

Research Prospectus



Surrey
Wildlife Trust

Foreword



I am delighted to introduce this prospectus; highlighting the importance of continually identifying and implementing key areas of research which can support our decision making.

Surrey Wildlife Trust was established over 60 years ago and is a member of the Royal Society for Wildlife Trusts. One of our main objectives as a charity is for the benefit of the public through the advancement of science and natural heritage; to promote research in all branches of nature study and to publish the results. Now annually reviewed, this prospectus is a significant step forward in meeting this mission objective and follows the publication of our Research and Monitoring Framework in 2019.

We know that we're facing complex challenges with ongoing biodiversity and bio-abundance losses as well as the impact of climate change. We also know that the restoration of biodiversity through a range of nature-based solutions is essential to achieve targets such as 30% of land protected and managed for nature by 2030.

In Surrey we have been building our knowledge and evidence base through work such as the State of Surrey's Nature, published in 2017. We know that over a third of species in Surrey are lost or in decline, mirroring the national picture. The role of research in guiding our work to halt and reverse this trend is vital.

Our strategic direction acknowledges that collaboration with a wide range of partners is essential, not only to implement but also to evaluate the interventions we make. This is where our relationships with academic partners and other specialist groups are so vital and this prospectus will encourage even more of these activities.

We look forward to working with you.

A handwritten signature in black ink that reads "Sarah Jane".

Sarah Jane Chimbwandira
CEO, Surrey Wildlife Trust

Introduction

At Surrey Wildlife Trust, we are committed to finding the long-term solutions to ongoing biodiversity declines that nature so badly needs in our county. Science is at the heart of our decision-making, and we strive to use sound scientific evidence to inform both our policy and our actions. Building this evidence-base is a continually iterative work-stream, ever growing with advancements in applied science and conservation experience. As part of this goal, we have signed an agreement to be an 'Evidence Champion' with Conservation Evidence to formally commit to contribute to this process, and use research outcomes to inform both ourselves and others. We are keen to work with external partners to further our collective understanding of the natural world. Our hope is that the work produced, and the collaborative relationships that develop through this research prospectus, will move us closer towards bridging the gap between academia and biodiversity conservation practice.

There are four themes to this work:

1. Measuring 'ecosystem health'

- Monitoring priority indicator species;
- Monitoring the quantum and supply of ecosystem services.

2. Seeking novel solutions

- Nature-based solutions;
- Emerging technologies.

3. Empowering people

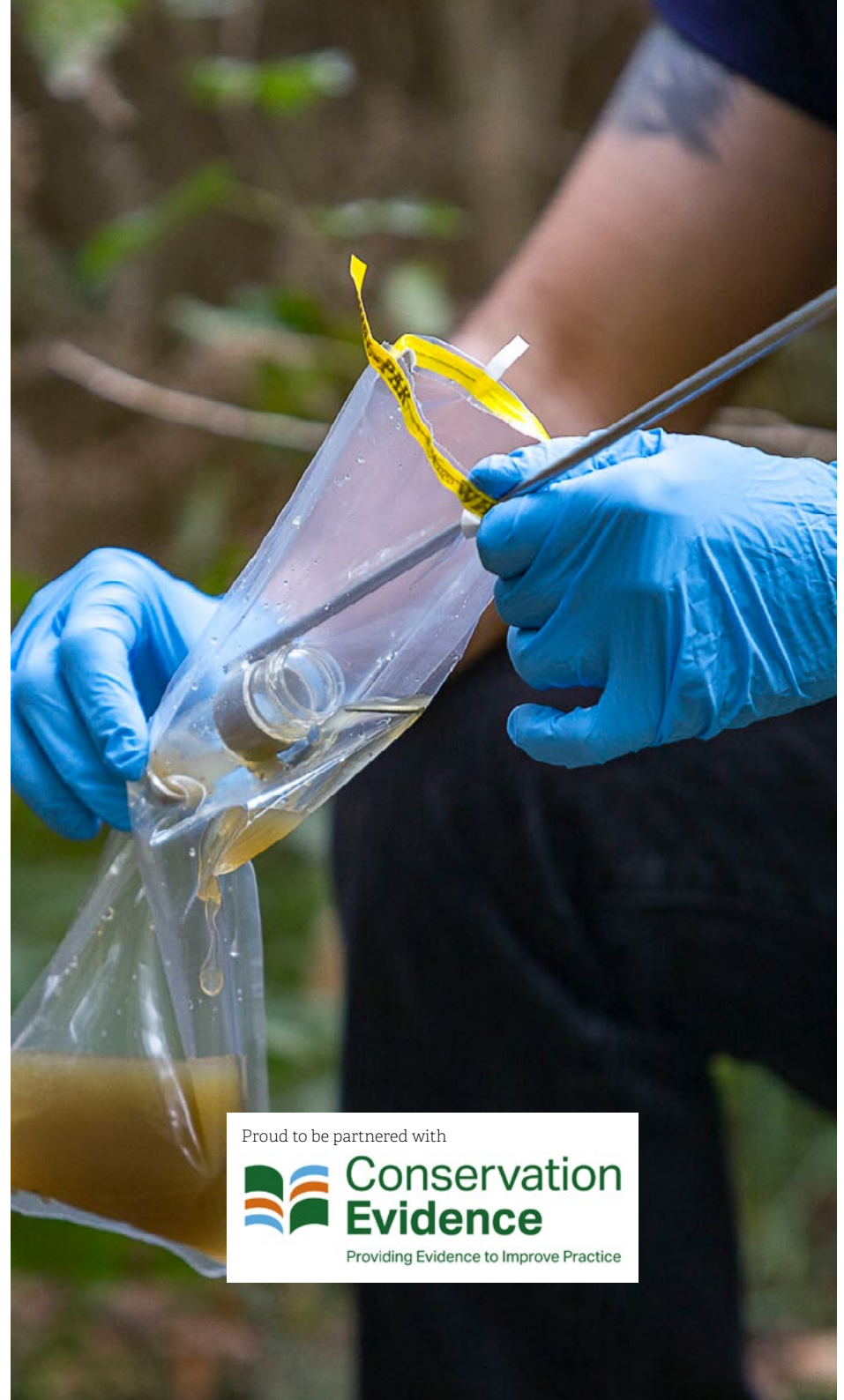
- Exchanging knowledge through education and engagement;
- Assessing barriers to nature connection.

4. Green economies

- Sustainable management of natural resources;
- Natural Capital accounting.

We are also committed to investing in successor generations of scientists and researchers, and ensuring they are involved in worthwhile and meaningful projects during their secondary and tertiary education.

Through our research placements, we aim to provide vital experience in the sector for young people and help them develop new skills in real-world research, monitoring and conservation work. By working as part of The Wildlife Trusts national movement, there will be ample opportunity for networking to promote future employment prospects.



Our Work with Universities

Surrey Wildlife Trust has been working with local universities for many years in different ways. We have a close relationship with the University of Surrey, with which we have had a variety of joint endeavours. Most recently, our flagship Space4Nature project is partnered with University of Surrey's Centre for Environment and Sustainability, where we are also hosting a PhD student.

We also work closely with our other local university, Royal Holloway College, with whom we have hosted several joint events and student placements. Additionally, Imperial College London visits the Trust annually as part of their Environmental Management MSc course, where students receive talks from our various departments and partake in practical conservation experience.

The University of Surrey's Biological Sciences BSc students have recently begun joining us for similar visits, where they learn about balancing the human and environmental demands on nature reserves. Since the launch of our first Research Prospectus in 2021, we have continued to build strong relationships with other local universities including the Universities of Kingston, Reading, Brighton (Sussex), and University College London.



Contact information

The primary contact for research projects is wiki.webster@surreywt.org.uk, please contact them in the first instance to express interest.

Please check the current version of the prospectus at: surreywildlifetrust.org/research

Summaries of a selection of completed projects can be found at the end of the document.

Past Students

These are some of the students we have worked with over recent years, talking about their experiences collaborating with us on their projects.



Rosa Singh - MSc Ecology Royal Holloway, University of London

Cultural & Demographic Differences in Conservation Engagement

I recently completed my Master's in Ecology at RHUL, where I investigated why people like or dislike certain animals and landscapes and how that can be useful in conservation. I also investigated the motivations and behaviour of SWT volunteers to see how we could engage even more people, something I hope to do with other Wildlife Trusts in the future!



Alexander Bayley - BSc Biology, University of Southampton

Moth Pollination on Grazed Versus Ungrazed Chalk Grassland

It has been a great experience working with Surrey Wildlife Trust. I loved spending a lot of time in wonderfully biodiverse calcareous grassland reserves, sampling a staggering 62 moth species. The results are valuable, as they uncover important research gaps which could have a big impact on current understanding and conservation practice. This is also the first study to create the first novel live moth pollen sampling method, which should be applied to future Lepidoptera studies aiming to minimise their impact.



Regina Cervantes Ramirez – MSc Environmental Management, Brunel University

Tracking Cattle Movement to Ground Truth Remote Sensed Grazing Patterns

For my master's dissertation, I collaborated with Surrey Wildlife Trust (SWT) on investigating grazing conservation strategies using new technologies like NoFence Grazing Collars. I chose to work with SWT due to their clear research vision and strong track record of successful academic collaborations. Although I was new to the field of zoology and spatial analysis, SWT provided valuable guidance, helping me navigate the project and use tools like QGIS. Their support and access to resources allowed me to expand my knowledge, gain practical experience, and connect with other professionals, which I greatly appreciated.



Measuring 'Ecosystem Health'

Surrey Wildlife Trust Research Prospectus 2024-2025

● Project 1.1: Promoting the Spread & Recovery of Marsh Gentians in Surrey

The Marsh Gentian *Gentiana pneumonanthe* is a striking wildflower that is becoming increasingly rare across the UK, with only one remaining population in Surrey. The decline of Marsh Gentian is a significant conservation concern, as the plant can be viewed as an indicator of healthy wet heath ecosystems that support a vast range of other species, and ultimately their range of ecosystem services. The reasons for decline are likely tied to habitat loss, changes in land use, and possibly insufficient management. This project aims to investigate the contributing factors to the decline of Marsh Gentian in Surrey and explore strategies for its future stabilisation, including the feasibility for re-establishment at historic sites.

Traditional conservation practices have focused on habitat protection, but for species like the Marsh Gentian, more active interventions may be necessary to ensure their future survival and in-site continuity. In addition to reassessing specific conditions of the last remaining site in Surrey, this project will explore successful restoration efforts in the Netherlands, Germany, and potentially the New Forest and Ashdown Forest here in the UK, where different management strategies have been trialled to support populations. By drawing on these international and regional examples, the project will develop a set of tailored recommendations for Surrey, potentially involving habitat restoration, seed dispersal techniques, and appropriate land management practices.

The project will involve an in-depth ecological assessment of the remaining site in Surrey, including soil analysis, hydrological conditions, and current vegetation. It will include a

review of historical records to identify former Marsh Gentian sites and assess their restoration potential. The final output will be a comprehensive species action plan, allied to Surrey's emergent Local Nature Recovery Strategy, aimed at restoring Marsh Gentians to additional sites in Surrey. Support will be provided for fieldwork, ecological assessments, and collaboration with international experts.

Key References:

- Oostermeijer, J.G.B., den Nijs, J.C.M., Raijmann, L.E.L., Menken, S.B.J. (1992) "Population biology and management of the marsh gentian (*Gentiana pneumonanthe* L.), a rare species in The Netherlands" *Botanical Journal of the Linnean Society*, Volume 108, Issue 2, Pages 117–130, <https://doi.org/10.1111/j.1095-8339.1992.tb01636.x>
- Pierce, S., Spada, A., Caporali, E. et al. (2018) "Identifying population thresholds for flowering plant reproductive success: the marsh gentian (*Gentiana pneumonanthe*) as a flagship species of humid meadows and heathland." *Biodivers Conserv* 27, 891–905. <https://doi-org.surrey.idm.oclc.org/10.1007/s10531-017-1470-1>
- Sankey, A.P., et al. (2024). "Surrey Rare Plant Register" Published by Summerfield Books.

● Project 1.2: Analysing Riverfly Species Data to Monitor River Health in Surrey

Surrey's watercourses are under increasing pressure due to human activities and climate change, which threaten the integrity of these ecosystems. The larvae of 'riverfly' species, such as mayflies, stoneflies, caddis-flies and to a lesser extent dragonflies, serve as vital indicators of water quality and river ecosystem health. These species are particularly sensitive to pollution and environmental changes, making them critical to monitoring aquatic habitats. While some species are resilient, others are highly sensitive to pollutants, making the analysis of species diversity, and abundance, an effective tool for assessing the overall condition of the rivers. Riverfly monitoring offers a reliable method to detect early signs of environmental

degradation, as these invertebrates are among the first to respond to changes in water quality. We have accumulated extensive data on riverfly species through volunteer-led monitoring efforts, which have involved collecting monthly samples from multiple riverbeds using small nets. This project will involve a thorough analysis of this data to uncover trends over time, identify potential correlations with pollution sources or climatic events, and determine the overall health of the river ecosystems in Surrey. This project focuses on analysing riverfly data collected between 2016 and 2023 across the Wey and Mole catchments in Surrey. By identifying trends in the data, the project aims to assess the impacts of various stressors on river health and provide actionable insights for conservation strategies.

This project will primarily be desk-based, focusing on statistical data analysis and interpretation. The findings will inform future conservation efforts, guiding policy decisions, and enhancing our understanding of how Surrey's rivers are responding to environmental pressures. Surrey Wildlife Trust will provide support with access to the data and relevant resources to facilitate this research.

Key References:

- Beach, E., England, J. and Gurnell, A. (2018). "Appraising chalk streams using citizen science." *Transactions of the Hertfordshire Natural History Society and Field Club*, [online] 50(1). Available at: <https://modularriversurvey.org/wp-content/uploads/Beach-et-al-2018-Appriasing-Chalk-Streams-Using-Citizen-Science.pdf> [Accessed 28 Aug. 2024].
- Brooks, S.J., Fitch, B., Davy-Bowker, J. and Codesal, S.A. (2019). "Anglers' Riverfly Monitoring Initiative (ARMI): A UK-wide citizen science project for water quality assessment." *Freshwater Science*, 38(2), pp.270–280. doi:<https://doi.org/10.1086/703397>.
- Pharaoh, E., Ormerod, S.J. and Vaughan, I.P. (2021). "An analysis of national macroinvertebrate trends for England, 1991–2019." [online] Environment Agency, pp.1–43. Available at: https://assets.publishing.service.gov.uk/media/616feeabe90e07197c0c2b17/An_analysis_of_national_macroinvertebrate_trends_for_England__1991_2019_-_report.pdf [Accessed 28 Aug. 2024].

● Project 1.3: Reviving Small Fleabane: A Restoration Project for *Pulicaria vulgaris*

Small Fleabane *Pulicaria vulgaris* is a protected plant species of principal importance, listed under Section 41 of the NERC Act 2006, which has dramatically declined in the UK due to habitat loss and deteriorating conditions of remaining habitats. Once common in south-east England (as the name suggests - vulgaris meaning 'common'), this species now survives only in a few locations in Hampshire's New Forest, having disappeared from neighbouring counties over the past 50 years. It thrives in seasonally-flooded pond margins, track ruts and hollows, and grazed acidic grassland; all habitats that have suffered from reduced management practices associated with the decline of traditional 'commoning'.

In Surrey, Small Fleabane is now believed to be locally extinct, following the failure of several attempts at recovery since its disappearance in the early 2000s, at its last remaining site on Backside Common. This Surrey Wildlife Trust-managed nature reserve is now the focus of a crucial recovery project aimed at reintroducing this plant. By implementing appropriate site management to revive the seedbank, and conducting ongoing monitoring, there is potential to restore this modest but significant species - serving as a key indicator for the positive management of former common land. Evidence suggests that Small Fleabane can recover from dormant seed-bank populations, which could provide the basis for an importation and/or ex-situ propagation and reintroduction programme.

This student project will combine fieldwork and desk-based research, including ecological surveys of Backside Common and trials to germinate seed-bank propagules. Data collected

will be analysed using statistical software to assess the success of these efforts. Support will be available for survey work, species identification, and collaboration with other bodies including the Surrey Botanical Society and Plantlife, to offer a hands-on experience in plant conservation and habitat restoration.

Key References:

- Chatters, C., McGuire, C., Rand, M. and Sanderson, N. (2014) Small Fleabane in the New Forest. [online]. Available at: https://www.hlsnewforest.org.uk/app/uploads/sites/3/2018/03/Small_Fleabane_report_140213_Final_Report_CC_CM.pdf
- FWHT (2013) Creating ponds for Small Fleabane *Pulicaria vulgaris* [online]. Available at: <https://freshwaterhabitats.org.uk/wp-content/uploads/2013/09/Small-Fleabane-new-logo.pdf>
- JNCC (2019). Report on the Species and Habitat Review (UK BAP) | JNCC Resource Hub. [online] Available at: <https://hub.jncc.gov.uk/assets/bdd8ad64-c247-4b69-ab33-19c2e0d63736>
- Sankey, A.P., et al. (2024). "Surrey Rare Plant Register" Published by Summerfield Books.



● Project 1.4: Investigating Smooth Snakes *Coronella austriaca*

The Smooth Snake is the rarest of Britain's six native reptiles and is

extremely secretive, occurring naturally on a handful of lowland heathland sites in Southern England. The species is well protected by UK and European legislation but has experienced

an estimated 90% population decline in the last century. Part of the difficulty studying the Smooth Snake is that it does not habitually bask in the open like other reptiles. It is therefore far more reliant on stands of mature heather, and so requires well-established dry heathland where it is especially vulnerable to wildfires.

Surrey Amphibian and Reptile Group (SARG) has monitored the Surrey population carefully over the recent decades. Detailed biometric data exists for each individual snake, which will enable researchers to answer many questions about the snake's movements, behaviour and population dynamics. One question concerns the genetic distinctiveness of Surrey's Smooth Snake population, which could be provisionally answered using the biometric data. A previous study found that even across Dorset's more widespread populations initial genetic differentiations could be detected.

The project would combine primary data, collected in the field, with secondary data provided by SARG to investigate long-term trends in Smooth Snake populations. GIS and statistics would be used in analysis. Support would be provided for survey work and species identification.

Key References:

- Langham, S. (2018). SARG: Smooth Snake. [online] Available at: http://surrey-arg.org.uk/SARGWEB.php?app=SpeciesData&Species=smooth_snake.
- Pernetta, A.P., Allen, J.A., Beebee, T.J.C. and Reading, C.J. (2011). Fine-scale population genetic structure and sex-biased dispersal in the smooth snake (*Coronella austriaca*) in southern England. *Heredity*, 107(3), pp.231–238.

● Project 1.5: In Search of the Red-Barbed Ant *Formica rufibarbis*

The Red-Barbed Ant *Formica rufibarbis* is an extremely rare ant in the UK, with its own dedicated Species Action Plan and is listed under Section 41 of the NERC Act 2006. Part of its rarity in the UK can be attributed to its specific habitat requirements, as it is one of the most thermophilic species of the *Formica* genus and requires an open unvegetated habitat with sandy substrate to obtain sufficient warmth. However, due to its relatively small colony size and similar appearance to other formicine ants it is certainly possible that there remain unknown populations both on heathland and on other sandy grassland sites, within the UK. Whilst more common in continental Europe, the UK mainland population is restricted to 14 recently discovered colonies within Hampshire. Until their discovery it was confined to a single population within Surrey at Chobham Common. However, this population has now been lost to *Formica sanguinea* slavery. The Slavemaker Ant *F. sanguinea* has increased in heathland sites in the south of England and it is no longer likely that *F. rufibarbis* persists in sites where *F. sanguinea* is now present. Neighbouring sandy grassland sites in Surrey, especially those within a short distance of former populations, could still support unknown *F. rufibarbis* colonies. If so, this would have significant implications for the protection and management of these sites.

The project will involve a mix of field and desk-based work, including ecological surveys of sites around Pirbright, Woking, Ash, Frimley and Chobham areas. The data would be analysed using statistical software and mapped using GIS. Support would be provided for survey work and species identification.

Key References:

- Bees, Wasps and Ants Recording Society. (2002). *Formica rufibarbis* Fabricius, 1793 | BWARS. [online] Available at: <https://www.bwars.com/ant/formicidae/formicinae/formica-rufibarbis> [Accessed 18 Jul. 2022].
- Gammans, N. (2008). Conserving the red-barbed ant (*Formica rufibarbis*) in the United Kingdom. Project Report 2008. <http://hymettus.org.uk/downloads/F%20rufibarbis%20tech%20report.pdf>
- Seifert, B. & Schultz, R. (2009). A taxonomic revision of the *Formica rufibarbis* FABRICIUS, 1793 group (Hymenoptera: Formicidae). Myrmecological News, 12, pp.255-272.

● Project 1.6: Brown Trout *Salmo trutta* in headwater streams

The native Brown Trout *Salmo trutta* is an anadromous fish that often migrates to the sea, then as a 'sea trout', from its birth-place in rivers. Anthropogenic impacts on freshwater systems have led to the decline of many native fish populations. Particularly for salmonid fish like *S. trutta*, the historic construction of weirs across our river systems has limited their access to traditional breeding sites in the headwaters of our river catchments.

Surrey's headwater streams are home to many genetically distinct populations of Brown Trout that have been isolated from other populations for centuries due to the impacts of instream barriers on fish passage. Although these isolated populations are therefore very precious, drought conditions associated with climate change, increasingly experienced in recent years, are beginning to impact Surrey's headwater streams thus putting these populations under increasing pressure. We want to better understand where these populations are across Surrey and of those, which are most vulnerable to climate change. This will help us target management interventions, at both the river-reach and landscape scale, to better protect them.

The project will involve a mix of field and desk-based work, including ecological surveys

of Brown Trout in different headwaters across Surrey, using eDNA (dependent on funding) as well as applied geographic analysis to map local pressures. The data would be analysed using statistical software and mapped using GIS. Support would be provided for survey work and species identification.

Key References:

- Gosset, C., Rives, J. and Labonne, J. (2006). Effect of habitat fragmentation on spawning migration of brown trout (*Salmo trutta* L.). Ecology of Freshwater Fish, 15(3), pp.247-254. doi:10.1111/j.1600-0633.2006.00144.x.
- Klemetsen, A., Amundsen, P.-A., Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. and Mortensen, E. (2003). Atlantic salmon *Salmo salar* L., brown trout *Salmo trutta* L. and Arctic charr *Salvelinus alpinus* (L.): a review of aspects of their life histories. Ecology of Freshwater Fish, [online] 12(1), pp.1-59. doi:10.1034/j.1600-0633.2003.00010.x.
- Jonsson, B. and Jonsson, N. (2009). A review of the likely effects of climate change on anadromous Atlantic salmon *Salmo salar* and brown trout *Salmo trutta*, with particular reference to water temperature and flow. Journal of Fish Biology, 75(10), pp.2381-2447. doi:10.1111/j.1095-8649.2009.02380.x.

● Project 1.7: Exploring Crane Fly diversity at Bay Pond, Boldermere & Eashing

The Craneflies or *Tipulidae* are an under-recorded invertebrate group and yet they represent an important ecological indicator of the quality of wetland ecosystems. Relatively little research exists around these insects, but their essential role in the diet of various bird species is well understood. As with many insect taxa, recent studies have shown that the phenology and distribution of the *Tipulidae* is likely to be impacted by climate change, which could then have trophic impacts on dependent predators.

At least two Trust-managed SSSI (Boldermere at Ockham Common and Bay Pond near Godstone) include important crane fly assemblages as one of their notified features. A further privately-owned site close to a Trust-managed SANG near Eashing also has this

feature. These sites all support Alder-dominated wet woodland, which is known to be an important habitat for craneflies, however the assemblages at the sites have not been formally re-assessed since the early 1980s. As discussed above, it would be prudent to improve our understanding of the current status of these assemblages to effectively monitor these sites in the coming years.

This project would review the three SSSI-qualifying datasets, conduct the necessary fieldwork and prepare a report summarising findings, with recommendations for conservation management. It would be partnered with Natural England and partner landowners. A new field guide is set to make this group far more accessible to would-be Dipterists and experienced entomologists alike, who would also boost the flow of much-needed records into the UK Cranefly Recording Scheme.

Key References:

- Devlin, J.J., Thomas, R.J., Long, S.E., Boardman, P. and Dupuis, J.R. (2022). Impact of climate change on the elevational and latitudinal distributions of populations of Tipulidae (Diptera) in Wales, United Kingdom. *Biological Journal of the Linnean Society*, [online] 137(1), pp.30–46. doi:10.1093/biolinnean/blac079.
- Rhymer, C.M., Devereux, C.L., Denny, M.J.H. and Whittingham, M.J. (2012). Diet of Starling *Sturnus vulgaris* nestlings on farmland: the importance of Tipulidae larvae. *Bird Study*, 59(4), pp.426–436. doi:10.1080/00063657.2012.725026.
- Stubbs, A.E. (2021). *British craneflies*. Hurst: The British Entomological and Natural History Society.

● Project 1.8: Impacts of Grazing on the Window-winged Caddis Fly *Hagenella clathrata*

The Window-winged Caddis Fly *Hagenella clathrata* is one of the rarest and most threatened caddisfly species in Europe and is known from only a small selection of sites across Northern Europe. It also relies on lowland wet heath and transitional valley mire habitats, both now highly threatened by climate

change. Decline in condition of the habitat is the prevalent cause of the decline of *Hagenella clathrata*. Relatively little research has been invested in effective conservation measures, but it has recently been proven that there is a clear co-occurrence of *Hagenella* with other endangered species.

There are two known, nationally important populations of *Hagenella clathrata* in Surrey; at Whitmoor Common and on Chobham Common, both of which are managed by Surrey Wildlife Trust on behalf of Surrey County Council. The Species Recovery Trust has supported the species' on-going monitoring, but there remains scope for autecological research into this charismatic species. In particular, the potential benefit of conservation grazing still requires assessment for future conservation strategies. Conservation grazing is practiced across Surrey's heathlands, so it is important we understand its impacts on *Hagenella*.

The project will involve a mix of field work in the spring together with desk-based work, including ecological surveys of Whitmoor and Chobham Commons, and possibly also on a newly discovered site in East Hampshire. The data would be analysed using statistical software. Support would be provided for survey work and species identification.

Key References:

- Buczyńska, Edyta & Cichocki, Włodzimierz & Patrycja, Dominiak. (2012). New data on the distribution and habitat preferences of *Hagenella clathrata* (Kolenati, 1848) (Trichoptera: Phryganeidae) in Poland – the species from Polish Red Book of Animals. *Annales - Universitatis Mariae Curie-Skłodowska, Sectio C. LXVII*. 25-32.
- van Kleef, H.H., van Duinen, G.-J.A., Verberk, W.C.E.P., Leuven, R.S.E.W., van der Velde, G. and Esselink, H. (2012). Moorland pools as refugia for endangered species characteristic of raised bog gradients. *Journal for Nature Conservation*, 20(5), pp.255–263
- Wallace, I. (2011). *Hagenella clathrata* Species dossier: *Hagenella clathrata*. [online]. Available at: <https://cdn.buglife.org.uk/2019/07/Hagenella-clathrata-species-dossier.pdf>

● Project 1.9: Rediscovering the Spider Assemblage at Chobham Common

Chobham Common National Nature Reserve is the most biodiverse site for spiders in the UK, with records of many nationally threatened, rare and scarce species. However, many of these records are now very old. The spider assemblage is moreover a notified feature of its SSSI status. A long-term monitoring project to review and update our knowledge of this important assemblage is long overdue.

The project would design and begin a long-term species recording and monitoring programme as an applied exercise in the purposes of ecological fieldwork, that would fully sample this extensive site within a decade; in combination with opportunistic autecological studies to ascertain the status of one or more species of conservation importance present on the site, such as *Cheiracanthium pennyi* (IUCN Endangered), *Lathys heterophthalma* (Vulnerable), *Diplocephalus erythropus* (Vulnerable) and both *Notioscopus sarcinatus* and *Araneus alsine* (Nationally Scarce).

The project would combine fieldwork and GIS mapping, providing experience on several applied survey methods including sweeping, pitfall trapping and DVAC sampling. Support would be provided for survey work and species identification.

Key References:

- Dodd, S G. (2011). *The Spiders of Chobham Common*, Surrey [VC 17]. Surrey Wildlife Trust Ecology Services.
- Harvey P et al. (2017). A review of the scarce and threatened spiders (Araneae) of Great Britain: Species Status No.22. British Arachnological Society
- Spider & Harvestman Recording Scheme national database; [online] Available at: <https://srs.britishtspiders.org.uk/portal.php/p/About+the+Spider+Recording+Scheme>

ENDS



Seeking Novel Solutions

Surrey Wildlife Trust Research Prospectus 2024-2025

● Project 2.1: Optimising the Reintroduction of White-Clawed Crayfish *Austropotamobius pallipes* Using eDNA

The White-Clawed Crayfish *Austropotamobius pallipes* is a native species in the UK that has been severely impacted by the invasive Signal Crayfish *Pacifastacus leniusculus*, a species introduced from western North America in the 1970s. The Signal (and several other alien) Crayfish, which carries the devastating Crayfish Plague (*Aphanomyces astaci*), has out-competed populations of White-Clawed Crayfish due to its larger size, aggressive behaviour, direct predation, and rapid spread. Despite various control efforts, the Signal Crayfish has proven difficult to manage, covering distances of over 150 meters per day and eluding effective control measures.

In Surrey, the presence of Signal Crayfish may date back to the late 1970s, with increasing documentation since the 1990s. The White-Clawed Crayfish currently survives in a few isolated headwater sites that have not yet been invaded. To prepare for any reintroduction programme for White-Clawed Crayfish, it is crucial to determine the present distribution of Signal Crayfish and identify any factors that may appear to limit their further expansion. Additionally, reaffirming locations of any persistent White-Clawed Crayfish populations is essential to their effective conservation and reintroduction strategies.

This project will combine fieldwork and desk-based research, including ecological surveys of Signal Crayfish across various headwaters in Surrey. The use of environmental DNA (eDNA) to detect White-Clawed Crayfish presence can also be explored, depending on funding availability. Data collected will be analysed using statistical software and mapped using

GIS. The project will provide support for survey work, species identification, and eDNA protocol implementation, ideally partnering with a university experienced in eDNA methods.

Key References:

- Chadwick, D.D.A., Pritchard, E.G., Bradley, P., Sayer, C.D., Chadwick, M.A., Eagle, L.J.B. and Axmacher, J.C. (2020). A novel 'triple drawdown' method highlights deficiencies in invasive alien crayfish survey and control techniques. *Journal of Applied Ecology*. doi:10.1111/1365-2664.13758.
- GB NNS. (2019). Signal Crayfish» NNS. [online] Available at: <https://www.nonnativespecies.org/non-native-species/information-portal/view/2498> [Accessed 18 Jul. 2022].
- Hudina, S. and Hock, K. (2012). Behavioural determinants of agonistic success in invasive crayfish. *Behavioural Processes*, 91(1), pp.77–81. doi:10.1016/j.beproc.2012.05.011.
- Ames, J., Nutbeam-Tuffs, S., Cable, J., Mrugała, A., Viñuela-Rodríguez, N., Petrušek, A. and Oidtmann, B. (2017) "The prevalence of *Aphanomyces astaci* in invasive signal crayfish from the UK and implications for native crayfish conservation," *Parasitology*. Cambridge University Press, 144(4), pp. 411–418. doi: 10.1017/S0031182016002419.

● Project 2.2: Evaluating Soil Health & Floral Response Under Mixed Grazing Versus Cattle-Only Grazing Systems

The continuity or re-establishment of grazing is vital for the maintenance of habitats such as heathlands and semi-natural chalk grassland. Much of the flora and fauna that exists within these landscapes now relies on this type of management to survive. Grazing management significantly influences the health of pasture ecosystems, impacting soil properties, biodiversity, and overall land productivity. While cattle-only grazing is common, mixed grazing—where cattle share the land with other herbivores such as sheep or goats—has been suggested to offer various ecological benefits. These benefits may include improved soil structure, enhanced nutrient cycling and increased plant species diversity due to the varied grazing habits and dietary preferences of different livestock species. Understanding the comparative impacts of mixed grazing

versus cattle-only grazing on soil health and floral composition is crucial for developing sustainable land management strategies.

Traditional cattle grazing and worse, intensive liveried horse grazing can lead to issues such as soil compaction, reduced plant diversity, and localised overgrazing, particularly when not managed effectively. Mixed grazing systems, on the other hand, may mitigate some of these issues by promoting more uniform grazing pressure and fostering a more diverse plant community. However, the effectiveness of mixed grazing compared to cattle-only systems in improving soil health and promoting floral diversity needs further investigation, particularly in different environmental contexts. Much of Surrey's remaining chalk grassland is on steep slopes, so livestock are a better management tool than vehicles.

This project will assess and compare soil health and floral responses in areas subjected to mixed grazing versus those grazed solely by cattle. Soil health indicators such as compaction, organic matter content, and nutrient levels will need to be measured alongside floral diversity and abundance. The study will involve fieldwork to collect soil samples and conduct plant species surveys. Data from this project will provide insights into the relative benefits of mixed grazing systems and inform best practices for grazing management. Support will be available for statistical analysis and experimental design.

Key References:

- Teague, R. and Kreuter, U. (2020). Managing Grazing to Restore Soil Health, Ecosystem Function, and Ecosystem Services. *Frontiers in Sustainable Food Systems*, [online] 4. doi:<https://doi.org/10.3389/fsufs.2020.534187>.
- Willems, J.H. (1983). Species composition and above ground phytomass in chalk grassland with different management. *Vegetatio*, 52(3), pp.171–180. doi:<https://doi.org/10.1007/bf00044994>.
- Xu, S., Jagadamma, S. and Rowntree, J. (2018). Response of Grazing Land Soil Health to Management Strategies: A Summary Review. *Sustainability*, 10(12), p.4769. doi:<https://doi.org/10.3390/su10124769>.



● Project 2.3: Exploring Synchronicity as a Measure of Connectivity in Fragmented Butterfly Populations

Connectivity between populations is crucial for the survival of species in increasingly fragmented landscapes. Traditional measures of connectivity often rely on evidence for physical movement, or of genetic consistency between populations. However, synchronicity in phenology - the timing of life-cycle events such as adult emergence, breeding behaviour, or migration - could serve as an innovative indicator of ecological connectivity. The hypothesis is that fragmented yet still ecologically-connected populations of butterflies should exhibit mirrored phenology across different sites, even in the presence of some degree of environmental variability. This project aims to investigate the potential of using phenological synchronicity as a connectivity measure for butterfly populations across the North Downs, leveraging extensive butterfly datasets, climate data, and other ongoing research efforts.

The concept of using synchronicity as a proxy for connectivity is based on the assumption that

connected populations will respond similarly to environmental cues, resulting in synchronised life-cycle events. However, this assumption is complex and needs more rigorous testing, which is why Met Office climate data is integral to this project. By analysing the synchronicity of butterfly populations in fragmented habitats and correlating it with climate patterns, we can assess whether phenological synchronicity can reliably indicate ecological connectivity.

This project will utilise butterfly datasets from Dorset Wildlife Trust (DWT) and the Berkshire, Buckinghamshire & Oxfordshire Wildlife Trust (BBOWT), along with Met Office climate data, to analyse the phenological patterns of butterfly populations across the North Downs. The study will compare these patterns across fragmented populations to identify any synchronicity, while accounting for local climate variations. Additionally, insights from ongoing research in Reading will provide methodological guidance and comparative data. The project will culminate in a critical evaluation of synchronicity as a connectivity indicator, potentially offering a novel approach to assessing ecological networks. Support will be provided for data analysis, statistical modelling, and collaboration with research partners.

Key References:

- Oliver T H. et al. (2017): Synchrony in population counts predicts butterfly movement frequencies. *Ecological Entomology*, 42 (3). 375-378

● Project 2.4: Uncovering & Mapping Ghost Ponds for Biodiversity Restoration

'Ghost' ponds; remnants of historical ponds that have been filled in or forgotten over time, represent lost ecological habitats that could potentially be restored to support biodiversity and enhance landscape connectivity. These

ponds were once common features in agricultural and rural landscapes, providing vital habitats for a variety of aquatic and terrestrial species. Their disappearance has contributed to the decline of species that depend on such habitats, including amphibians, specialised invertebrates and aquatic plants. This project aims to identify the locations of ghost ponds and assess their potential for restoration as part of broader conservation efforts.

Traditional conservation efforts often overlook the historical presence of ponds, focusing instead on the preservation or creation of new water bodies. However, restoring ghost ponds could be a highly effective strategy for re-establishing ecological networks and increasing biodiversity in fragmented landscapes. These sites may still contain viable seed banks and other biological legacies that could allow them to rapidly regain their ecological functions if restored. Identifying and mapping these lost ponds is the first critical step toward understanding their potential role in modern conservation strategies.

This project will involve the use of historical maps, aerial photographs, and local knowledge to locate ghost ponds in a selected study area. Once identified, these sites will be assessed for their restoration potential based on factors such as current land use, hydrological conditions, and ecological connectivity. The project will produce a detailed map of ghost pond locations, along with recommendations for prioritising sites for restoration. The findings will contribute to ongoing efforts to enhance biodiversity through habitat restoration and provide guidance for landowners and conservationists on how to incorporate ghost pond restoration into their management plans. Support will be provided for GIS mapping, historical research, and ecological assessment.

Key References:

- Alderton, E., Sayer, C. D., Davies, R., Lambert, S. J., & Axmacher, J. C. (2017). Buried alive: Aquatic plants survive in 'ghost ponds' under agricultural fields. *Biological Conservation*, 212, 105–110. <https://doi.org/10.1016/j.biocon.2017.06.004>
- Sayer, C., Hawkins, J., & Greaves, H. (2022). Restoring the ghostly and the ghastly: A new golden age for British lowland farm ponds? *British Wildlife*, 33(7), 477–487.

● Project 2.5: Using Drone Footage to Monitor Deer Populations Following Wildfire Events

Deer-browsing can be an important management tool for restoring biodiversity and ecosystem resilience in heathland habitats, which are also prone to wildfires. The feeding action of deer can also help to create natural fire breaks. Conversely, over-grazing can rapidly deteriorate heathland communities and may slow the post-wildfire recovery of the land, although not enough grazing may allow invasives to quickly dominate the vulnerable area. As climate change worsens, wildfires are likely to occur more frequently. Monitoring deer population sizes against their impacts on vegetation is therefore crucial for risk management and conservation strategies in heathland habitats.

Traditional census methods for monitoring large herbivores are often labour intensive, time consuming, and frequently inconsistent as they rely on chance sightings of the herd. This is compounded when a site has limited public access. Remote sensing techniques such as camera traps and Unmanned Aerial Vehicles (UAVs) fitted with high resolution thermal imagers are increasingly being used to monitor deer populations. Drones are capable of identifying the species, sex, and in some cases the approximate age of the deer.

Surrey Wildlife Trust released Red Deer onto Pirbright Ranges in 2010 and has been monitoring the population ever since. There was

a large wildfire on the site in 2022, from which it is still recovering. We have extensive drone and camera trap footage of the deer which could be used to understand sub-herd composition and distribution, capture current population sizes, behavioural patterns across the population, and potentially post-wildfire recovery. This would primarily be a desk-based project, and SWT would be able to provide support on GIS and spatial analyses.

Key References:

- Ito, T. Y., Miyzaki, A., Koyama, L.A., Kamada, K., and Nagamatsu, D. (2022) "Antler detection from the sky: deer sex ratio monitoring using drone-mounted thermal infrared sensors" *Wildlife Biology* 2022(4) pp. e01034 doi: 10.1002/wlb3.01034
- Tuia, D., Kellenberger, B., Beery, S. et al. Perspectives in machine learning for wildlife conservation. *Nat Commun* 13, 792 (2022). <https://doi.org/10.1038/s41467-022-27980-y>
- Silva, J.S., Catry, F.X., Moreira, F., Lopes, T., Forte, T., and Bugalho, M.N. (2013) "Effects of deer on the post-fire recovery of a Mediterranean plant community in Central Portugal" *Journal of Forest Research* 19(2), doi: 10.1007/s10310-013-0415-0

● Project 2.6: Novel uses of UAVs for Invertebrate Monitoring

Unmanned Aerial Vehicles (drones) are rapidly becoming a staple of environmental monitoring methods. While most UAV monitoring is achieved by aerial photographic sensors, there has been recent experimentation using UAVs to physically collect invertebrate samples, by attaching sweep nets to the drones. These pilot studies found that the method was successful in showing a degree of representativeness similar to the traditional (manual) approach, as well as providing additional benefits of being minimally invasive and time efficient.

Surrey Wildlife Trust manages multiple open habitats where this kind of monitoring could be trialled. In particular, chalk grassland reserves would be ideal for this approach due to their open nature and herbaceous vegetation, as well as the importance of these sites for invertebrates. In the published studies, the

applications are largely related to pest-control in agriculture and have been conducted in the United States. This novel application of "Drone Netting" for conservation-based investigations could be valuable to the Trust for accelerating the monitoring of site habitat condition.

The project would involve field work, accompanying the SWT UAV operator in conducting a number of surveys across different reserves. The 'catch' of the surveys would then require identification; specialist assistance can be provided for this. Statistical analysis would also be necessary.

Key References:

- Löcken, H., Fischer, O.W., Selz, J. and Boppré, M. (2020). 'Drone-Netting' for Sampling Live Insects. *Journal of Insect Science*, 20(5). doi:10.1093/jisesa/ieaa086.
- Neufeld, J., J. Ryu, and J. Barbour. (2019). Development of a UAS-based insect scouting method. *J of the NACAA*. 12(2): pp.1–5.
- Yu, J.H., Clements, J. and Neufeld, J. (2022). Low-Cost Live Insect Scouting Drone: iDrone Bee. *Journal of Insect Science*, 22(4). doi:10.1093/jisesa/ieac036.

● Project 2.7: Modelling Adder Meta-population Linkages with GIS

Adders *Vipera berus* have experienced large population declines across the UK, largely driven by habitat destruction and degradation and it is estimated that their range has reduced by 39% in recent times.. Remaining priority heathland habitat remains largely fragmented, such that establishing corridors between these patches is vital for the conservation of remaining Adder populations. Barriers to dispersal across the landscape lead to Adder populations becoming isolated and vulnerable to genetic separation.

In Surrey, Surrey Amphibian & Reptile Group (SARG) has identified several Adder metapopulations from many years of surveying these reptiles. Surrey's Adder population remains strong and hence we have a national

responsibility for the species, but it is declining. It has been observed that Adders are reluctant to cross certain features, even with the introduction of solutions aimed at facilitating their movement. A better understanding of just how fragmented the landscape is for Adders is desirable if we are to continue to champion their conservation.

The project would be desktop-based, using GIS and connectivity modelling tools to investigate landscape resistance to Adder movement. Adder data will be provided by SARG and support would be provided for GIS work by SWT.

Key References:

- Gardner, E., Julian, A., Monk, C. and Baker, J. (2019) Make the adder count: population trends from a citizen science survey of UK adders. *Herpetological Journal*, 29. pp. 57-70. ISSN 0268-0130
- Langham, S. (2018). Surrey Amphibian and Reptile Group - Adder. [online] Available at: <http://surrey-arg.org.uk/SARGWEB.php?app=SpeciesData&Species=adder>.
- Worthington-Hill, J. (2016). Reintroduction of the adder *Vipera berus* to Nottinghamshire: a feasibility study Final Report to People's Trust for Endangered Species. [online] Available at: <https://ptes.org/wp-content/uploads/2016/11/adders-final-report.pdf>

● Project 2.8: Using Satellite Imagery to Monitor Wildfire Recovery

Wildfires are becoming increasingly frequent globally as a direct result of climate change, with their global incidence doubling since the mid-1980s. Increasing temperatures lead to increased evaporation and desiccation of soils and vegetation, which are then more liable to burning, and facilitates more rapid wildfire spread across a habitat area. Whilst burning is a routine natural process in many ecosystems, narrowing occurrence intervals are prohibiting the successful recovery of ecosystems between fire events. To better understand how habitats respond in the years following extensive burns, conservationists can use remote sensing data to provide insights. This is advantageous due to the long-term imagery available, and ability to infer

soil moisture and vegetation health through the variation in spectral signatures recorded by many satellites.

In Surrey, this is of particular concern for our internationally important lowland heathland habitat. Heathland is a landscape with a high risk of burning, where there are many dry, woody and fine-leaved plants which have co-evolved with various xero- and thermophilic species. Surrey Wildlife Trust manages over 2000 ha of lowland heathland and is responsible for supporting its recovery from severe wildfires which have occurred in recent years. We also have a close partnership with researchers based at the University of Surrey, who have previously used remote sensing to examine impacts of wildfires on our reserves. Key questions, however, remain over whether these approaches can reliably monitor and predict species recovery, and which landscape features are key in assisting recovery efforts.

The project would be desktop-based, using GIS and remote sensing tools to investigate wildfire occurrences and impacts on heathlands in Surrey. Much of this data will be available online, but additional species and reserve data will be provided by SWT.

Key References:

- Leblon, B., San-Miguel-Ayanz, J., Bourgeau-Chavez, L. and Kong, M. (2016). Remote Sensing of Wildfires. *Land Surface Remote Sensing*, pp.55–95. doi:<https://doi.org/10.1016/b978-1-78548-105-5.50003-7>.
- Mansoor, S., Farooq, I., Kachroo, M.M., Mahmoud, A.E.D., Fawzy, M., Popescu, S.M., Alyemeni, M.N., Sonne, C., Rinklebe, J. and Ahmad, P. (2022). Elevation in wildfire frequencies with respect to the climate change. *Journal of Environmental Management*, 301, p.113769. doi:<https://doi.org/10.1016/j.jenvman.2021.113769>.
- Surrey Wildlife Trust (2022). New research from Wildlife Trusts shows increased risk of fires and water loss as climate warms | Surrey Wildlife Trust. [online] Available at: <https://www.surreywildlifetrust.org/news/new-research-wildlife-trusts-shows-increased-risk-fires-and-water-loss-climate-warms> [Accessed 12 Sep. 2023].



● Project 2.9: Can Adder Patterns Be a Proxy for Genetic Diversity in Monitoring?

The potential use of Adder *Vipera berus* morphological coloration as a proxy for assessing genetic diversity within populations could revolutionise monitoring efforts in conservation biology. Adders exhibit unique dorsal patterns, and it is hypothesised that these patterns might correlate with genetic variation within the species. If validated, this method could offer a non-invasive and cost-effective alternative to traditional genetic analysis, providing valuable insights into population health and aiding conservation strategies for this species.

Currently, the use of genetic markers to assess population diversity is the standard approach, but it is often labour-intensive, expensive, and requires direct handling of individuals. In contrast, pattern-based monitoring could be conducted using photographic records, which are easier to obtain and analyse. The Surrey Amphibian & Reptile Group (SARG) has a substantial database of Adder photographs, which could serve as a foundation for this study. However, the validity of using patternation as a

genetic diversity proxy has yet to be confirmed, necessitating rigorous testing against established genetic data.

This project would involve both fieldwork and laboratory analysis. The field component would include collecting new genetic samples from Adders across various Surrey sites, alongside compiling and analysing existing photographic data. Laboratory work would focus on comparing the genetic diversity indicated by DNA analysis with that suggested by pattern recognition algorithms. The ultimate goal would be to determine whether Adder patterns can reliably indicate genetic diversity, potentially providing a new tool for conservationists.

Key References:

- SARG photo records (2023) Surrey Amphibian and Reptile Group. Available upon request from SARG.
- Ball, S., Hand, N., Willman, E., Durrant, C., Uller, T., Claus, K., Mergeay, J., Bauwens, D. and Garner, T.W.J. (2020). Genetic and demographic vulnerability of adder populations: Results of a genetic study in mainland Britain. PLOS ONE, 15(4), p.e0231809. doi:<https://doi.org/10.1371/journal.pone.0231809>.
- Madsen, T., Stille, B., Ujvari, B., Bauwens, D. and Endler, J.A. (2022). Negative frequency-dependent selection on polymorphic color morphs in adders. Current Biology. doi:<https://doi.org/10.1016/j.cub.2022.05.060>.

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Empowering Empowering People

Surrey Wildlife Trust Research Prospectus 2024-2025

● Project 3.1: How Can We Facilitate Youth Taking Action for Nature in Surrey?

Engaging youth in nature conservation is crucial to both enhance their connection to the environment and to invest in the future strength in our conservation efforts. Research indicates that involvement with nature significantly boosts environmental stewardship, promotes social responsibility, and also supports the well-being of participants. Conservation organisations, including The Wildlife Trusts, have been actively including youth nature engagement through initiatives such as the annual “30 Days Wild” campaign. Additionally, a national goal aims for 1 in 4 people to ‘..take action for nature’ by 2030, signalling a pivotal moment for shifting social attitudes towards nature. However, a notable challenge remains in successfully engaging young people (ages 16–30) in these initiatives, despite their critical role as the future stakeholders in addressing the long-term biodiversity and climate crises.

Recent efforts have focused on creating opportunities for youth within the conservation sector on both local and national levels. In Surrey, we have introduced a Youth Action Committee to cultivate leadership among young people and involve them in environmental decision-making processes. Nevertheless, youth representation among SWT members, donors and volunteers remains limited. Insights from a pilot study conducted in 2020 highlight various barriers to youth involvement, underscoring the need to better understand and enhance their willingness and capacity to engage more broadly.

This project aims to explore sociological approaches to facilitating youth action for nature, potentially using methods such as semi-structured interviews, focus groups, or

questionnaires. Collaboration with the Youth Action Committee coordinator and committee members will be essential to developing effective strategies for increasing youth participation in conservation activities.

Key References:

- Richardson, M. et al. (2016) ‘30 Days Wild: Development and evaluation of a large-scale nature engagement campaign to improve well-being’, *PLOS ONE*, 11(2). doi:10.1371/journal.pone.0149777.
- The Wildlife Trusts (2022) Bringing Nature Back: The Wildlife Trusts’ Strategy 2030. The Wildlife Trusts. Available at: <https://www.wildlifetrusts.org/sites/default/files/2022-04/TheWildlifeTrustsStrategy2030.pdf> (Accessed: 14 September 2023).
- Zurba, M. et al. (2023) ‘Pathway to mainstream youth engagement and intergenerational partnership in nature conservation’, *Frontiers in Ecology and the Environment*, 21(4), pp. 175–181. doi:10.1002/fee.2612.

● Project 3.2: Evolving Landscape of Volunteering

The COVID-19 pandemic has dramatically shifted the landscape of volunteering, influencing the motivations and behaviours of individuals who participate in citizen science and general volunteer activities. Understanding these changes is crucial for organisations like Surrey Wildlife Trust (SWT), which rely heavily on volunteer support for conservation efforts. Post-pandemic, there is growing interest in exploring the differing motivations between citizen scientists—who typically engage in data collection and research—and general volunteers, who may participate in a broader range of activities.

This project seeks to analyse these evolving motivations and the demographic profiles of volunteers involved in Space for Nature (S4N), a key volunteer initiative involving SWT. By understanding these aspects, SWT can tailor its volunteer recruitment and engagement strategies to better align with the current trends and needs of volunteers.

The study would involve a combination of qualitative and quantitative research methods, including contextual inquiries, surveys, and interviews with current and prospective volunteers. You would work closely with SWT’s volunteer coordinators and data analysts to gather and interpret data, providing actionable insights for enhancing volunteer engagement and retention, post-COVID.

Key References:

- Furlong R., Hallam, J. and Barnes, C. (2024). Conservation volunteers’ experiences of connecting with nature during the COVID-19 pandemic: an interpretative phenomenological analysis. *Discover Psychology*, 4(1). doi:<https://doi.org/10.1007/s44202-024-00144-3>.
- Qu, G., Ju, E., Qin, G., Chen, X. and Luo, Y. (2023). Profiles of volunteers’ motivations and positive experiences relate to their sustained volunteering during the COVID 19 pandemic. *Journal of Community and Applied Social Psychology*, 34(1). doi:<https://doi.org/10.1002/casp.2748>.

● Project 3.3: How Can We Spark ‘Domino Effects’ with Actions for Nature?

One of our key strategic goals in SWT is empowering people to take actions for nature and inspiring nature connection. The most effective way of doing this is to create “domino effects” where a small-scale intervention causes a cascade of positive environmental actions and behaviours on a large scale. For example, a successful rewilding or conservation project can serve as a catalyst for neighbouring landowners or communities to adopt similar measures, expanding the scope of conservation efforts across a broader landscape. These strategies promote sustainable environmental practices that, once initiated, can expand through community involvement and policy support, driving a widespread positive impact on biodiversity and ecosystem health.

A fantastic example of this in Surrey is the Bookham Blue Hearts campaign. This

community-led project started with the aim of encouraging wildflowers to grow on road verges in the local village and has since spread across the county. People marked areas of their gardens and local spaces with a wooden blue heart to mark that it was not being mown. Local communities engaged through peer-to-peer contact, where neighbours observe and learn from each other's conservation efforts, which helped to build momentum. Case studies like Bookham demonstrate how localised successes in habitat restoration or species recovery can inspire nearby areas to replicate these efforts. This project would assess what elements helped the Blue Hearts be so successful to determine how this effect could be duplicated in other areas. We would also be interested in what the limiting factors are in creating domino effects and how we can overcome them. We can provide a wealth of knowledge about previous projects (successful and unsuccessful) and access to community group contacts to assist with this project.

Key References:

- Bookham 'Blue Hearts Campaign' (2024) Available at: <https://www.surreycc.gov.uk/roads-and-transport/roadworks-and-maintenance/trees-grass-and-hedges/grass/the-blue-campaign-increasing-biodiversity-in-grass-verges> [Accessed December 2024]

● Project 3.4: Understanding Charitable Giving Behaviour in Surrey

The way individuals support charities is evolving, with a shift from focusing on a few select organisations to supporting a diverse range of causes through various methods. This trend poses both a challenge and an opportunity for charities like the Wildlife Trusts, which have traditionally depended on a subscription-based model of support. The need to adapt to these changing behaviours is becoming increasingly urgent, especially in the context of the ongoing

cost of living crisis in the UK. This crisis has significantly impacted many charities, including the Wildlife Trusts, which have experienced a notable rise in membership cancellations. To mitigate this loss of income, the Wildlife Trusts are exploring ways to diversify charitable support options and more effectively target potential supporters.

This project aims to explore the following key research questions: How has charitable giving behaviour changed, and what factors are driving these changes? How does charitable giving vary across different demographic groups? Which charitable giving options resonate most with various demographics? Are people more inclined to give one-off donations, make adhoc contributions, commit to regular donations, or join membership schemes?

The research will involve a combination of desk-based research and surveys targeting various demographic groups within Surrey. Statistical analysis will be used to identify patterns and preferences in charitable giving behaviour. The findings will be instrumental in helping the Wildlife Trusts and similar organisations tailor their outreach and fundraising strategies to better align with the preferences of current and potential supporters.

Key References:

- Bekkers, R. and Wiepking, P. (2010). A Literature Review of Empirical Studies of Philanthropy: Eight Mechanisms That Drive Charitable Giving. *Nonprofit and Voluntary Sector Quarterly*, [online] 40(5), pp.924–973. doi:<https://doi.org/10.1177/0899764010380927>.
- Kessler, J.B. and Milkman, K.L. (2018). Identity in Charitable Giving. *Management Science*, [online] 64(2), pp.845–859. doi:<https://doi.org/10.1287/mnsc.2016.2582>.
- Bekkers, R. and Wiepking, P. (2011). Who gives? A literature review of predictors of charitable giving Part One: Religion, education, age and socialisation. *Voluntary Sector Review*, 2(3), pp.337–365. doi:<https://doi.org/10.1332/204080511x6087712>.



● Project 5.5: Identifying Market Gaps for Nature Literacy & Business Readiness for Environmental Prioritisation

As environmental sustainability becomes increasingly important, the concept of “nature literacy”—the understanding of ecological principles and the importance of biodiversity—is gaining traction in the business world. However, it remains unclear whether a significant market gap exists for services that enhance nature literacy among businesses. Additionally, understanding how many businesses are prepared to make environmental considerations a core component of their operations, or even allow them to be a key influence on their “bottom line,” is essential for developing effective strategies to market Surrey Wildlife Trust's (SWT) advisory services.

This project aims to answer two critical questions: Is there a market gap for nature literacy services targeted at businesses? How many businesses are ready and willing to integrate nature and sustainability into their fundamental business practices? Addressing these questions will help SWT tailor its advisory services to meet the needs of businesses that

are increasingly recognising the importance of environmental stewardship.

The research will involve a comprehensive market analysis, including surveys and interviews with business leaders across various industries in Surrey. Additionally, it will explore the current demand for nature literacy and the extent to which businesses are prepared to adopt nature-focused strategies. The findings will provide a data-driven foundation for SWT to position its advisory services effectively and identify potential clients who are most likely to benefit from these services.

Key References:

- Luo, W. and Cheng, J. (2022). Transition to sustainable business models for green economic recovery: role of financial literacy, innovation and environmental sustainability. *Economic Change and Restructuring*. doi:<https://doi.org/10.1007/s10644-022-09408-1>.
- Kineman, J.J. and Poli, R. (2014). Ecological Literacy Leadership: Into the Mind of Nature. *Bulletin of the Ecological Society of America*, 95(1), pp.30–58. doi:<https://doi.org/10.1890/0012-9623-95.1.30>.

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Economics

Surrey Wildlife Trust Research Prospectus 2024-2025

● Project 4.1: Identifying Optimal Use of Leaky Dams for Natural Flood Management (NFM)

Healthy wetlands store carbon and slow the surface flow of water, cleaning it naturally and reducing flood risk downstream. They support an abundance of plant life, which in turn provides perfect shelter, nurseries and breeding grounds for wildlife. Unfortunately, many wetlands have been lost or damaged in recent decades due to pollution or unsustainable development. 'Leaky dams' are becoming a standard Natural Flood Management (NFM) intervention used to impede water flow in streams and rivers, alleviating the risk of downstream flooding. These semi-permeable barriers are designed to mimic natural wood jams, allowing some water to pass through while temporarily holding back the rest, thus reducing peak flows during heavy rainfall events whilst also enhancing opportunities for nature recovery. However, while leaky dams are effective, this efficiency depends heavily on their number, size, and placement within a catchment area. Over-reliance on leaky dams could lead to unintended consequences such as excessive sediment buildup or waterlogging, whereas insufficient use may not provide the predicted flood mitigation. Finding the "sweet spot" between effective NFM and over-engineering is essential for sustainable flood risk management.

Flood defence measures typically rely on hard engineering solutions, but these are costly and also environmentally disruptive. NFM, including the use of leaky dams, offers a more ecologically-sensitive approach that works with natural processes. However, the effectiveness of leaky dams relative to other NFM methods, such as re-meandering rivers and/or floodplain restoration, remains an area of active research. Understanding the optimal configuration and quantity of leaky dams in comparison/

parallel with other interventions is crucial for maximising flood resilience while minimising environmental impacts. The Trust's Nature-Based Solutions landowner consultancy will increasingly be recommending the appropriate application of NFM solutions, where accurate, evidence-based information is imperative.

This project will use Wallis Wood as a case-study site to model the effectiveness of various configurations and numbers of leaky dams, comparing these with other NFM interventions. The study will involve hydrological modelling to simulate different scenarios and assess their impact on flood risk reduction. Primarily desk-based (with field validation and support for GIS mapping), the project will analyse the ecological and physical impacts of each method, helping to identify the most sustainable and effective flood management strategy for the area.

Key References:

- Hankin, B., Hewitt, I., Sander, G., Danieli, F., Formetta, G., Kamilova, A., Kretzschmar, A., Kiradjiev, K., Wong, C., Pegler, S. and Lamb, R. (2020). A risk-based network analysis of distributed in-stream leaky barriers for flood risk management. *Natural Hazards and Earth System Sciences*, 20(10), pp.2567–2584. doi:<https://doi.org/10.5194/nhess-20-2567-2020>.
- Wilkinson, M.E., Addy, S., Quinn, P.F. and Stutter, M. (2019). Natural flood management: small-scale progress and larger-scale challenges. *Scottish Geographical Journal*, 135(1-2), pp.23–32. doi:<https://doi.org/10.1080/14702541.2019.1610571>.
- Z.R. van Leeuwen, Klaar, M., Smith, M.W. and Brown, L.E. (2023). Quantifying the Natural Flood Management Potential of Leaky Dams in Upland catchments, Part II: Leaky Dam Impacts on Flood Peak Magnitude. *Journal of Hydrology*, 628(130449), pp.130449–130449. doi:<https://doi.org/10.1016/j.jhydrol.2023.130449>.

● Project 4.2: Optimising Hedgerow Placement for Enhanced Natural Flood Management (NFM)

Hedgerows have long been recognised for their environmental benefits, including supporting biodiversity, soil stabilisation and water retention. In recent years, their role in Natural Flood Management (NFM) has gained attention as a means to divert and mitigate downstream

flooding, particularly from agricultural and rural landscapes. Hedgerows can slow surface water flow, increase infiltration and evaporation rates, and reduce soil erosion, thereby helping to manage floodwaters more effectively.

However, the effectiveness of hedgerows in flood management greatly depends on their strategic placement within the landscape. Given the increasing frequency of extreme weather events due to climate change, optimising hedgerow placement is crucial for enhancing flood resilience in vulnerable areas.

Traditional flood management practices often involve engineered structures such as dams and levees, but these can be expensive and ecologically disruptive. NFM provides a sustainable alternative, using natural features like hedgerows to manage water flow. By analysing the topography of a landscape, it is possible to identify optimal locations for hedgerow planting that would maximise their flood management potential. This project aims to evaluate the effectiveness of hedgerows on the Holmesdale region east of Redhill, comparing areas with and without hedgerows to determine the best strategies for their placement. Holmesdale Moors is an unusual assemblage of riparian habitats within a priority Biodiversity Opportunity Area (BOA) that supports many migratory wetland birds.

The project will involve a detailed analysis of the Holmesdale region as a case-study site, using topographical mapping and hydrological models to assess how different hedgerow configurations could influence water movement and retention. The study will compare flood impacts on land with existing hedgerows against areas without them, and use this data to propose optimal hedgerow placements for improved NFM. This project will be both field and desk-based, with support provided for GIS mapping, hydrological modelling and statistical analysis.

Key References:

- Montgomery, I., Caruso, T. and Reid, N. (2020). Hedgerows as Ecosystems: Service Delivery, Management, and Restoration. *Annual Review of Ecology, Evolution, and Systematics*, 51(1). doi:<https://doi.org/10.1146/annurev-ecolsys-012120-100346>.
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- Natural Flood Management Measures, A practical guide for farmers (2017). Available at: <https://thefloodhub.co.uk/wp-content/uploads/2018/11/North-West-NFM-handbook.pdf#:~:text=Hedgerows%20provide%20excellent%20natural%20weather%20barriers%20and> [Accessed 22 Aug. 2024].



● Project 4.3: Identifying and Prioritising Trans-Habitat Interventions for Maximum Impact on Surrey's Priority Threatened Species

Surrey is home to a diverse range of species, many of which are considered priorities for conservation due to their vulnerability to local extinction and/or ecological importance. The emerging Surrey Local Nature Recovery Strategy (LNRS) includes a comprehensive review of threatened and declining species, to identify those priority species requiring stand-alone conservation efforts to support their recovery. The remaining species would theoretically be adequately catered for through

generic interventions prescribed for their main preferred habitat(s). This project would examine the complete review to test the soundness of this approach for the resultant habitat guild assemblages involved. Conversely, it would also support the Short-Listing criteria for identifying species requiring bespoke “trans-habitat interventions” across multiple habitat types. By using species examples, this project would add support for the habitat-specific species guild approach, or otherwise expose its limitations. Ultimately, the guilds approach is seen as the most cost-effective use of limited conservation resources, but this does require a hierarchical prioritisation that could then be matched to a variable funding model going forwards.

By identifying commonalities in the ecology of multiple species and habitats, it is possible to develop integrated management practices to benefit the broadest range of threatened biodiversity. This project will assess the degrees of synergy or tension between different interventions, to identify a set of prioritised actions that maximises both resource efficiency and conservation outcomes.

The project will involve a detailed analysis of the emerging Surrey LNRS, cross-referencing the proposed interventions (LNRS ‘measures’) with examples of species’ autecology. Spatial analysis could be used to map areas where multiple species’ needs overlap. The study will also involve consultation with expert species conservation practitioners to validate findings and refine the prioritisation of interventions. The final output will be a strategic conservation plan that outlines the most impactful interventions, providing evidence for the effective deployment of resources. Support will be available for data analysis, GIS mapping, and stakeholder engagement.

Key References:

- Draft Local Nature Recovery Strategy for Surrey (available on selection of this project)
- Defra (2022) Habitats and species of principal importance in England. Available at <https://www.gov.uk/government/publications/habitats-and-species-of-principal-importance-in-england> [Accessed December 2024]

● Project 4.4: How Does Natural Capital Reward Good Farming Practice in England?

We are currently in a biodiversity and climate crisis. Ecosystem services such as production of food and water, climate regulation, nutrient cycling etc. are finite resources that have been increasingly threatened from human activity over the past century. The quantification of global stocks of these natural assets, termed ‘Natural Capital’, allows a monetary value to be assigned to them. This is crucial for showing the impact of losing these ecosystem services to the global economy which in turn, incentivises the redirection of funding into nature recovery to mitigate for the economic repercussions of the loss of these natural systems.

Food security is one of the ecosystem services under threat. A recent review of the state of Natural Capital in the UK highlighted loss of cultivated crops, pollinator-dependent crops, and reared animals as significant risks to the UK economy. The report suggests that these risks can be alleviated through sustainable farming practices such as creating species-rich nature networks within enclosed farmland and increasing the biodiversity of cultivated soils. Using this framing for these among other ecosystem services (e.g. Natural Flood Management) could help farmers attach value to the natural assets found on farmland and source funding to support sustainable agricultural practices.

This project aims to explore farmer’s understanding of Natural Capital, and assesses

how it can be integrated into farming practices while maintaining business viability. It involves exploring farmer perceptions of Natural Capital, evaluating its integration into farming operations, and developing practical guidelines for implementation. Additionally, the project could examine the relationship between tenant farmers and Natural Capital assets, exploring incentive structures and collaboration dynamics with landowners.

Key References:

- United Nations et al. (2021). System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA). White cover publication, pre-edited text subject to official editing. Available at: <https://seea.un.org/ecosystem-accounting>.
- Natural England (2024) State of Natural Capital Report for England 2024 : Risks to nature and why it matters. Natural England Research Report. Available at: <https://publications.naturalengland.org.uk/publication/6683489974616064>



Project 4.5: Green Finance for Nature Recovery in Surrey: Assessing Funding Needs & Financial Models

In the UK, there is an estimated £56 billion gap between the money required to meet environmental targets set out in public policies and the money committed and planned by the public sector. This is moreover likely to be an underestimate. The UK government has

attempted to bridge this gap by incentivising private sector investment into Natural Capital through the creation of nature markets such as Biodiversity Net Gain. In 2023 the government at the time set a goal to increase investment flows to nature by more than £1 billion by 2030. This still leaves approximately £55 billion unaccounted for and time is running out to meet the commitment to protect and conserve 30% of land and sea for biodiversity by 2030, which the UK made to the United Nations back in 2022.

A successful plan for the recovery of natural ecosystems in Surrey requires a thorough understanding of the financial resources needed and the sources of these funds. This project seeks to determine the total financial requirement for nature recovery in Surrey, distinguishing between public and private sector contributions. There is scope for this project to also/alternatively review and compare existing financial models used in nature recovery and conservation, including approaches like impact investing, blended finance, and nature markets within a Surrey context.

This analysis will help to understand the financial landscape and identify funding gaps. Ideally, we would like recommendations for the most suitable financial models for Surrey's nature recovery efforts as an output of this work. Our Nature-based Solutions team can help give context for which nature markets are active in Surrey and who to contact for advice.

Key References:

- GFI, eftec, Rayment Consulting (2021) "The Finance Gap for UK Nature". Green Finance institute publication. Available at: <https://legacy.greenfinanceinstitute.com/wp-content/uploads/2021/10/The-Finance-Gap-for-UK-Nature-13102021.pdf>
- Defra (2023) "Nature markets framework". Available at: <https://www.gov.uk/government/publications/nature-markets>
- Hawkins, I., Smith, A., Addison, P., Malhi, Y., Whitney, M., and zu Ermgassen, S. (2023) "The potential contribution of revenue from Biodiversity Net Gain offsets towards nature recovery ambitions in Oxfordshire". University of Oxford and Oxfordshire's Local Nature Partnership. Available at: <https://>

www.naturerecovery.ox.ac.uk/wp-content/uploads/2023/08/BNG-report-final-29-June-2023.pdf

Project 4.6: Quantifying the Economic Impact of Ecological Interventions: A Methodological Framework for Water Management

Ecological interventions, such as the implementation of leaky dams, offer potential economic benefits by enhancing ecosystem services and reducing costs related to flood management and water quality improvements. Developing a robust methodology to quantify these economic impacts, particularly in the context of water management, is essential for demonstrating the value of such interventions. This project aims to create a comprehensive framework for evaluating the economic benefits of ecological interventions, focusing initially on water management, with the potential for adaptation to other ecological contexts.

The project will develop a methodology for quantifying the economic impact of water management interventions, identifying key economic metrics such as cost savings from flood mitigation, improvements in water quality, and increased ecosystem services. The methodology will encompass the collection of baseline data, measurement of changes over time, and estimation of the monetary value of these changes. A specific case study area where leaky dams have been implemented will serve as the focal point for validating the methodology. Monitoring frameworks will be established to collect data before and after the installation of leaky dams, with key indicators such as water flow rates, sediment retention, and changes in biodiversity being tracked. This analysis will provide practical insights and highlight the economic benefits of the intervention.

The research will involve the development of a detailed approach for quantifying economic

impacts, informed by a review of existing literature and best practices in environmental economics. Baseline data collection and post-implementation monitoring will be integral to the case study, with statistical and economic analyses used to evaluate the impact of the leaky dams. The findings will be reported, and the methodology refined based on the insights gained from the case study.

Key References:

- White, T.B., Petrovan, S.O. , Booth, H., Correa, R.J., Gatt, Y., Martin, P.A., Newell, H., Worthington, T.A., and Sutherland, W.J. (2022). Determining the economic costs and benefits of conservation actions: A decision support framework. ProQuest. [online] doi:10.1111/csp2.12840.
- White, T.B., Petrovan, S.O., Christie, A.P., Martin, P.A. and Sutherland, W.J. (2022). What is the Price of Conservation? A Review of the Status Quo and Recommendations for Improving Cost Reporting. *BioScience*, 72(5). doi:<https://doi.org/10.1093/biosci/biac007>.

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Examples of Ongoing & Completed Projects



Private Funding for Farmers Elva King (Imperial College London)

The UK Government's 25-Year Environmental Plan highlights the importance of sustainable agriculture in addressing environmental challenges and restoring ecosystems. Yet, the transition to sustainable farming practices is often hindered by financial constraints, as these methods can generate less income for farmers, particularly in the first few years. Combining public funding schemes, like the Sustainable Farming Incentives (SFI), with private funding mechanisms, such as the Woodland Carbon Code (WCC), could provide a solution. However, the uptake of these combined mechanisms remains low. My research aimed to identify the barriers to combining funding schemes and provide actionable insights to help overcome them.

I conducted an economic analysis on a case study farm in Surrey which calculated the 'Net Present Value of the farm business under different funding scenarios. This allowed me to outline the financial feasibility of integrating SFI and WCC. I then interviewed a range of farmers and agricultural consultants to get a broader understanding of the barriers to combining public and private funding mechanisms. These included: profitability challenges, scepticism towards carbon markets, administrative complexity, and site-specificity requiring expert advice. Combining public and private funding mechanisms in agriculture is crucial to farm businesses accessing the additional cashflows needed to transition to more sustainable systems. Therefore, it is essential to overcome these barriers, so that sustainable agricultural practices can become more widespread.

I hope this research can support SWT's Nature-Based Solutions team in helping farmers navigate these challenges and integrate sustainable practices into their operations. By bridging the gap between public subsidies and private markets, hopefully sustainable agriculture can become more accessible and mainstream in the UK.

Tiny Forests: Big Solutions for Urban Biodiversity and Community Engagement

Parth Pardeshi (University of Surrey)

In recent years, urban areas have faced an increasing number of environmental challenges, including climate change, biodiversity loss, and a disconnection from nature. As cities expand and populations grow, the need for innovative solutions to these pressing issues has become more urgent. One promising approach that has gained traction is the concept of Tiny Forests.

Tiny Forests, also known as Miyawaki forests, are small-scale forests that can fit into spaces as small as a tennis court. Despite their limited size, they can accommodate up to 600 native trees and shrubs, creating rich ecosystems that support diverse flora and fauna. These micro-forests are increasingly recognised as effective nature-based solutions for combating climate change by acting as a carbon sink and providing habitats for various species that may otherwise struggle to survive in urban environments. Beyond their ecological advantages, Tiny Forests serve as powerful tools for community engagement. As urbanisation continues to disconnect people from nature, initiatives like Tiny Forests provide opportunities for individuals to reconnect with their environment.

My research project aimed to assess local perceptions regarding the establishment of Tiny Forests and identify factors influencing community engagement. I used a combination of surveys and interviews to assess their awareness of Tiny Forest projects, perceived benefits associated with these initiatives,

willingness to participate in forest activities, and shifts in environmental attitudes post-implementation.

I found that community awareness of Tiny Forest projects is generally high among residents in Surrey. Many participants expressed positive attitudes toward the establishment of these micro-forests due to perceived benefits such as increased biodiversity, improved air quality, and enhanced recreational opportunities. However, some concerns were raised regarding potential maintenance challenges and the need for ongoing community involvement to ensure long-term success. Addressing these concerns through effective communication strategies will be crucial for fostering sustained engagement among residents.

This research, conducted at Unstead Nature Reserve, underscores the importance of understanding local attitudes toward these initiatives—highlighting how effective communication strategies can empower communities while ensuring sustainable management practices are upheld over time. Ultimately, embracing nature-based solutions such as Tiny Forests represents an essential step towards achieving resilient cities capable of thriving amidst ongoing environmental changes—ensuring future generations inherit healthy ecosystems filled with diverse flora and fauna.

Optimal Conservation Prescriptions for Agricultural Land

Peter Hewetson (Merrist Wood College)

The Wildlife Trusts have a target to move 30% of UK land into management which is beneficial for nature by 2030, as this is viewed as essential to reverse the biodiversity loss and

environmental degradation which has taken place over recent decades. Former agricultural land will be a key element of this plan, as it has enormous potential to deliver space for wildlife to flourish, while still benefitting the economy, and being a valued component of a thriving holistic ecosystem.

This project is considering three SANG (Suitable Alternative Natural Greenspace) sites located across Surrey totalling 54 hectares, which previously had agricultural use, but are now managed by Surrey Wildlife Trust for conservation utilising 10 different prescriptions. During summer 2024 ecological surveys have been undertaken gathering primary data on flowering herbaceous plant species and invertebrate pollinators, to consider, species abundance and richness, flower-insect assemblages, and overall biodiversity.

Further research is required to determine the ecological functionality of agricultural land which has recently been restored for conservation, in terms of the improvement of biodiversity. The results of this research could be used to better understand the value of different conservation management regimes, including, mowing, grazing, seed sowing and natural plant succession.

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Afterword

The wider aim of this research is to continue to challenge the conundrum whereby good scientific evidence generated by the academic sector routinely fails to usefully inform biodiversity conservation in practice. Historically, accessibility to research and evidence has been an issue and the majority of conservation actions have remained experience based and heavily reliant on anecdotal knowledge. We believe that evidence and the outcomes of applied ecological research should be freely available and as accessible as possible to land managers and decision makers. The Wildlife Trusts is well placed to act as a conduit for the dissemination of this information through both our own practice and our close ties with partner land managers. We hope that through the work produced by this research prospectus we can positively influence the discourse surrounding conservation actions and their relationship with academia and applied ecology.

Please check the current version of the prospectus at: surreywildlifetrust.org/research



Contact information

The primary contact for research projects is wiki.webster@surreywt.org.uk, please contact them in the first instance to express interest.

Please check the current version of the prospectus at: **surreywildlifetrust.org/research**

Summaries of a selection of completed projects can be found at the end of the document.



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