

Research Space
Conference paper

Marine microplastics: an assessment of the North Kent coastline

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Tanvi Agrawal, Ashoka Trust for Research in Ecology and the Environment

Understanding farmers' cropping decisions and implications for crop diversity conservation: Insights from Central India

Conserving crop diversity is promoted for global food system stability and creating local benefits like improved farmer nutrition, incomes and adaptive capacities. However, little is known about how farmers make decisions shaping crop diversity, and how conservation efforts can be aligned with farmers' goals. This study examines how interacting values, rules and knowledge shape decisions of subsistence farmers in central India. Findings suggest that farmers' values play a central role in shaping crop diversity. Their culinary and health preferences for consuming various self-cultivated crops primarily drive portfolio decisions. Farmers are hesitant to invest in commercial agriculture because of unreliable returns. Furthermore, they prefer to control water availability and land quality as means of coping with environmental change, rather than resorting to crop diversification. Finally, a rich understanding of local crop diversity dynamics questions the ethics of expecting marginal farmers to shoulder the burden of conservation for global gain, suggesting ex-situ strategies are appropriate where in-situ practices are not autonomously selected. Overall, the analysis demonstrates the importance of understanding farmer-level decision-making for wider crop diversity conservation debates.

Allan Baino, University of Greenwich

Using stable isotopes to estimate diet composition in Gyps vultures over space and time

1. Dietary studies in birds of prey involve direct observation and examination of food remains at resting and nesting sites. Although these methods accurately identify diet in raptors, they are time-consuming, resource-intensive, and associated with biases that stem from the feeding ecology of raptors like *Gyps* vultures (*Gyps africanus* and *Gyps rueppelli*). Our study set out to estimate diet composition in *Gyps* vultures informed by stable isotopes that provide a good representation of assimilated diet from carrion resources in local systems.
2. We hypothesized that diet composition in *Gyps* vultures derived from stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope ratios vary over space and time in Serengeti National Park and Selous Game Reserve in Tanzania, and that location of prey items (prey source) derived from stable sulfur ($\delta^{34}\text{S}$) isotope ratios does not vary across sites, as *Gyps* vultures have been observed to move great distances in search of food.
3. Through a combination of linear and Bayesian models, diet-derived from $\delta^{13}\text{C}$ in *Gyps* vultures consisted of grazing herbivores across study areas, with those in Serengeti National Park consuming higher proportions of grazing herbivores (> 87%). $\delta^{13}\text{C}$ differences in vulture feather subsets per site did not indicate vulture diet change and in combination with blood $\delta^{13}\text{C}$, vultures fed largely on grazers for ~159 days before they were sampled in both sites. Similarly, $\delta^{15}\text{N}$ values implied that *Gyps* vultures fed largely on herbivores across space and time. $\delta^{34}\text{S}$ ratios separated prey source for vultures between the two sites. $\delta^{34}\text{S}$ variation in vultures across sites resulted from baseline differences in plant $\delta^{34}\text{S}$ values, though it is not possible to match $\delta^{34}\text{S}$ to specific locations.
4. Our findings highlight the relevance of repeated sampling that considers tissues with varying isotopic turnover and emerging Bayesian techniques for dietary studies using stable isotopes. Findings also suggested limited vulture movement between the two local systems. However, more sampling coupled with telemetry is required to fully comprehend this observation and its implications to *Gyps* vulture ecology and conservation.

Naomi Beddoe, Canterbury Christ Church University

A scoring system for road verge plants based on uses and attributes.

Roadside verges are becoming increasingly important as a natural resource and efforts to understand their biodiversity and contribution to ecosystem services are being made globally. There are 500,000 km of rural roadside verge in the UK, and they are under pressure from the competing interests of councils, commuters, and wildlife as to how they should be managed. This study built on the Hay Time project's (Star-Keddle & Barrett, 2012) scoring of plant species for their positive or negative effect on the habitat by increasing the scoring criteria. This study included aesthetics, edible for humans/livestock, medicinal/social/economic/ecological uses, associations with pollinators, abundance, invasiveness, competitive nature, host of pests or diseases, toxicity to humans or livestock and origin. This study has initially included plants found in the Thanet Way study area and additional species likely to appear in grasslands or other Kent habitats. This database will be of use to ecologists, students, and the wider community to easily access plant attributes and associated data. The scoring system can be used to indicate levels of plant communities' functions and attributes and to inform targeted management conversations around marginal and roadside land.

Marieke Bloemink, Canterbury Christ Church University

Marine microplastics: An assessment of the North Kent coastline

Microplastics (MP) are officially defined as plastic particles which are smaller than 5 mm in diameter. They originate from a wide range of sources, such as cosmetics, microfibers from clothing or degradation of fishing nets. Microplastics take a long time to degrade, and marine environments in particular can accumulate high levels of microplastics. As a result, microplastics have been detected not only in sea water, but also in a wide range of marine organisms, from plankton to whales. This study aims to determine microplastic contamination along the north-east Kent coastline as there is a lack of data from this area. Seawater samples were collected from 8 sample sites by IFCA (Inshore Fisheries and Conservation Authorities, Ramsgate) and processed at Canterbury Christ Church University. The samples were analysed for MP levels according to guidelines set by the National Oceanic and Atmospheric Administration (NOAA) with recovery rates consistently between 85-95%. The amount of MP (mg/L) found for each site has been classified as low (average 0.025 mg/L plastic), medium (average 0.055 mg/L plastic), high (average 0.083 mg/L plastic) and very high (average 0.1 mg/L plastic). Preliminary data (two independent experiments) show MP contamination at all eight sample sites. Using a microscope both microfibers and microbeads could be identified, with microfibers being about five-fold more abundant than microbeads. Sample sites 4, 7 and 8 contained very high quantities of MP (>0.1 mg/L), whereas the remaining sample sites showed medium levels of MP contamination (0.05-0.06 mg/L), apart from site 3 which was classified as low MP contamination (0.03 mg/L). FT-IR analysis indicates plastic polymers such as polyethylene (PE) and polyethylene terephthalate (PETE or PET) are the most common polymers found in the samples.

Jon Bramley/Oliver Parfitt, Bramley Associates

The Beaver population in East Kent

Bramley Associates have been involved in Mammal Research since the company's inception in 1998. Staff at Bramley Associates carried out a comprehensive survey of beaver in the Stour Valley from Ashford to Sandwich Bay in 2018, and have since increased our knowledge of the current size and impact of the East Kent beaver population.

Phil Buckley, Canterbury Christ Church University

Beaver impact in context

Beaver were introduced into the closed reserve of Ham Fen in 2002. Since that time they have modified the wild and human landscape in the area surrounding the Fen. The Ecology Research Group has undertaken a number of different studies of the ecological and social dynamics of Ham Fen and the wider aquatic landscape in which it sits.

Joseph Burman, Canterbury Christ Church University

**Identification of female sex pheromone for monitoring the Barred Tooth Striped Moth,
Trichopteryx polycommata, a priority conservation species**

Pheromone-baited traps can be excellent tools for sensitive detection of insects of conservation concern. Here, identification of the sex pheromone of *Trichopteryx polycommata* (Denis & Schiffermüller, 1775), an under-recorded UK priority species, is reported. In analyses of extracts of the pheromone glands of female *T. polycommata* by gas chromatography coupled to electroantennographic recording from the antenna of a male moth, a single active component was detected. This was identified as (Z,Z)-6,9-nonadecadiene (Z,Z6,9-19:H) by comparison of its mass spectrum and retention times with those of the synthetic standard. In a pilot field trial in Kent, UK, *T. polycommata* males were caught in pheromone traps baited with lures loaded with 1 mg and 2 mg (Z,Z)-6,9-19:H. Optimum lure loading was identified in a further five trials in Kent, Sussex and Lancashire where lures of 0, 0.001, 0.01, 0.1, 1, 2, 5 and 10 mg loadings were tested. Traps baited with 1 to 10 mg of ZZ6,9-19:H caught significantly more *T. polycommata* than traps baited with 0 mg and 0.001 mg. In a pilot survey of *T. polycommata* using pheromone lures around Morecambe Bay, UK, *T. polycommata* males were captured at 122 new sites within the three counties where trials took place, demonstrating the potential of pheromone monitoring to increase knowledge of abundance, distribution and ecology of this elusive species.

Ximena Chamorro Bolaños, University of East London

Manufacture of Lightweight Aggregates (LWA) as an option for recycling Air Pollution Control Residues (APCr)

The use of Municipal Solid Waste (MSW) in Energy from Waste (EfW) facilities is increasing in the UK as a sustainable option to reduce the amount of waste that is sent to landfill. However, an issue associated with MSW incineration is the volatilisation of hazardous compounds contained in MSW. These contaminants are removed from the gaseous emissions by Air Pollution Control (APC) units. The solid waste generated during this cleaning process is known as APC residues (APCr), which are classified as hazardous because of their environmental impact associated with their chemical composition and leaching properties. APCr treatment before landfilling is highly expensive, and therefore, there is a need for recycling of these waste material.

This research focuses on the assessment of different treatments for APCr, so that these residues can be used in the manufacture of construction materials called lightweight aggregates (LWA). This is a partnership between the Sustainability Research Institute (SRI) of the University of East London and Augean PLC, which is a market leader in management of hazardous materials coming from MSW incinerators.

The first stage of this research is the physical and chemical characterisation of APCr coming from 16 EfW facilities in the UK. The contents of heavy metals accepted by the Waste Acceptance Criteria (WAC) were determined by ICP-OES, resulting as the main elements: Zn, Pb and Cu, among others. The analysis of mineral phases on APCr was performed by X-Ray diffraction, obtaining as the most common phases: Calcite, Quartz, Calcium hydroxide, Halite, Sylvite, among others. The mineral phases represent around 70% of the total composition of APCr, while the other 30% is amorphous material. The elemental composition of APCr is currently being performed by Scanning Electron Microscopy coupled to Energy Dispersive Spectroscopy (SEM/EDS), after the implementation of a complete sample preparation process.

Lauren Chamberlain, Canterbury Christ Church University

Heavy Metal Contamination (Cu, Pb and Cd) of Washed and Unwashed Roadside Wild Blackberries (*Rubus fruticosus*)

Foraging provides a multitude of individual, social and environmental benefits. With green spaces decreasing in the UK there is the opportunity for roadside verges to become foraging resources through management schemes. There is public concern over the safety of roadside forage. Human ingestion of heavy metal contaminants such as copper (Cu), lead (Pb) and cadmium (Cd) originating from traffic activity induce toxic effects in the body. Therefore, Cu, Pb and Cd maximum allowed limits for human consumption in small fruits have been established. Studies on heavy metal concentration in roadside forage and the effect of surface washing on concentration are limited. This study examines Cu, Pb and Cd in washed and unwashed wild blackberries (*Rubus fruticosus*) at two locations along Thanet Way, Kent. Average Pb concentration (wet weight) at the roundabout and main road locations in washed (0.367mg/kg, 0.307mg/kg, respectively) and unwashed (0.495mg/kg, 0.508mg/kg, respectively) samples were above the maximum limit for human consumption (0.020mg/kg wet weight). Cu and Cd concentration in washed and unwashed samples were below maximum concentrations. Location had a significant effect on Cu concentration in unwashed samples (P-value = 0.020). Wild blackberries along Thanet Way are not suitable for human consumption, findings are not representative for all forage.

Adriana Consorte-McCrea, Canterbury Christ Church University

Human-wildlife interaction as an imperative of Biodiversity Conservation

Amid the present biodiversity crisis, as conservation biologists we strive to find solutions that reflect the urgency of arresting biodiversity loss and recovering species. However, failure in considering the relationship between diverse sectors of the community and wildlife may contribute to the development of human-wildlife conflicts that impacts on the success of in situ conservation and species restoration. A review of human-wildlife interactions (HWI) featuring in the IUCN Global Conservation Translocation Perspectives (2021) identified areas of interest: HWIs occur across the phylogenetic spectrum; out of 69 projects 41 reported HWI issues in relation to Goals, Success Indicators, Major Difficulties Faced, Major Lessons Learned or Project Outcome; although themes are commonly found amongst projects, human dimensions identified in relation to one aspect of a report are seldom found all the way through the same project suggesting a lack of consistency in addressing HWI; HWIs have often taken project staff by surprise, becoming a barrier to the success of the conservation translocation. HWIs identified in the reports was grouped into four common themes: 1) inclusion and collaboration between interest groups, 2) addressing human-wildlife conflict; 3) developing benefits for the focus species and the community and 4) long-term planning and funding. These preliminary findings strongly suggest the need for guidance to help project planners consider HWI at all stages of a project to increase the effectiveness of conservation translocations and restoration towards biodiversity conservation. During this presentation I will discuss these findings and introduce the work conducted by the Human-Wildlife Interaction Working Group of the IUCN Conservation Translocation Specialist Groups, which combines research and applied knowledge.

Ria Devereux, University of East London

Impact of New Year firework displays on the microplastic abundance within the River Thames

Freshwater and estuarine ecosystems are essential resources that are fully utilised as a water source, a network for economic development or anthropogenic activity. As a result, these systems, particularly rivers, have become a significant contributor and a major pathway for plastic pollution to enter the sea. Whilst a range of sources have been well documented, one potential source of plastic pollution appears to be lacking. Macrodebris from fireworks have been recorded in numerous studies, especially washed up on beaches, but studies that focus on microplastic resulting from firework events seem to be lacking. The amount of pollution (air, noise, light and debris) released varies on the scale of the firework event. Arguably the biggest of these worldwide is that of New Year as the majority of these displays are held over water for example, UK (London), Australia (Sydney harbour) and Singapore (Marine Bay) to name a few. As a result, we aimed to assess the impact of the 2020 New Year's firework display on microplastic abundance within the River Thames. Water samples were collected, at high tide, from one site located at Westminster over nine consecutive days. Overall fibres (99%) dominated this study, with microplastic abundance increasing by 1051% from the 31st December 2019 to 1st January 2020. Fourier Transform Infrared Spectroscopy (FTIR) was used to analyse 119 visually identified microplastics resulting in 37 different types of plastic and materials being identified. These findings demonstrate that microplastics are present in the River Thames, and a short-term influx of microplastics caused by the fireworks are evidenced in the River Thames, which may have a detrimental impact on the ecology and aquaculture of the river and neighbouring waterways.

Henry Dymoke, Scrivelsby Biomass

Grass Verge harvesting

A look at how to cut, collect and use roadside verges to produce electricity and heat from an AD plant and the issues that come with it.

Chris Ferguson, Canterbury Christ Church University

From abandoned to abundant – remediating India's contaminated farmland

Contamination via tannery effluent has rendered farmland in many areas of southern India unusable and potentially harmful to the local population. With many areas supporting low-income individuals, expensive remediation methods are unviable. Phytoremediation, being cost-effective and environmentally friendly, is an ideal tool to reverse environmental damage to soils. However, in areas that rely on the land for income and sustenance, it is important to identify crops that continue to provide the same benefits to the local community whilst removing pollutants. Comprehensive analysis of the contaminated area with the use of geographical imaging systems (GIS) allows for the mapping of contamination as well as important indicators including foliage cover and desertification, while also producing visual aids making the research more assessable. The first chapter of this study looks at heavy metal contamination levels around tanneries in Dindigul, Tamil Nadu, India. Analysis of soil samples collected from abandoned farmland were analysed using ICP-OES. Results are mapped using ArcMap, with inverse distance weighting and kriging being used to determine the extent and spread of the contamination from the tannery sites and the variation in the soil properties. The data produced then informs the next stages of the study including pot experiment contamination levels and soil community analysis.

Marcella Fernandes De Souza, Ghent University

Creating value from roadside grass clippings – main results from the Grassification project

The Grassification project aims at using roadside grass clippings as a renewable resource for the production of biobased products. For this, the whole value chain for grass clippings valorization is being assessed. A new mowing head was developed for reducing the amount of sand content in the grass clippings, thus increasing their potential for further processing. For the bulk processing of grass clippings, anaerobic digestion was investigated both as a mono-digestion in batch and continuous configurations and as a co-digestion with pig slurry for a more agricultural application. The high-quality grass fibers were also tested for the production of building panels and bio-composites, and several prototypes containing grass fibers, including a picnic table, were produced. The liquid fraction obtained from the pressing of grass clippings was tested for the production of biogas, fertilizers, and feed (using insects and microalgae). Biogas production was successful, however with a low output of methane per ton of liquid fraction. The use of the liquid fraction as a fertilizer proved to be challenging, and new tests are still on the way to better assess the potential of this application. For feed production, the liquid fraction proved to be a good nutrient source for the growth of microalgae. From an environmental perspective, creating value from roadside grass clippings is a sustainable practice with lower impacts than the current baselines (cut-and-leave or collect and compost). However, from a legal and economic point of view, not all the proposed value-chains are currently viable. Grassification has proven that the use of roadside grass clippings is technically possible and environmentally attractive, and that exchanges with policymakers are needed to further enable the roll-out of the proposed technologies.

Iain Fraser, University of Kent

Consumer preferences for Known Wild Provenance plants in the horticultural trade

The relationship between the acquisition of novel plants from the wild for use in ornamental horticulture, commonly referred to as “Plant Hunting”, and Access and Benefit Sharing (ABS) agreements introduced under the Nagoya Protocol (2010), part of the United Nations Convention on Biological Diversity, is investigated. The Nagoya Protocol allows countries to both set out terms under which access may be given to their indigenous genetic resources in return for benefits from any research and development of those genetic resources and place restrictions on the commercialisation of wild plants and seed. We examine if plants of Known Wild Provenance (KWP) are valued more highly than those of horticultural origin by UK consumers, and if the potential premium could be translated through an ABS agreement with plant hunting nurseries, into monetary benefits for the countries providing access to this plant material. To undertake this analysis, we employed a discrete choice experiment (DCE) survey instrument, implemented online, to assess consumers’ preferences and willingness to pay (WTP) for KWP, with the aim of understanding if there is a price premium for plants of KWP compared to plants with a range of other attributes. Our preliminary econometric analysis reveals that KWP did not prove to be a strong driver for plant buyers, although there is a positive value attached to this attribute by a significant segment of the buying population. Thus, the ability for commercial horticulture to provide monetary benefits is found, although any ABS agreement should not be based solely on monetary benefits from the sale of plants.

Spyridoula Gerasimidou, Brunel University

Challenges and trade-offs of a wider adoption of bio-based plastics in food packaging value chain through a system thinking approach

Global plastic pollution has placed attention to alternative materials such as bio-based plastics. Notwithstanding the potential benefits of these alternatives, there can also be negative hidden impacts associated with them, which are underexplored. Herein, we aimed at identifying the potential challenges and trade-offs associated with the production, use and end-of-life management of bio-based plastics from primary feedstock (e.g. agricultural crops) in the food packaging industry to illuminate important knowledge gaps. Via a systematic literature evidence mapping, we carried out a comparative analysis of the performance of bio-based plastics to that of conventional (petrochemical-based) alternatives across their entire lifecycle. From that comparative analysis, a sustainability decision matrix was developed, which provides insights into the potential impacts of introducing a larger amount of bio-based plastic food packaging in the market. In summary, bio-based plastics production can lead to considerable environmental impact such as climate change, biodiversity loss, soil erosion, eutrophication of ground and surface waters and carbon emissions, largely attributed to land use change and the use of fertilizers and pesticides, and energy required for the cultivation and harvesting of agricultural crops. In the stage of production, the biorefinery and polymerisation processes are also generally associated with high energy consumption, and air pollution. In the stage of use and end-of-life the migration of chemical additives and leaching to the surrounding environmental compartment when composted could result to hidden negative environmental and human health impacts. In essence what the preliminary high-level assessment of the bio-based plastics production, use and waste management system indicated was large number of blind-spots that need to be scrutinised to be able to ensure the sustainability potential of these alternative solutions. Further research is therefore needed to ascertain whether the substitution of petrochemical-based plastics with bio-based alternatives in food packaging sector will not lead to unintended consequences.

Lewis Halsey, University of Roehampton

Energy compensation in animals, including humans

Evidence from the lab suggested that animals exhibit 'energy compensation' in that they reduce basal metabolic rate in response to chronic periods of increased activity. That is, if more energy was spent on activity then basal metabolic rate decreased to limit the overall increase in daily energy expenditure. By measuring heart rate in a range of birds and mammals, which is a proxy for metabolic rate, we show that energy compensation also occurs in wild animals, and particularly during periods when they are expected to be particularly active. Do humans also exhibit energy compensation? Again, work in the lab indicated that this was the case, when participants undertook prescribed aerobic exercise over months, and again we investigated whether this was also the case under more 'natural' conditions. This time using the doubly-labelled water technique, we measured the metabolic rate of people living their natural lives. Similar to other animals, we found evidence of clear energy compensation (of at least 25%), and the degree of compensation was greater in people with a higher body mass index. Energy compensation has implications both for understanding energy management by animals and, for humans specifically, the use of prescribed exercise to manage body weight.

Jeremy Haggard, University of Greenwich

Seeking Sustainability in Coffee Agroecosystems

Coffee production can be practised in a wide range of production systems from high-input mono-crop plantations to coffee agroforests, between these are many different kinds of agroforestry practices with a range of intensities and sustainability characteristics. Across these different production systems there are multiple interactions and trade-offs between productivity, carbon footprint, biodiversity and resilience. Sustainability certifications such as Organic, Fairtrade and Rainforest Alliance aim to compensate or recognise the investments by farmers in sustainability, evidence of their actual outcomes for farmers is presented and discussed.

Chris Harvey, Canterbury Christ Church University

Discovering cryptic diversity: The case of the Shining Ramshorn Snail

The Shining Ramshorn Snail, *Segmentina nitida*, is widely distributed in standing freshwater habitats in Europe, but is experiencing declines in its populations, especially in the UK. The species is a focus of a Biodiversity Action Plan in the UK. We investigated the population genetics and shell morphology of populations from the UK, Germany, Sweden and Poland to evaluate their genetic diversity and relatedness. Our analysis of nuclear and microsatellite DNA markers suggests the presence of two cryptic species coexisting in Europe that may also have subtle shape differences. We will discuss the implications of these findings for the conservation of *S. nitida* and other snails in the UK.

Gregg McIntosh, Canterbury Christ Church University

Magnetic biomonitoring of air quality across Kent

Air quality continues to be an important issue in terms of its impact on environmental and human health and as such the development of rapid and cost-effective methods to monitor it have remained at the forefront of environmental science. Magnetic biomonitoring has been established as a powerful method across many global settings, with a variety of different target species used to capture atmospheric particles from a range of different natural and anthropogenic sources. In this study, the results of magnetic biomonitoring across Kent will be presented and the results obtained from moss balls, strawberry plants, geranium, ivy and petunia will be compared. This leads on to a discussion of the effectiveness of the technique and a discussion of how this might affect the quantitative nature of the results.

Recycling coconut coir substrate in strawberry production

Coconut coir is a medium that has been used extensively in soilless tabletop strawberry production in the UK for over a decade, particularly as a more sustainable alternative to peat-based media. The substrate however is only used for one cropping cycle. A more sustainable and economically attractive option for growers is to extend the number of seasons that the coir medium could be used. However, experiments by the UK industry have reported reductions in strawberry yield with reused coir probably due to pathogen accumulation and nutrient imbalance. The current study aimed to gather more information regarding this reported yield decline. In addition, fruit quality (BRIX) was also assessed. In 2018 and 2019, the June-bearer strawberry variety 'Malling Centenary' was used, and in 2020 the ever-bearer strawberry variety 'Prize' was used. In 2018, unused and once-used coir were tested. In 2019, unused, once-used and twice-used coir were tested. In 2020, unused, once-used, twice-used, and three times used coir were tested. The effect of adding woody biochar (oak, beech) on coir recycling, fruit yield and quality were also investigated. We have shown that there was no significant effect of coir age or biochar amendment on the yield or quality of June-bearer strawberry variety 'Malling Centenary' while approximately 6% year-on-year yield decline was observed in ever-bearer strawberry variety 'Prize'. The reuse of coir in strawberry production has immense potential for environmental and economic benefits in a circular economy approach. However, other factors also need to be considered such as pest and disease persistence in the coir, changes to the microbiome, physical and chemical properties of the coir over time.

Kate Petty, Plantlife International

Transforming the UK's road verges

Since launching in 2012 Plantlife's Road Verge Campaign has been working to transform the way the UK's verges are managed. We've been raising awareness of the importance of road verge wild flowers and the wealth of wildlife they support, and changing perceptions of what they road verges can be. This presentation will explore why road verges matter and what land managers (whether councils, contractors, or highways agencies) and members of the public can do to make verge management more sustainable and boost biodiversity along our roadsides. Plantlife's award-winning best practice grassland verge management guidelines will be introduced alongside case studies from successful projects across the country that are putting good management principles into practice on the highway estate. The talk will look at several of the barriers to wider adoption of more wildlife-friendly management that exist, such as negative public perceptions and what to do with grass arisings, as well as possible solutions and next steps. Join this session to find out how changing grassland verge management, and the conversations around it, can bring benefits to not only plants and pollinators, but also people and the planet.

Naomi Rintoul, Canterbury Christ Church University

Aesthetics of road verges: understanding the public perception of "visually appealing" habitats

Road verges account for a significant proportion of the terrestrial landscape: in the UK alone, they cover over 2,400km². It is estimated that on a global scale, 270,000km² of land – an area the size of the UK – is road verge habitat. These habitat offers wide variety of ecosystem services, from regulating services like pollination and air quality regulation to provisioning services such as food, fibre and natural medicines. Despite this, these areas are often under-researched and poorly managed. It has been shown that management of these areas is often influenced by the perceptions of the public rather than a scientific approach. A limited number of studies have investigated public perceptions of landscape aesthetics of road verges and other urban marginal land. These have shown that the public tends to attribute higher value to "formal landscapes" (green areas that are designed and managed) than natural or semi-natural habitats. However, this is the first study to date that investigates the aesthetic value that the public give to specific species. This research has collated data from over 500 surveys that cover 231 plant species. It gives a value using a Likert scale approach (from 1 to 10) for each species, but also investigates the reasoning behind those values. This research is aimed at land managers and policymakers to ensure that these habitats are managed to ensure high biodiversity (and thus several ecosystem services) whilst being acceptable to the public.

Naomi Rintoul, Canterbury Christ Church University

Earthworms and zinc pollution: time for a new approach to earthworm toxicity studies

Soil is a valuable and diminishing resource. Chemical contamination is a major problem as harmful substances such as heavy metals often persist in the environment for long periods of time. The natural zinc content of soils is estimated to be 1-300mg/kg-1, although past industrial activities such as smelting have resulted in far higher concentrations in pollution “hot spots” across the UK. Pollution is known to cause harm to soil communities, and earthworms have been identified as the most sensitive soil organism to metal pollution, particularly for zinc. Although several studies have examined earthworm toxicity, the majority of these follow guidelines on experimental setup set out by EPA (2012) or OECD (2016), which have remained relatively unchanged for the last three decades. The research determined whether elevated zinc concentrations of 75mg/kg-1 (lower than current permissible limit), 200mg/kg-1 (permissible concentration of Zn in UK), 440mg/kg-1 (upper limit in rural UK soils) and 1,200mg/kg-1 (studies have found significant mortality occurs at or above this concentration) had a detrimental effect on two species of earthworm: *Eisenia fetida* (a compost earthworm that is cited as the recommended species for earthworm toxicity studies) and *Lumbricus terrestris* (a deep-burrowing worm that is commonly found in temperate ecosystems). This research also examined whether the guideline “model soil” is appropriate by running simultaneous experiments with worms in model soil and a standard topsoil. The results suggest that current guidelines set out by EPA (2012) and OECD (2016) are not appropriate for earthworm toxicology studies.

Harry Sanders, Canterbury Christ Church University

Non-native domination of benthic fauna in The Norfolk Broads, UK, and commensalism between non-native Ponto-Caspian taxa at the landscape scale

Invasive alien species (IAS) have deleterious ecological, geomorphic, social and economic impacts. Further, impacts from one IAS may be amplified where commensalism with another IAS allows for accelerated spread and population. In such scenarios, establishment of IAS can facilitate further invasions and additional system disruption through ‘invasional meltdown’ mechanisms, with potentially accumulative impacts on native ecology. However, no field evidence at the landscape scale exist to evaluate these mechanisms. The UK, and the Norfolk and Suffolk Broads National Park in particular, have been identified as being at risk from invasional meltdown, but no macroinvertebrate data exist to assess the progression and effects of species invasions in The Broads. Therefore, benthic macroinvertebrate samples were collected from 71 sites across 16 lakes in the Norfolk Broads to assess the associations between IAS and community abundance and structure. IAS dominated abundance (51%) and biomass (76.4%), and were predominantly of Ponto-Caspian origin. In particular, zebra mussel (*Dreissena polymorpha*) were found to structure benthic communities. Whilst native macroinvertebrate density, richness and biomass were not different between zebra mussel invaded and non-invaded regions, the abundance of other Ponto-Caspian species (*Dikerogammarus villosus* and *Chelicorophium curvispinum*) were significantly positively associated with zebra mussel abundance, and were only found at sites where zebra mussel were abundant. This study provides the first empirical field evidence from the UK of commensalism between Ponto-Caspian IAS, and is the first field study to empirically examine the invasional meltdown hypothesis in freshwater environments at the landscape scale. Given the positive, facilitative relationships observed between Ponto-Caspian IAS in The Broads, further spatial and temporal monitoring of benthic communities is key to assess the rates of invasions and community change, and careful and proactive measures are required to conserve and restore these important and at risk landscapes.

Mark Schofield, Lincolnshire Wildlife Trust

Highways for wildlife - managing our road verge networks and public open spaces for economically sustainable biodiversity gain

Road verges and green public open spaces can be viewed as a potential network of wildlife sanctuaries and corridors. Despite many demands and constraints on their management, it is contended that biodiversity gain can be delivered and sustained through an approach which can begin to address habitat fragmentation and climate change while seeking to reduce costs to local authorities. A case study in Lincolnshire highlights an approach to surveying and safeguarding the ecological value of Roadside Nature Reserves since 1960 and how innovative trials have been undertaken since 2016 to understand the potential of biomass harvesting from verges and public open spaces to deliver economically sustainable biodiversity gain. It is hoped that lessons learned in Lincolnshire can inform the national context.

Nicola Sheppard, Canterbury Christ Church University

Make Pine Martens Kentish again

Pine Marten were historically widespread in the UK. Efforts to re-introduce Pine Marten to places such as Kent rely initially on modelling what is known of their distribution, often in habitats not found in Kent. My Master's degree thesis catalogues my attempt to identify the most suitable places in Kent where Pine Marten could be re-introduced.

Stan Smith, Kent Wildlife Trust

Wilder Blean - Design, set up and early findings

The Wilder Blean project aims to bring about transformational change to West Blean woods to benefit nature and kick start natural processes through the use of grazing animals including European bison. This project, now in the setup phase, exposes the challenges of setting up a scientific trial in a real-world setting and is already delivering some interesting findings. This presentation covers these challenges and how they are being managed, plus the early incidental findings both ecologically and socially.

Robbie Still, Kent Wildlife Trust

Bugs Matter - A citizen science app for monitoring insect abundance

An introduction to the Bugs Matter app from Buglife - an innovative citizen science tool to monitor insect abundance in order to build up a better understanding of insect populations in the UK.

Shamaz Tabraiz, Canterbury Christ Church University

Effect of nutrients on biofilms properties of *Neurospora discreta*

This study investigated the effect of initial carbon, nitrogen and phosphorous concentrations in the growth medium on properties of biofilms produced by *Neurospora discreta*, and their nutrient-removal efficiencies. *Neurospora discreta* biofilms were grown in synthetic wastewater (modified Vogel's media) with varying concentrations of C, N and P. Reactors were harvested after 7 days post which physiochemical characterisation of biofilms and analysis of spent medium were carried out. Results showed that carbon and nitrogen levels in the medium affected biofilm growth more significantly compared to phosphorus levels. Water retention value (WRV) were proportional to the growth of biofilm. The concentration of proteins and polysaccharides in extracellular polymeric substances (EPS) increased with decrease in carbon and nitrogen concentrations but increased with increase in phosphorus concentration. Carbon removal efficiencies decreased with decrease in carbon and nitrogen concentrations, whilst phosphorous levels did not have a significant impact. The results of this study will be useful in designing a wastewater treatment process using *N. discreta* biofilms and for predicting the nutrient removal rates.

Himani Taneji, Canterbury Christ Church University

Development and optimisation of a lab-scale process for biological treatment of phenolic and lignin-rich effluents using biofilm-membranes formed by *Neurospora discreta*

The rapid growth in industrialisation has resulted in large quantities of toxic effluents being generated every year by many industries including oil, petrochemical, resin, coal and steel, and paper and pulp mills. Paper and pulp industries are particularly water-intensive and generate effluent rich in lignin-derived and phenolic contaminants. The European commission has listed phenols and phenolic compounds as priority pollutants due to the environmental concerns and high toxicity levels. These factors have led to an urgent need for sustainable processes to treat phenolic effluents. The aim of this project is to develop an environment-friendly and sustainable process for the treatment using novel biofilms formed by *Neurospora discreta*. This fungus is known for its ability to degrade lignin, as well as to form strong biofilms at the air-liquid interface. This poster presents an overview of the project including the objectives, process flow, analytical methods being developed and preliminary results of biofilm growth experiments on various concentrations of lignin.

Konstantinos Tsiolis, University of Reading

Establishing nesting sites for ground nesting bees: Impacts of soil and vegetation

The annual market value of animal pollination has been estimated at £180-442 billion worldwide and the value of native, wild, solitary bees for UK apple pollination at £51.4 million. Solitary bees need both flowers for food and a place to live such as bare ground to nest in. Ways to provide floral resources for apple pollinators are well developed, however, methods for provisioning areas for ground-nesting bees are poorly understood. In this study, artificially prepared plots of bare soil were constructed with the aim to attract ground-nesting bees to nest. Eighteen non-parasitic ground-nesting bee species (7 *Andrena*, 9 *Lasioglossum*, 1 *Halictus* and 1 *Colletes*) were recorded. Nine soil properties were investigated to determine the factors which drive nest-site selection of the attracted species. Soil stoniness and soil temperature were significant positive predictors, and vegetation cover and hydraulic conductivity were significant negative predictors of the numbers of ground-nesting bee nests on the plots. Building a greater understanding of their nesting ecology will allow better management of their populations, resulting in enhancement of pollination services in agriculture and urban areas.

Alex Vujakovic, University of Exeter

Evolution of diversity explains the impact of pre-adaptation of a focal species on the structure of a natural microbial community

Rapid within-species evolution can alter community structure, yet the mechanisms underpinning this effect remain unknown. Populations that rapidly evolve large amounts of phenotypic diversity are likely to interact with more species and have the largest impact on community structure. However, the evolution of phenotypic diversity is, in turn, influenced by the presence of other species. Here, we investigate how microbial community structure changes as a consequence of rapidly evolved within-species diversity using *Pseudomonas fluorescens* as a focal species. Evolved *P. fluorescens* populations showed substantial phenotypic diversification in resource-use (and correlated genomic change) irrespective of whether they were pre-adapted in isolation or in a community context. Manipulating diversity revealed that more diverse *P. fluorescens* populations had the greatest impact on community structure, by suppressing some bacterial taxa, but facilitating others. These findings suggest that conditions that promote the evolution of high within-population diversity should result in a larger impact on community structure.

Peter Vujakovic, Canterbury Christ Church University

The Living and the dead: churchyards as urban wildlife hubs

Churchyards in urban areas often represent areas of 'encapsulated countryside', containing grassland that has been largely undisturbed for centuries. If well managed they may be returned to biodiverse meadows. This presentation explores the management practices and the politics required to effectively manage these resources and their role in education as well as conservation with specific reference to sites in Canterbury and Cirencester.