical capillary action. Concurrently, FTIR and TGA data demonstrate robust chemical adsorption and thermal stability, highlighting a polysaccharide backbone deeply integrated with proteinaceous salivary secretions and abundant hydrophilic groups. Furthermore, GC-MS analysis of the outermost layer reveals a specialized chemical profile dominated by long-chain alkanes (dotriacontane and dodecane).

These findings reveal a sophisticated, multifunctional, compartmentalized matrix that passively manages internal temperature and humidity, protected by a targeted hydrophobic wax barrier, offering an optimized paradigm for advanced technological resources.

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P23 - Tom Hartman, University of Nottingham

Staff and student co-curation for the redesign of a First-Year Practical on insect mouthparts with notes on AI generated diagrams

The redesign of the first-year 'Life on Earth' insect mouthparts practical, prompted by staff changes was informed by student feedback. Students critiqued technical difficulty, constraints, and the unclear morphology context. Key issues were the small species (cricket, wasp, fly) leading to clustering around the microscope and resulting in students copying rather developing dissection skills. Guided by current and former students, the practical moved to two dissections, replacing the challenging Cricket and Fly specimens with a larger, more accessible Locust and Wasp. Feedback showed a significant easing of the initial barrier for students naive to dissection, particularly using binocular microscopes. The change was supported by including video instruction and live insect displays. The skills shifted from just manual dexterity to include comprehensive observation and understanding functional anatomy, taxonomy and natural history. It also introduced critical thinking by linking mouthparts to life cycles and pest control.

This evidence-based approach enhanced the key pedagogical outcomes, increases the number of skills learned and resolved bottlenecks in the delivery of this practical.

Assessment was a multiple-choice test that was checked against AI generated questions. It was only when asked for AI generated diagrams to label that the quirky nature of productions became obvious.

Other Authors: Dr Jen Stockdale, University of Nottingham

P24 – Samuel Hodgkinson, University of Southampton
Fatty acid synthesis and metabolism in honeybees

Honeybees (*Apis mellifera*) are obligate palynivorous and nectivorous pollinators, obtaining all dietary nutrients from pollen and nectar. Pollen provides honeybees with their main source of dietery protein and lipid, but the pollen of plant species vary greatly in their quality and quantity of these nutrients. Therefore, honeybees must balance intake of different pollen species to construct a nutritional profile suiting their requirements.

Of particular research interest is the dietary ratio of omega-3 to omega-6 polyunsaturated fatty acids (PUFAs), and the downstream impacts on physiology. Using chemically defined, holidic diets alongside deuterated water, we tested how bees responded behaviourally and physiologically to diets that differed in their fatty acid composition. Using newly-emerged honeybees, we confined bees to diets for five days to measure nutrient balancing behaviour. Subsequently we analysed the limitations of their de-novo fatty acid synthesis as well as the metabolism of lipid metabolites throughout the body using LC/MS.

We found that honeybees exhibit extreme nutrient balancing behaviour to mitigate overconsumption of free PUFAs in the diet and the resultant physiological impacts. Validated using NMR, we also found that bees were unable to synthesise 'essential' PUFAs, but can synthesise long-chain saturated fatty acids and monounsaturated omega-9 acids.

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P25 – Robin Hutchinson, UK Centre for Ecology & Hydrology
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Co-developing citizen science for parasitic interactions using an invasive non-native ladybird

Harmonia axyridis is an invasive non-native species in the UK due to its impact on native ladybirds. One possible reason for its rapid range expansion is a lack of natural

enemies within its acquired range. Over time, *H. axyridis* may acquire new enemies. Alternatively, the presence of *H. axyridis* as an unsuitable host may act as a sink for native parasites. We currently lack methods for sustained and structured monitoring of parasites in ladybirds, which would allow us to determine the large-scale and long-term community-level effects of *H. axyridis*.

We worked with volunteer recorders to trial two new recording forms for the UK Ladybird Survey. One form was designed for recording parasites which are visible in the field, the other for assessing parasites within ladybird pupae. Recorders provided feedback on the design of the forms and the benefits and barriers to taking part.

Recorders found taking part to be meaningful, as they spent more time observing ladybirds and felt that their records were valued. Using their feedback on the forms, we will launch a national survey monitoring five parasites of ladybirds. This will enable us to inform understanding of the effects of parasites within biological invasions.

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P26 – Nika Jachowicz, University of Copenhagen, Department of Plant and Environmental Sciences

Spying on the bugs and birds: a computer vision approach to assessing biological pest control

Camera traps paired with machine learning offer an underexplored approach to monitoring predator-pest interactions in agroecosystems. We applied this method to investigate predation on the gooseberry sawfly *Nematus ribesii*, a highly destructive pest of gooseberry and red currant with no options for chemical control in organic systems. For organic farmers, regulation of sawfly larvae by natural enemies is therefore a crucial ecosystem service, yet the natural enemy community of *N. ribesii* remains largely uncharacterized.

Six low-cost Raspberry Pi cameras were deployed in gooseberry bushes within an organic strip cropping system intercropped with arable crops. Video footage was continuously recorded and analyzed using a YOLOv8-based detection model to detect and classify interactions between sawfly larvae and their arthropod and avian predators. Video analysis was supported by visual assessments, sweep netting, and bird exclusion experiments to quantify the effect of predation on larval densities. Preliminary results will be presented.

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P27 – Ioanna Kollia, Animal and Plant Health Agency

Enhanced retrospective arbovirus surveillance in UK mosquitoes for Batai and Sindbis viruses

Vector-borne pathogens are rapidly becoming a threat to public and animal health across temperate zones, facilitated by increasing temperatures and land use changes. West Nile virus (WNV) and Usutu virus (USUV) are two such mosquito-borne orthoflaviviruses of increasing importance in Europe. Following the first USUV detection in the United Kingdom in 2020, the virus has become established in south-east England with detections confirmed in north-west England and Scotland. Batai virus (BATV; Orthobunyavirus) and Sindbis virus (SINV; Alphavirus) circulate in several north European countries, including Sweden and the Netherlands, where they have been detected in mosquito vectors and vertebrate hosts. Given their circulation in neighbouring and climatically similar regions, assessing their presence in UK mosquito populations is important for the early detection of emerging arboviruses.
To address this, more than 4,000 archived mosquito pools (>42,000 individuals from 21 species), collected through enhanced active surveillance as part of the VB-RADAR project (March 2023 – February 2026 inclusive), were retrospectively screened for BATV and SINV.

Initial molecular screening of 1,500 mosquito pools returned four non-positive BATV RT-qPCR results. Ongoing analysis of non-negative RT-qPCR results may yield valuable insights into drivers of viral emergence and persistence. The completed study will provide baseline data on the incidence of BATV and SINV in UK mosquitoes, informing future surveillance activities, risk assessments and preparedness for emerging mosquito-borne arboviruses in the United Kingdom.

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P28 – Anna Kraft, Queen Mary University of London

People, plants and pollinators: broadening participation in entomology through community engagement and student-led outreach

Entomology, particularly in urban areas, often remains inaccessible to many communities traditionally underrepresented in the natural sciences. Through a Royal

Entomological Society EDI grant we developed a series of intergenerational, interactive pollinator workshops in central London designed to facilitate access to entomology for underrepresented groups. The workshops were particularly aimed at families and children from diverse cultural and socio-economic backgrounds living in densely urban areas with limited access to green space, as well as older adults living alone or on low incomes. Workshops aimed to increase awareness of urban pollinators, encourage participation in insect conservation, and engage both community members and university students from groups underrepresented in entomology.

Three workshops were designed and delivered in spring 2026 by 12 students from Queen Mary University of London, ecologists from Pollinating London Together, and community group volunteers from Friends of St John's Garden. Activities included pollinator safaris, bee hotel construction and planting pollinator-friendly plants. The workshops engaged over 60 participants, including schoolchildren, families, older adults and youth groups.

Qualitative feedback indicated high levels of engagement, with participants highlighting bee safaris and bee hotel construction as favourite activities. Participants enjoyed learning about pollinator diversity, bee behaviour and solitary bee ecology, while student volunteers reported increased entomological knowledge, practical skills and confidence in public engagement. All surveyed student volunteers expressed interest in future entomology and outreach opportunities.

These findings suggest that collaborative, community-based, hands-on activities can provide accessible entry points into entomology while supporting efforts to diversify both public participation and future pathways into the discipline.

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P29 – Kelly Martinou, Joint Services Health Unit, British Forces Cyprus

OviScanner and OviDetect: Transforming entomological surveillance for *Aedes* mosquitoes

Aedes albopictus and *Aedes aegypti* have been accidentally introduced around the globe aided by international transport and trade. Both mosquito species lay drought resistant eggs on wet substrates. Medical entomologists use this specific behaviour to

track *Aedes aegypti* and *Aedes albopictus* through oviposition traps (ovitraps). Oviposition traps are usually black plastic containers that contain oviposition substrates (such as tongue depressors, styrofoam or paper). During mosquito surveillance initiatives hundreds or thousands of oviposition substrates can be generated with hundreds of eggs to count on each substrate making timely detection, identification and recording difficult for professionals in the field. OviScanner and OviDetect are two complementary initiatives aiming at facilitating the work of medical entomologists and public health authorities. OviScanner is a computer vision and AI-based system for detection and image analysis of mosquito eggs from ovitrap substrates while OviDetect is a web-based platform for crowdsourcing and managing these images designed to make data collection and annotation accessible to the broader research community and professionals in a timely and effective manner.

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P30 - Tommy Matthews, University of Leeds *(no longer able to attend)*

Improving Taxonomic Resolution for Large-Scale Entomological Monitoring Using Weather Surveillance Radars

Monitoring and diagnosing the causes of insect declines requires new ways of measuring invertebrate abundance at larger scales. Recently, aerial insect abundance trends have been derived from weather radar data, but the current taxonomic resolution of weather radars only allows for the division of biological signals into either insects or birds. This low taxonomic resolution limits the application of weather radar to bulk measurement of abundance and can lead to bias in those abundance counts, where larger insects produce a disproportionally larger signal. Here, we identify the limits of the taxonomic resolution of weather radar for insects, using detailed 3D models of insects and electromagnetic simulations. We find that insects with different morphology are not reliably discriminable within the simulations, suggesting that the taxonomic limits to weather radar may be coarse and hard limits. However, we propose four categories based on insect size that do show discriminability, which may allow for size distribution analysis and improved abundance estimates.

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P31 – Ailsa Miller, Forest Research
Improving surveillance of regulated forest pests at high-risk entry points

Preventing the establishment of non-native forest pests in Great Britain relies on effective surveillance at high-risk entry points, such as ports, piers and processors. Port-based trapping has been in place since 1985 to detect accidental introductions of regulated bark and wood-boring beetle species, which are frequently imported in timber and packaging products. To improve early detection strategies for the increasing range of regulated pests requiring surveillance, this research aims to identify key factors influencing bark and wood-boring beetle dispersal from ports.

We compared how trap type, lure components, and trap modifications, including Fluon coatings and UV-absorbing surfaces, affect the number and diversity of captured beetles. Additionally, mark–release–recapture experiments were carried out using native bark beetles to simulate the dispersal of individuals in a port setting. These trials explored how variables such as weather conditions, presence of imported material, and proximity to forests influence trap encounter rates, with the aim of gathering insight into optimal trap placement for monitoring regulated pests.

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P32 – Niamh Millward, IAC Archaeology
Now and Then: How Humans and Beetles have Shaped each Other's Environments

Palaeoentomology is the study of preserved insect remains removed from archaeological and natural contexts. The majority of the insects preserved in these contexts are from the order Coleoptera (beetles). By identifying these insects it is possible to reconstruct past landscapes, climates and even past human activity. As humans altered their environments, beetles responded in kind by occupying newly created niches.

Sometimes, they even occupied human spaces and directly impacted the everyday lives of people. The destruction and creation of new environments for beetles to inhabit is a tradition that continues to the present day. By analysing the ways in which humans and insects have interacted in the past, it is possible to determine the ways in which current human activities can impact insect ecosystems.

P33 – Caitlin Mitchell, University of Oxford

Regulation of the Homeotic Mutant Antp[NS] and Its Effects on Segment Identity in *Drosophila melanogaster*

Precise regulation of homeotic gene expression is essential for maintaining segment identity during development. Homeotic mutations in *Drosophila melanogaster*, such as Antp[NS], provide a valuable model for investigating these cis-regulatory mechanisms. Antp[NS] is a gain-of-function allele of the Antennapedia gene that induces an antenna-to-leg transformation through ectopic expression in antennal tissue. The Fab7[1] deletion allele, which disrupts the Fab-7 regulatory region in the bithorax complex, enhances phenotypic severity of the Antp[NS] allele over 10Mb away, potentially through altered 3D genome organisation and promoter-specific expression. However, the regulatory mechanisms underlying this interaction remain poorly understood.

To investigate this relationship, we are characterising the Antp[NS] allele using sequencing approaches and conducting phenotypic analyses of Antp[NS]; Fab7[1] flies by scoring antenna-to-leg transformation severity across five generations. Additionally, head tissue from each generation will be collected for qPCR analysis to assess promoter-specific expression changes associated with phenotypic severity. These analyses aim to evaluate how disruption of Fab-7 mediated regulation influences ectopic Antennapedia expression across generations.

This work aims to improve understanding of how cis-regulatory mechanisms influence developmental outcomes in *Drosophila melanogaster*. More broadly, these findings may provide insight into how insect developmental systems maintain segment identity in variable genetic and environmental backgrounds.

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P34 – Yuta Morishige, The Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association

Infection dynamics of *Mycobacterium tuberculosis* in silkworm haemocytes and fat body

Silkworm larvae are useful invertebrate hosts for studying microbial infections, including those caused by non-tuberculous mycobacteria. However, their utility for analysing *M. tuberculosis* (Mtb) infection and pathogenicity remains incompletely established. In this study, we examined whether silkworm larvae can serve as a tractable model for assessing total or sub-population Mtb infection dynamics and tissue pathology. Larvae were infected with viable or formalin-fixed Mtb, and survival,

bacterial recovery, and electron microscopy were used to evaluate the progression of infection. Viable Mtb cells caused dose-dependent larval mortality, whereas formalin-fixed Mtb cells did not induce comparable mortality, indicating that death was associated with active infection rather than nonspecific toxicity. LD50 was 2.2 x 10^7 CFU per larva.

Time-course CFU analysis showed bacterial proliferation in infected larvae. Electron microscopy revealed numerous intracellular bacilli within haemocytes, supporting haemocytes as a niche for mycobacterial growth. Fat body also showed infection-associated pathological changes, including intracellular vesicular structures and electron-dense bodies. Diphenyleneiodonium-induced viable but non-culturable (VBNC) Mtb cells, a dormant-like state relevant to latent tuberculosis infection, retained pathogenicity, although mortality was delayed compared with culturable cells.

These findings indicate that silkworm larvae provide a useful invertebrate model for analysing Mtb pathogenicity and disease-forming potential of non-culturable states.

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P35 - Sesilia Niehaus, University of Edinburgh

What was bugging early farmers? Early pests and environmental change at the Neolithic site of Lin 3, Albania

Archaeoentomological studies provide unique insights into past interactions between insect communities, human activities, and environmental change. This study presents subfossil insect results from the lakeshore site of Lin 3, Albania (occupied from ca. 7750 cal BP), one of the earliest agricultural settlements in Europe. The assemblage is characterised by abundant grain pests and yields the earliest European records of the grain weevil *Sitophilus granarius (L.),* providing strong evidence for large-scale and sustained cereal storage. Moreover, the presence of this non-native weevil demonstrates how Neolithic farming facilitated the introduction of invasive stored-product pests into the region, documenting the initial stages of their spread into inland Europe. Results further highlight the diverse interactions early settlers had with the wider environment, with insect indicators of open and grazed landscapes pointing towards a mixed strategy of arable cultivation and pastoral activities, while the presence of bark beetles (Scolytinae) and reed beetles (Donaciinae) suggests exploitation of forests and wetlands respectively. Insects from deposits overlying the archaeological sequence offer evidence for later landscape development, indicating

both ecological recovery towards a diverse wetland system and the enduring legacy of anthropogenic impacts through the continued presence of introduced insect species.

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P36 – Liam O'Donnell, Natural Resources Institute / University of Greenwich
Effect of entomopathogenic fungi on learning and memory in the hoverfly, *Eupeodes corollae*

Hoverflies (Diptera: Syrphidae) are key pollinators in agro-ecosystems. For pollinators, learning and memory are crucial for discriminating between low- and high-value flowers and maximising foraging efficiency. Yet, exposure to pathogens may disrupt these cognitive processes, forcing an energetic trade-off between mounting an immune response and maintaining cognitive performance. Naturally widespread, many species of entomopathogenic fungi (EPF) are utilised as biological control agents for agricultural pests. However, the sub-lethal effects of EPF on insect cognition remain poorly understood.

Using classical olfactory conditioning, we evaluate the effect of *Beauveria bassiana* on learning and memory in *Eupeodes corollae*. We investigate 3 key areas: (1) innate responses to linalool and sucrose, (2) odour-reward associations, and (3) short- and long-term memory retention. In our experimental design, hoverflies undergo 10 learning trials using dodecyl acetate paired with 50% sugar solution, with memory tested 2 and 72 hours post-training. Learning and memory are determined via the proboscis extension reflex (PER). This research provides critical insights into how EPF influences the cognitive health and performance of non-target pollinators.

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P37 – Awatif Khidir Omer Yousif , Nile Valley University-Sudan (*no longer able to attend*)
Annotated List of Ants (Hymenoptera: Formicidae) of South Sudan

The first annotated checklist of the ants of South Sudan based on literature records and additional newly collected material carried out since 2005 is presented. A total of nine subfamilies, 44 genera, 164 species, and 54 are documented.

Camponotus galla. Camponotus maculatus nubis and *Oecophylla textor* were collected from new localities. On the other hand, *Crematogaster marnoi, Dorylus aegyptiacus, Pheidole escherichii, Lepisiota curta, Cataulacus traegaordhi, Tetramorium sericeiventre Camponotus galla, Oecophylla textor,* and *Pachycondyla ruginota* ,
are first records to South Sudan.

Key words: Checklist, Formicidae, New localities and records, South Sudan.

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P38 - Chris Onuoha, Nottingham Trent University
X-ray micro-CT visualisation and quantification of calcium accumulation in the anterior malpighian tubules of Black Soldier Fly larvae (*Hermetia illucens*)

Black Soldier Fly Larvae (BSFL) are highly capable of bioaccumulating minerals from their substrate, due to their efficient gut absorption and metal-binding proteins (metallothioneins), e.g., Ca, etc. (Rubio *et al.*, 2022). BSFL have 4 Malpighian tubules; the two larger anterior-facing ones are frequently visible on X-ray micro-computed tomography (micro-CT) because their lumens are filled with radio-opaque calcium-rich material. X-ray micro-CT was used to visualise and quantify calcium-rich deposits in the Malpighian tubules of BSFL reared on substrates with varying calcium content. Larvae were fed poultry feed waste (6.0–8.5 g/kg Ca) or wheat bran (0.7–1.0 g/kg Ca) for eight days before scanning unstained specimens using a Skyscan 1072 system and reconstructed using NRECON.

Radio-opaque material, interpreted as calcium-rich concretions, was detectable in the anterior malpighian tubules. Larvae reared on poultry feed waste consistently showed greater accumulation of calcium-dense material compared to those reared on wheatbran.

Calcium-rich voxels were quantified in micro-CT reconstructions using TomoMask, which confirmed significantly higher calcium-associated volume in larvae fed poultry feed waste (mean ± SD: 0.00653 ± 0.00296 mm3) compared to wheat bran (0.00143 ± 0.00124 mm3; $p < 0.001$).

These findings demonstrate that micro-CT enables non-destructive visualisation and quantification of mineral bioaccumulation in BSFL.

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P39 – Candice Owen, Chester Invertebrate Research Group, University of Chester
Can physiological and finer-scale climate data improve species distribution model outputs?

Species distribution models typically utilise data at a broad scale, such as global climate variables from the WorldClim database. Very few investigations have included finer-resolution data, such as that provided by microclimates across a landscape, and even fewer have attempted to incorporate physiological data of the focus species into these models. This study used the invasive Argentine ant, *Linepithema humile* (Hymenoptera: Formicidae), to illustrate how microclimate data can be thresholded with the focal taxon's recorded Critical Thermal Minima (CTmin) value, and incorporated as a predictor variable in MaxEnt modelling. Model performance and suitable area predictions in scenarios with and without microclimate data as a predictor variable were compared, and models were independently validated on the known invaded range of *L. humile*.

The results suggest that, although model performance was comparable across the different designs, estimates of suitable area differed in some invaded regions with the inclusion of physiological characteristic-thresholded microclimate data. These findings offer valuable insights into the possible over- or underestimation of climatically suitable areas for invasive or biological control species using finer-scale data in MaxEnt models, and how species-specific microclimate data could be used to better inform conservation and invasive species monitoring programmes.

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P40 – Veronika Pavlasova, Newcastle University
Characterization of a Novel Amino Acid Transporter from *Anopheles gambiae*

Blood feeding provides female mosquitoes with the nutrients required for egg production, and necessitates efficient digestion and absorption of blood meal-derived proteins in the midgut. While the induction of digestive proteases following a blood meal has been well documented, less is known about the transport systems responsible for amino acid uptake. Here, we identify and characterise a novel amino acid transporter from *Anopheles gambiae*.

Candidate transporters belonging to the SLC36-related branch of the Amino Acid/Auxin Permease family were identified through genomic analyses, and substrate preferences were predicted using structural modelling approaches. Functional characterisation using heterologous expression in *Xenopus laevis* oocytes and radiotracer uptake assays revealed that the transporter mediates H+–coupled uptake of a broad range of neutral amino acids. A closely related orthologue in *Aedes aegypti* has previously been shown to localise to the apical membrane of the midgut and to be upregulated following blood feeding. These findings identify a candidate amino acid uptake pathway in the mosquito midgut and contribute to our understanding of the mechanisms underlying nutrient acquisition during blood meal digestion.

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P41 – Kavya Prabhakar, Royal Botanic Gardens, Kew

Do male and female brood cells of solitary bees differ in their pollen and nutrient composition?

Pollinators are essential for maintaining global plant diversity. Approximately 90% of flowering plants rely on animal pollination for reproduction and bees are the most important pollinators. They provide pollination services while collecting floral resources used to feed their offspring.

In solitary bees, it is widely recognised that mothers invest more in their daughters than in their sons in terms of provision quantity. However, whether mothers also influence the composition of pollen is not known. Our study investigates *Osmia bicornis*, a solitary nesting bee, where females are larger than males.

Given the higher fitness value of body size in females, we hypothesise that mothers provision female cells with more diverse and chemically richer pollen than male cells. To test this, provisions from sexed cells were examined using microscopy for pollen diversity and LC-MS for sterol composition, a key nutrient for bee development. We identify some differences in pollen and sterol composition between male and female cells.

These findings improve our understanding of maternal investment strategies in solitary bees and have important implications for the conservation and management of wild bee habitats on managed land.

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P42 - Khushboo Rai, Indian Institute of Science Education and Research, Mohali
Distribution and efficacy of bacterial symbionts in *Odontotermes obesus* colonies

Higher termites, *Odontotermes obesus*, evolved around 50-60 Mya to cultivate fungi in their colonies, demonstrating a symbiotic relationship with fungi. They form a symbiotic relationship with the crop fungus *Termitomyces* and can maintain a monoculture of it within their colony. Conversely, another fungus, *Pseudoxylaria*, emerges as the most conspicuous weed and possess competitive threat to the crop fungus. The microbiome and mycobiome of *O. obesus* are well established as highly diverse and forming a complex partnership to maintain the monoculture of *Termitomyces*, with some members preventing the proliferation of weedy fungi. The source of these specialised symbionts can be either members of the colony or the environment. To assess the contributions of soil and colony members to shaping these microbial symbionts, the microbial communities were analysed and compared across body parts, mound soil, and peripheral soil using high-throughput amplicon sequencing and qPCR. Furthermore, to evaluate the functional efficacy of bacterial mutualists with antifungal activity, their interactions were characterised in vitro.

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P43 - Chris Ranger, USDA-Agricultural Research Service
Next-Generation Alcohol Biosensor for Detecting the Emission of Stress-Induced Ethanol from Trees

Exotic ambrosia beetles are destructive wood-boring pests that target horticultural trees. Trees emit ethanol in response to stressors like flooding and freezing, which the beetles use to locate vulnerable hosts. Rapid detection of this ethanol emission can help growers and arborists identify trees at risk of infestation. Our objective was to determine if a next-generation alcohol bio-sensor designed for humans can detect the emission of ethanol from flood-stressed trees. Sugar maple, *Acer saccharum*, trees were flood-stressed using a pot-in-pot system. Non-flooded control trees received a standard irrigation regime. The BACtrack® wearable alcohol biosensor (SKYN, San Francisco, CA) was positioned at the base of stems trees.

The BACtrack Skyn app installed on an Apple iPhone was used to display in near real-time the detection of alcohol (µg/L) over a 10 min duration for each tree. Time-course

emissions of ethanol were detected beginning at 3 days after initiating flooding but not from the untreated control trees, thereby confirming that a next-generation alcohol biosensor bracelet, designed for human use, can also detect ethanol emissions from flood-stressed trees. The biosensor also detected ethanol emissions in real-time from flood-stressed trees before mass attacks by invasive ambrosia beetles. This discovery will aid in efforts to develop an ethanol biosensor that alerts pest management specialists to trees at risk of infestation by invasive ambrosia beetles.

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P44 – Manish Ravi, Indian Institute of Science Education and Research

Thiruvananthapuram Ants in the Anthropocene: Spatiotemporal variation in ant communities along a landscape gradient in the southern Western Ghats

Anthropogenic landscape modification may affect the species composition of insects. Ants, being ubiquitous, respond to such changes, indicating ecosystem health. We are interested in understanding the effect of landscape changes on ant communities in the Western Ghats, a global biodiversity hotspot.

We expected habitat edges to have a high local diversity of ants. Due to the abundance of green habitats, we also expected the community composition to show less-pronounced spatiotemporal differences. We sampled ant communities along a forest-plantation-urban gradient in the southern Western Ghats during March (dry) and November (wet) for two years. We deployed malaise and pitfall traps at 24 distinct sites to sample ant communities. The specimens were morphotyped and identified to the nearest possible taxon.

We sampled around 45000 individuals across the sampling frame. Contrary to our expectations, we find that the urban and plantation communities are richer and more diverse than the forest communities. Community composition differs between the forest and urban sites, with the plantation community overlapping with the other two. This study helps unravel the processes behind community assemblies and ultimately facilitates making informed land-use policies.

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P45 – Dachena Romain Gracia , University Mohammed VI Polytechnic
Changes in the diversity and abundance of insects associated with quinoa under the influence of climate variation in Morocco

Quinoa (*Chenopodium quinoa* Willd.) is attracting increasing interest for its high nutritional value and adaptability to a wide range of environmental conditions. However, climate change significantly affects the insect communities associated with this crop, altering their abundance, species diversity, and seasonal dynamics. This study aimed to analyze changes in quinoa insect populations in relation to climatic factors, including temperature, relative humidity, seasonal variation, and plant phenological stages. Entomological surveys were conducted in quinoa plots across different growth stages to identify associated insect species and evaluate their population fluctuations throughout the crop cycle.

Preliminary results show significant variation in the number of individuals and the composition of insect species, depending on climatic conditions and quinoa phenology. Certain phytophagous species, notably seed bugs and sap-sucking insects, showed increased abundance during hot and dry periods, while other groups exhibited decreased abundance or shifts in activity over time. In parallel, variations were also observed among beneficial insects, suggesting potential impacts on the ecological balance within quinoa agroecosystems.

This research highlights the importance of entomological monitoring in the context of climate change and advances understanding of the interactions among climate, insect biodiversity, and quinoa production. The findings could serve as a basis for developing integrated management strategies adapted to future environmental conditions.

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P46 – Armando Rosario-Lebron, Swansea University
Outreach to Open Platform: Writing for Entobites

EntoBites is a science communication platform run by students and early-career researchers that turns new entomological research into short, easy-to-read

summaries. Stories range from the wild biologies of insects to pieces on the etyomology of insect names, we break studies down into bite-sized pieces that make insect science more approachable. Best of all? It's great fun.

But EntoBites is more than just a blog project, it's an open invitation. We're a community of passionate entomology writers building our science communication skills, gaining experience, and sharing our enthusiasm for entomology and we want you to join us. Whether it's an idea you'd bring to an outreach talk or a paper you can't stop thinking about, EntoBites gives you the freedom to write about the entomology you love, with friendly editorial support and a real public audience. Come write with us and help make insect science accessible to everyone.

P47 – Pankaj Sharma, Division of Entomology, Department of Entomology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat

De Novo Transcriptomic Insights into Deltamethrin-Induced Molecular Responses in the Pulse Beetle *Callosobruchus chinensis* (L.)

The pulse beetle, *Callosobruchus chinensis* (Coleoptera: Chrysomelidae), is a major pest of stored legumes, causing substantial post-harvest losses. Despite extensive use of pyrethroid insecticides, the molecular basis of insecticide adaptation in pulse beetle remains poorly understood.

In this study, transcriptomic responses of *C. chinensis* following prolonged deltamethrin exposure were investigated using Illumina RNA sequencing. Comparative analysis generated 58,120 transcripts, 25,343 unigenes, and 13,614 predicted coding sequences, revealing 330 significantly differentially expressed genes. Functional annotation and pathway enrichment analyses demonstrated the activation of detoxification and stress-response networks associated with xenobiotic metabolism and signal transduction. Key regulatory pathways included MAPK signaling, ROS-mediated Keap1/CncC signaling, CREB-mediated transcriptional regulation, AhR/ARNT signaling,

JAK/STAT signaling pathways, which collectively regulate detoxification-associated genes such as cytochrome P450s, glutathione-S-transferases, and ABC transporters. Quantitative real-time PCR validated significant upregulation of cncc, cyp4c3, gst, and gpx, whereas sod and pdi were downregulated. Molecular docking further supported interactions between deltamethrin and detoxification-related proteins. These findings provide novel insights into the molecular mechanisms underlying pyrethroid adaptation in *C. chinensis* and identify potential biomarkers for resistance monitoring and sustainable stored-product pest management.

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P48 – Ali Hassan Syed, University Of Ostrava

Microbial communities associated with *Retinia resinella* larvae and galls in Scots pine forests: Potential role in terpenoid degradation

Plants, especially conifers like *Pinus sylvestris*, produce resin rich in terpenoids as a chemical defense against herbivores. These compounds have strong insecticidal and antimicrobial properties, making them a significant barrier for most insect feeders. However, the larvae of *Retinia resinella,* a moth species found in Scots pine forests, are uniquely adapted to survive within terpene-rich resin galls. This study investigates the role of gut microbiota in enabling *R. resinella* to tolerate and potentially metabolize these toxic compounds.

Using next-generation sequencing (NGS), we analyzed the bacterial and fungal communities within larval guts and their surrounding gall tissues. Our preliminary results suggest the presence of diverse and resin-tolerant microbial taxa, including candidates with potential terpenoid-degrading capabilities.

These findings support the hypothesis that gut microbiota play a critical role in helping the insect overcome host plant chemical defenses. In the next phase of the research, we will conduct transcriptomic analysis to identify gene expression pathways involved in terpenoid degradation, further clarifying the functional contributions of specific symbionts.

This study enhances our understanding of insect-microbe-plant interactions and provides insight into ecological adaptation mechanisms. It also opens the door to exploring microbial applications in biotechnology and environmental detoxification.

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P49 – Madeline Taipale, University of Reading

Revising beetles is in-tents: the tent-caterpillar hunters of the genus *Plochionus*

The Carabidae (ground beetles) are one of the largest and most ecologically important lineages of Coleoptera. Despite their diversity, attractiveness, and value as providers of ecosystem services, many groups remain poorly understood, requiring taxonomic revision. Such revisions are fundamental to understanding the biology and ecology of these beneficial insects and can provide the framework upon which broader biodiversity research depends.

The pantropical ground beetle genus *Plochionus* is a small, rarely encountered group of arboreal carabids notable for their unusual "tent-hunting" lifestyle. Species are typically specialist predators of silk-spinning insects, particularly Lepidoptera larvae, and are often port-intercepted, associated with dried plant material. Despite their distinctive biology, their taxonomy remains poorly resolved, having received little attention since their original description in 1821. Several species remain undescribed, and many described taxa lack descriptions of genitalia and other key diagnostic characters.

This project will provide the first comprehensive revision of *Plochionus* in over two centuries, including updated descriptions of known species, descriptions of new taxa, imaging of type material, and the compilation of label data and historical literature. The resulting taxonomic framework will improve species identification, provide new insights into the ecological associations, host use, and biogeography of this distinctive lineage of pantropical carabids.

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P50 – Beatrix Ward, Harper Adams University

Not simply the pest: Using the Forest Trapping Network to assess biodiversity

This project, conducted in collaboration with Forest Research, examines the ecological value of non-target insects collected through the Great Britain-wide Forest Trapping Network (FTN), a surveillance programme designed to detect priority forestry pests such as bark beetles and other regulated species. Although FTN traps routinely capture large quantities of bycatch, these non-target specimens have remained largely unexplored as an ecological dataset. This study investigates whether the functional composition of bycatch, specifically sap-feeding, fungivorous, and predatory Coleoptera, varies in response to pest dominance within Scots pine (*Pinus sylvestris*) forest stands.

Specimens collected from Scots pine stands across England, Scotland and Wales were identified to the lowest feasible taxonomic level, with particular focus on taxa associated with bark-beetle galleries, larvae, or broader indicators of forest disturbance. Samples were compared to test the hypothesis that traps with high pest dominance exhibit a distinct bycatch composition, characterised by increased relative abundance and richness of sap-feeders (e.g. Nitidulidae), fungivores (Cryptophagidae, Leiodidae), and predatory beetles (Staphylinidae, Salpingidae), compared with traps where pests were lower.

The findings aim to demonstrate how routine pest-monitoring programmes can yield broader biodiversity information, enhancing understanding of arthropod interactions within British conifer forests. They also highlight how non-target bycatch can be utilised more effectively, providing information that may support long-term ecological monitoring and inform future forest management policies and practices.

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P51 – Thavinsa Dewmini Weerakoon Gamage, Independent Researcher

Social immunity, division of labour and behavioural plasticity in *Camponotus irritans:* insights from a long-term field study

Camponotus irritans is a polymorphic carpenter ant widely distributed across South and Southeast Asia, yet its long-term behavioural ecology remains poorly documented. This study presents a five-year field-based behavioural analysis of a *Camponotus irritans* colony in Sri Lanka (2021–2025), focusing on social immunity, caste differentiation and behavioural plasticity. Data were collected through repeated daytime and nocturnal observations of natural behaviour, with species identity confirmed using regional taxonomic keys and morphology.

A distinct subset of small-headed minor workers consistently performed caregiving behaviours including grooming, wound treatment and limb removal of injured nestmates, suggesting task specialization linked to colony hygiene. The colony exhibited temporal plasticity in activity patterns, shifting from both diurnal and nocturnal activity (2021–2024) to predominantly nocturnal foraging in 2025, coinciding with reduced sugar availability, indicating a link between carbohydrate access and activity patterns.

Up to three queens were observed within a single nesting system, maintaining spatial separation with limited non-lethal aggression, indicating a flexible social structure, including potential polygyny or temporary multi-queen coexistence.

These observations reveal behavioural specialisation not previously documented in *C. irritans*, alongside adaptive responses, highlighting how environmental pressures shape social immunity strategies in eusocial insects more broadly.

P52 – Charlotte Wood, SRUC

Invertebrate Communities: Measuring Nutritional Robustness in the Agricultural Landscape

Biodiversity is the variability of life on earth. Without it, ecosystems may lose resilience, species can disappear, and the essential processes that support life begin to break down, including invertebrate populations critical to ecosystem functioning through pollination, nutrient cycling, and food web support.

When we measure biodiversity, we often use abundance and diversity metrics; but does this give us the whole picture? Nutritional ecology explores how organisms acquire, balance, and utilise key nutrients, by bridging individual physiology and population-level ecological processes. Insects are particularly sensitive to variation in macronutrients (proteins, lipids, and carbohydrates) which influence development, reproduction, and survival. Consequently, changes in plant nutrient composition, driven by agricultural land-use practices and environmental pressures, may therefore affect insect communities in ways not reflected by abundance and diversity metrics alone.

My project aims to assess invertebrate community nutritional robustness across agricultural habitats within north-east Scotland. My research will combine a range of techniques, including ecological field sampling, macronutrient-manipulation experiments under controlled conditions, and analytical biochemical laboratory assays.

I will quantify macronutrient ratios at all trophic levels within natural communities, from plants through to apex predatory invertebrates; to assess how nutrient imbalances propagate through food webs.

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P53 – Jude Woodcock, University of Bristol

Repeated Cold Stress Reduces Egg Size and Affects Offspring Fitness in a Beneficial Aphid Parasitoid

Climate change is leading to warmer winters in temperate regions. Consequently, ectothermic insects are undergoing reduced incidence of diapause, instead remaining winter-active. Increased winter activity may expose insects to unpredictable extreme cold events, causing lethal and sublethal effects. One sublethal effect is the impact of cold exposure on fertility and fecundity. Thermal fertility limits (TFLs) tend to occur at less extreme temperatures than lethal limits but can incur similar costs to population viability. This study used repeated daily cold exposures of varying intensities to assess the impact of cold temperatures on reproductive traits of *Aphidius ervi*, a beneficial aphid parasitoid. Dissections revealed a significant effect of repeated cold exposure on egg size. A follow-up experiment examined whether cold-induced reductions in egg size as well as any other potential intergenerational effects could affect offspring life history traits. Data show significant effects of maternal cold exposure on offspring size, wing area, and lipid content. These results reveal insights into how insects may respond both directly and intergenerationally to extreme cold events which suggests potential cascading effects on aphid–parasitoid dynamics under changing seasonal regimes.

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P54 – Amelia Wych, University of Bristol & Universidade Federal do Pará

Living on the edge: exploring the impacts of edge effects on tropical forest dung beetles

Forest fragmentation is increasing globally, with approximately 20% of remaining forests located within 100m of a non-forest edge. These edges alter environmental conditions and can disrupt ecological processes, yet their impacts on biodiversity remain variable across taxa. Dung beetles are integral to forest functioning and serve as indicators of disturbance due to their sensitivity to environmental change. We investigated the impacts of forest edges on dung beetle assemblages using a paired sampling design across 58 plots (29 edge and 29 interior) distributed in two regions of the Brazilian Amazon. At each plot, dung beetle assemblages were sampled alongside leaf litter, temperature, humidity, and canopy openness. We collected 24,528 individuals representing 110 species across 22 genera.

Edge plots exhibited environmental changes consistent with edge effects, with higher temperatures and lower humidity compared to interior plots. Although no significant changes were observed for richness and abundance, dung beetle community

composition differed significantly between habitat types, indicating a compositional shift between edge and interior forests. These findings suggest that forest edges can retain diverse dung beetle communities hosting distinct species, potentially driven by increased dominance of generalist and matrix-associated dung beetles at the expense of forest-specialists.

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P55 – Aleksandra Wyszyńska, Adam Mickiewicz University, Faculty of Biology, Department of Animal Taxonomy and Ecology

Factors influencing phoretic interactions between mites from the cryptic species complex *Uroobovella nova* (Uropodina) and burying beetles (*Nicrophorus spp.*)

Beetles from the *Nicrophorus spp.* genus are known for using small carrion and for exhibiting complex interactions between males and females. Many burying beetle species are known for their phoretic interactions with mites *Poecilochirus* (Canestrini & Canestrini, 1882 (Parasitidae)). Representatives of the genus *Nicrophorus* are also carriers of mites from the cryptic species complex *Uroobovella nova* (Uropodina), although these associations have been studied less extensively. The aim of the study was to see how season, species, sex, and beetle's body size influence the phoretic interactions between deutonymphs from the cryptic species complex *Uroobovella nova*. The distribution of the deutonymphs on the beetle's body has also been analysed.

The research material was collected in 2018 and 2019 in the Niepołomice Forest near Kraków. The deutonymphs were present on all analysed beetle species. The species differed in intensity of infestation (number of deutonymphs found on a beetle) and extensivity of infestation (the percentage of beetles that were infested). The most important species in the dispersal of studied mites was *Nicrophorus vespilloides* (Herbst, 1783), and the least important turned out to be *Nicrophorus interruptus* (Stephens, 1830). Temporal variation in deutonymph phoresy and pattern of distribution of phoretic deutonymphs on the beetles was observed.

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