CIEEM in practice

Issue 118 | December 2022

Bulletin of the Chartered Institute of Ecology and Environmental Management

Biodiversity Metric and Priority Habitats and Species of Conservation Priority

New Tool For Environmental Impact Assessments

New Volunteering Platform to Support Community Nature Restoration Projects

Editorial

Hope in dark times

I think it is fair to say that it has been a difficult few months, since the last *In Practice*. Not least of our worries is the cost-of-living crisis, which is really starting to bite for many people and organisations. As ever we are grateful to all of you, for renewing your membership and demonstrating your trust in the Institute to support and represent you and the sector and to work tirelessly for a healthy natural environment. If you are struggling, please reach out to the secretariat, and also remember the Member Assistance Programme (in the members' area of the website) which gives you access to free and anonymous advice about everything from mental health to financial concerns.

Added to this, there is the ongoing uncertainty about the UK Government's intentions towards the natural environment – dubbed the 'attack on nature' by the campaigning conservation NGOs. We share those concerns and are actively engaging with the UK administration, in Westminster, Scotland, Wales and Northern Ireland, and will do everything in our power to ensure the importance of nature is not diminished and the contribution of our professions is recognised and valued. See the article on page 59 for more on this. If you are anything like me, this is causing a lot of anxiety, but we have to hope that the clarion voices that have responded to this latest threat to nature, will be heard, and a progressive, optimistic approach to tackling the climate and nature emergencies will prevail.

On a more positive note, CIEEM's commitment and leadership on climate action is going well. The Action 2030 working group – set up to challenge the Institute and aid us in getting to carbon net zero by 2030 – has helped us to reduce our overall emissions from c.78 tonnes of CO2e in 2019-2020 to c.51 tonnes CO2e for 2021-2022, but of course there is still a long way to go. You may remember that CIEEM committed to net zero by 2030 in our original declaration of a climate emergency and biodiversity crisis in 2019. We set the very ambitious target of a 90% absolute reduction of scope 1, 2 and 3 GHG emissions by 2030 from a 2019 baseline. Our pledge to net zero means that by 2030 we must reduce our CO2 emissions to no more than c.7.8 tonnes CO2e and to compensate for unavoidable residual emissions. We continue to make progress and will keep you informed.

We have a growing collection of resources that the Action 2030 group has put together for us all to use. We encourage you and your organisations to use the information available and make your own pledge, on the actions you will take, through the website - https://cieem.net/action-2030/. It is particularly important to be able to work out your emissions and what contributes to them, which is not as hard as it may seem, and there are simple calculators available.

By the time you read this we will have just had Climate COP27 (the UN Framework Convention on Climate Change's 27th Conference of the Parties) and just about to have Biodiversity COP15 (the Convention on Biological Diversity's 15th Conference of the Parties). COP27 needs to agree to strong action and acknowledge that the global cost of living and energy crises

are interlinked with climate change. We hope that biodiversity loss features again as prominently as it did at COP26, recognising the fact that we cannot address one without the other. Governments from around the world will shortly convene at COP15 to agree a new Global Biodiversity Framework. Given that the latest *Living Planet Report* says that our global wildlife populations have declined by 70% over the past 50 years, this agreement needs to be robust – but more than that it needs to accelerate action. See the CIEEM website at https://cieem.net/biodiversity-climate-cops/ for more information on our engagement with the COPs.

I hope you enjoy this non-themed edition of *In Practice*. It's great having the themes where we can focus in on a specific topic, but equally interesting to have a random collection of articles too.

Dr Richard Handley CEcol MCIEEM
President

Cover photo: Detection dog seeking out Japanese knotweed. See article on page 52. Photo credit: HOEK.

Prioritise Your Professional Development in the New Year...

Each year, well over 1000 delegates attend CIEEM training delivered by some of the best-known names in the sector. These trainers deliver over 100 training courses on a variety of topics every year, providing you with the opportunity to improve your knowledge and understanding for your current and future roles. But don't just take our word for it...

Identify your next professional development opportunity and secure your place at

www.cieem.net/events

CIEEM

"One of the best training courses I've attended in a very long time."

"During each question and answer section, the course leaders were so knowledgeable and really clearly outlined how to practically use BNG."

"Having the ability to go through one of our own EcIA reports and understand where we needed to make improvements was invaluable."

"The best part of the course was learning all the terminology that will help me to understand the botanical keys and identify grass parts. I am excited to try this myself and build my experience."

CIEEM 2023 AWARDS

ARE OFFICIALLY OPEN FOR NOMINATIONS!

Our annual awards are your chance to inspire the next generation, to recognise the skills of your peers and to remind one another why we're here, doing what we do and striving every day to make a difference.

The following categories are open for nominations:

- Best Practice – Innovation
- Best Practice – Knowledge Sharing
- Best Practice – Stakeholder Engagement
- Best Practice – Large-Scale Practical Nature Conservation
- Best Practice – Small-Scale Practical Nature Conservation
- Best Practice – Small-Scale Project Mitigation, Compensation and Enhancement
- Best Practice – Large-Scale Project Mitigation, Compensation and Enhancement
- Consultancy of the Year – Small
- Consultancy of the Year – Medium
- Consultancy of the Year – Large
- Climate and Nature Action 2030
- Promising Professional
- Member of the Year
- NGO Impact

CIEEM

Visit our website to download a nomination form

www.cieem.net/2023-awards

In this issue

In Practice

Editor
Dr Nik Prowse (nikprowse@cieem.net)

Internal contributions coordinator
Mr Jason Reeves
(jasonreeves@cieem.net)

Editorial Board
Dr Kate Bayley, Mr Dominic Coath, Dr Mihai Coroi, Dr Joanne Denyer, Ms Ursula Digby, Dr Frances Giaquinto, Mr Neil Harwood, Dr Claire Howe, Dr Sue Lawley, Dr Caroline McParland, Mr Ian Morrissey, Dr Patrick White

CIEEM Office

Grosvenor Court,
Ampfield Hill, Ampfield,
Romsey SO51 9BD, UK

T: 01962 868626
E: enquiries@cieem.net
W: www.cieem.net

In Practice No. 118: December 2022
ISSN 1754-4882

CIEEM News

Recent webinars

We continue to run a full and varied series of webinars for members and the sector. Readers may be interested in the below recent webinars that are available on the CIEEM Resource Hub.

- Measuring acoustic similarity within and between populations (Academia Special Interest Group)
- CIEEM ENDS 100 Power List Discussion Panel
- Early Careers Webinar: Top tips on applying for a job in the sector
- Becoming a Chartered Ecologist
- An Overview of CIEEMs CPD Tool, MyCareerPath

Past webinars are available in the CIEEM Resource Hub (https://cieem.net/i-am/resources-hub/). Also look out for future webinars in events and training listing on the website (https://events.cieem.net/Events/Event-Listing.aspx).

Recent blog posts

Recent blog posts on the CIEEM website (https://cieem.net/news/) include:

- Forest restoration saving an island's population, the St Helena Cloud Forest Project: Conserving a globally important ecosystem – by Katie Medcalf
- Achieving carbon zero and environmental sustainability through graduate employability – by Liz Lakin and Laura Roberts
- Celebrating National Mentoring Day
- Taking the Path toward a Nature Positive, Carbon Negative Business – by Tom Butterworth and Margot Greenen
- Policy Debate on National Parks in Scotland
- Another Game of Snakes and Ladders – by Sally Hayns
- A Very Professional Standard – by Allison Potts
- Can Marine Net Gain Really Turn the Tides for Our Sea's Biodiversity? – by Amber Connett and Richard White
- On-the-job Training and Early Career Development – by Paul Whitby
- Ideas for CIEEM Action to Address the Climate Emergency – by John Box and Amber Connett
- Volunteering: My Role as a Solent Seagrass Champion – by Krystie Hamilton
- Key Actions to Tackle the Climate Emergency and Biodiversity Crisis: Everyone Can Make a Difference – by John Box

If you would like to contribute your own blog, please contact SophieLowe@cieem.net.

Staff changes

In September, **Alison Wells** joined the team as Membership and Marketing Administrator, followed in late October by **Rachel Eckton** as Membership Manager. Our previous Membership Manager, **Sarah Cox**, is now on maternity leave, and will return in spring 2023 to take up the role of Professional Standards Manager.

In early November, we said goodbye to **Amber Connett**, whom many of you will have known in her role as Policy Officer. And later that month we welcomed **Douglas Lewns** as the new Policy Officer.

In Practice digital editions

If you would like to reduce your and CIEEM's carbon footprint and receive only digital editions in the future, please let us know by contacting enquiries@cieem.net.

Early Careers SIG

We are pleased to announce that the Early Careers Special Interest Group is up and running. If you would like to find out more about the group or get involved please contact DrewLyness@cieem.net.

Green Jobs for Nature Launched

The Green Jobs for Nature website (www.greenjobsfornature.org) has now launched. Find out more on page 58.

Merry Christmas and Happy New Year

From everyone at CIEEM, we wish you all a joyous festive break and a happy New Year. We look forward to seeing you again in 2023.

In Practice Themes and Deadlines

Edition	Theme	Article submission deadline
March 23	Rewilding, Habitat Restoration & Species Reintroductions	n/a
June 23	Invertebrates	17 Feb 2023
September 23	Diversity, Accessibility & Capacity in the Sector	19 May 2023
December 23	Non-themed (submissions welcome on any topic)	18 Aug 2023

If you would like to contribute to one of these issues, please contact the Editor at nikprowse@cieem.net. Contributions are welcomed from both members and non-members. Further information and guidance for authors can also be found at: https://cieem.net/in-practice/

Did You See?

Backlash after UK Government's Growth Plan and EU law reform plans published

Green groups, MPs and governments in the devolved nations have issued strong responses to the government's economic growth plans and proposals to remove all EU legislation by December 2023 unless otherwise preserved, calling them an attack on nature and the devolution settlement (see the policy update on page 60 for more information). Scotland's Environment Minister Mairi McAllan and Biodiversity Minister Lorna Slater wrote to the UK Government urging them to drop the proposals announced in its mini-budget. Reports also emerged that the government was considering scrapping its Environmental Land Management Scheme in favour of a return to an EU-style subsidy scheme. Following further backlash from green groups, the Environment Secretary has now confirmed the schemes will not be scrapped, but will be reviewed, in a statement.

https://deframedia.blog.gov.uk/2022/09/28/government-reiterates-commitment-to-environmental-protections/

https://www.gov.scot/publications/environmental-impact-of-mini-budget-and-retained-eu-law-bill-letter-to-uk-government/

Beavers gain legal protection in England

On 1 October 2022, Eurasian beavers gained legal protections in England, meaning it is now an offence to deliberately disturb, injure, capture or kill a beaver without the appropriate licence. Natural England has published guidance on how to manage Eurasian beavers on your land without a licence and when you need a licence.

https://naturalengland.blog.gov.uk/2022/10/03/beavers-are-now-legally-protected-in-england-the-licensing-regime-explained/

Agriculture (Wales) Bill

Lesley Griffiths MS, Minister for Rural Affairs, introduced a new Agriculture (Wales) Bill on 26 September which establishes the post-Brexit Sustainable Land Management (SLM) agriculture policy. The Bill is an enabling Bill giving Welsh Government powers to deliver SLM objectives through the forthcoming agricultural payment schemes. Support must contribute to the four SLM objectives written in the Bill.

https://senedd.wales/media/51ncc5s0/pri-ld15330-e.pdf | https://senedd.cymru/media/4j5ilrlx/pri-ld15330-w.pdf

O'Dowd announces new approach to road verge management to protect the environment

Northern Ireland Infrastructure Minister John O'Dowd has announced a new approach to verge management, focusing on protecting wildlife and promoting biodiversity when managing roadside verges. This will support actions needed to comply with the Climate Change Bill passed by the Assembly earlier this year.

https://www.infrastructure-ni.gov.uk/news/odowd-announces-new-approach-road-verge-management-protect-environment

Shared National Vision for Forestry 2050 published

Irish Forestry Minister, Senator Pippa Hackett, has published a new trees vision, entitled Shared National Vision for Trees, Woods and Forests in Ireland until 2050. The document calls for *"the right trees in the right places for the right reasons with the right management – supporting a sustainable and thriving economy and society and a healthy environment"*.

https://www.gov.ie/en/press-release/15d15-shared-national-vision-for-forestry-2050-published-visionary-document-based-on-project-woodlands-extensive-public-consultation/

New rules for companies to help limit global deforestation

The EU Parliament has adopted its position on the Commission proposal for a regulation on deforestation-free products. The new law would make it obligatory for companies to verify that goods sold in the EU have not been produced on deforested or degraded land anywhere in the world. Parliament is now ready to start negotiations on the final law with EU member states.

https://www.europarl.europa.eu/news/en/press-room/20220909IPR40140/climate-change-new-rules-for-companies-to-help-limit-global-deforestation

Biodiversity plan gets billion-dollar funding boost

Ahead of the UN Biodiversity Conference, COP15, Germany announced that the country is increasing its funding for international biodiversity conservation to €1.5 billion a year making it the largest national financial pledge yet to save nature. The new funding was bolstered by other pledges and developments, including a promise from a partnership of private philanthropic foundations and charities to add to the $5 billion they have already committed to conservation, if other countries promise more funds.

https://www.nature.com/articles/d41586-022-03047-2

Find more news from CIEEM at: www.cieem.net/news

Viewpoint

Evidence is Vital if we are to Deliver Biodiversity Gains

Thomas White
University of Cambridge

Matthew Bowell CEnv MCIEEM
Atkins

Alec Christie
University of Cambridge

Harriet Downey
University of Cambridge and the Woodland Trust

Keywords: evidence-based practice, biodiversity impact mitigation, net gain

Ecological practitioners often strive for evidence-based practice as a way of improving ecological outcomes, but what does it mean? And why is it important? In this article we outline the benefits promised by evidence-based practice, highlighting how appropriate use of the evidence base can help reach increasingly stringent biodiversity targets, and prevent resources being wasted on ineffective or suboptimal actions within projects and policies. Although utilising evidence can be challenging, there are several solutions to help transition the sector towards evidence-based practice. Doing so is vital if we are to effectively address the risks posed by biodiversity loss and achieve Biodiversity Net Gain.

Introduction

The terms evidence-based practice, science-based or evidence-led are often used in the practitioner community to describe the strategies and actions we take to mitigate impacts to species and habitats. In the UK there is an increasing expectation that actions taken to minimise and compensate for impacts will be effective, evidence-based and comply with the mitigation hierarchy (CIEEM 2018, Natural England 2020). Projects will increasingly strive to achieve net gain for biodiversity, within which many actions will need to be taken to effectively minimise impacts and restore different habitats. But why is using evidence to guide actions so important? Is current practice living up to expectations? And if not, how can we improve practice?

Evidence can be broadly defined as local or global information used to back up a hypothesis or assertion of interest (Salafsky *et al.* 2019). It can include information on species, habitats and landscapes, impacts of different business activities (e.g. construction, sourcing), evidence on the effectiveness or cost-effectiveness of given actions or the effectiveness of different monitoring measures.

Using evidence promises two main benefits to the sector. First, if practitioners can ensure that actions are based on the best available evidence, then we can be more certain that beneficial outcomes for wildlife will be achieved. Secondly, ensuring action is effective means that businesses and regulators avoid wasting resources on less effective, or ineffective, actions that attempt to mitigate impacts. Reducing the risks of ineffective action ultimately reduces reputational and financial risks to businesses (White *et al.* 2022).

A growing evidence base details the effectiveness of different mitigation/conservation actions (Box 1). However, there are also worrying examples outlining poor evidence use. A recent study investigated 65 different mitigation actions used by UK housing developments, including measures such as reptile translocations and hibernacula (Hunter *et al.* 2021). But when these actions were compared to the evidence base, a large proportion had no evidence available or were of unknown effectiveness. The study found that 10% of the plans cited scientific evidence backing up these measures, and these measures were often justified by citing guidance (56% of the time). However, when researchers investigated that guidance, they found that it was often out of date and with recommendations not based on evidence (Downey *et al.* 2022). This highlights a problem with current mitigation practice. Much mitigation

> **Much progress has been made building and collating the evidence base demonstrating that certain mitigation actions are effective or ineffective to varying degrees.**

may well be effective and/or meet statutory requirements, but without appropriate use and expansion of the evidence base, practitioners risk utilising ineffective measures, calling into question the reliability of claims to have achieved biodiversity goals.

What can you do?

Much progress has been made building and collating the evidence base demonstrating that certain mitigation actions are effective or ineffective to varying degrees (Box 1). While keeping up to date with the rapidly growing evidence base poses a challenge to practitioners, Box 2 shows that there are tools and solutions to help build so-called 'evidence bridges' between science and practice. Using these tools can help quickly identify the relevant evidence base to investigate the effectiveness of actions. It can also also allow access to secondary information on the status of biodiversity and impacts which can then guide actions to avoid and minimise impacts at early project stages.

Practical steps

There are several practical steps we can all take to move towards more evidence-based practice. White *et al.* (2022) set out principles for using evidence to guide biodiversity impact mitigation actions. The following list outlines some suggestions for how we can collectively move the sector forward.

- Use and create evidence-based guidance: statutory and regulator-published guidance is a vital tool to help consultants recommend the best actions. However, if not evidence-based, guidance can 'lock in' poor practice. Principles have been developed for helping identify and write evidence-based guidance (Downey *et al.* 2022). If using guidance, quick checks on the information used to inform recommendations can help identify whether it is evidence-based, or where evidence is out of date. Where it may be outdated, use of guidance can be supplemented with additional evidence searches. Regulators should work to ensure that all guidance is evidence-based and that it recommends effective actions.
- Integrate evidence into decision-making and review processes: develop decision-making processes or structures within organisations that ensure evidence is collated from diverse sources, and that actions and/or recommendations are based on the best available evidence. The evidence-to-decision tool

Box 1 Examples of evidence detailing both effective and ineffective mitigation actions

Evidence showing the effectiveness of mitigation actions

- Evidence indicates that installing underpasses or culverts on road and railway infrastructure can be effective in reducing bat collisions with traffic (Berthinussen *et al.* 2021a).
- Minimising collisions of bats with wind turbines can be successfully achieved through stopping wind turbines at low wind speeds (Berthinussen *et al.* 2021a).
- Using acoustic devices to deter marine mammals during high-amplitude construction activities can be effective, but also risks hearing damage in target and non-target species (Berthinussen *et al.* 2021b).
- Marking power lines to reduce collisions can be effective at reducing collisions with at-risk bird species. However, the risk varies depending on the type of marker used, and the species impacted (Bernardino *et al.* 2019).
- There is a large amount of evidence on peatland restoration techniques. For example, rewetting peatlands by raising the water table and adding mixed vegetation to peatland surfaces are likely to be beneficial to help restore degraded peatlands (Taylor *et al.* 2018).

Evidence showing poor or ineffective mitigation action

- Bat gantries are structures placed over roads to prevent bats colliding with traffic. They have been used in the UK for over a decade, at a total cost of around £2.5 million. They are known to be ineffective but they are still used (Berthinussen *et al.* 2021a).
- Translocation of reptiles is also a common mitigation action in the UK, but there is limited evidence. One study showed that 1.6% of translocated individuals were detected in subsequent monitoring of the translocation sites (Nash *et al.* 2020).

Box 2 Tools and resources

The effects of mitigation actions:

- Conservation Evidence: online database compiling the evidence of effectiveness for conservation actions
- Applied Ecology Resources: open platform to access information on the management of biodiversity (project reports, grey literature, etc.)
- IUCN Panorama: database of detailed case studies of biodiversity conservation programmes, with their successes and failures

Data on status, impacts and dependencies that can be used to guide avoidance and minimisation:

- ENCORE: an online tool to understand business impacts and dependencies on nature and ecosystem services
- TRASE: a platform presenting evidence of business supply chains and investment impacts
- IBAT: a tool allowing access to key evidence sources (IUCN Red List, Protected Planet and Key Biodiversity Areas)

(www.evidence2decisiontool.com/) can help consultants clearly lay out the evidence of effectiveness, costs, acceptability and feasibility of given actions. This can aid decision-making, but also increase the transparency of how decisions were made (Christie *et al.* 2021).

- Prioritise effort surrounding evidence use: using evidence can be time consuming and complex. But the level of detail and effort can be partitioned according to risks. Using evidence-based guidance is a quick solution to ensure that actions are evidence based without the need for a detailed evidence review. In some situations, a more detailed review of recommended actions may be required (e.g. when actions are novel, high risk or costly, or when there could be serious consequences in the result of failure).
- Monitoring, piloting, and testing: often, the evidence base is incomplete or lacking, with higher weight placed upon the judgement of consultants and regulators. In these situations, monitoring, evaluation and adaptive management are very important to ensure that desired outcomes are achieved. Monitoring should be a key component of mitigative action and is often a requirement, with responsibilities and design set out early in the design of mitigation plans. Monitoring, alongside adaptive management, allows unintended effects to be noted quickly, and practice modified to remedy the issues. When evidence is lacking, monitoring can be designed to test an action through the design of experiments with controls and replication. The results can be shared by publication in practitioner-focused journals (e.g. *In Practice*, *Conservation Evidence Journal* and *Ecological Solutions and Evidence*), adding to the global evidence base and benefiting the wider community. There is ample opportunity to collaborate with researchers to design and implement monitoring.

In the UK, it is becoming a requirement for many projects to upscale the minimisation and compensation of biodiversity impacts on both species and habitats, including new requirements to achieve net gain for biodiversity. To realise biodiversity gains, mitigation needs to be effective. Effective mitigation demands that the sector better assesses, utilises and contributes to the evidence base.

References

Bernardino, J., Martins, R.C., Bispo, R. and Moreira, F. (2019). Re-assessing the effectiveness of wire-marking to mitigate bird collisions with power lines: a meta-analysis and guidelines for field studies. *Journal of Environmental Management*, **252**: 109651.

Berthinussen, A., Richardson O.C. and Altringham J.D. (2021a). *Bat Conservation: Global Evidence for the Effects of Interventions.* Conservation Evidence Series Synopses, Cambridge.

Berthinussen, A., Smith, R.K. and Sutherland, W.J. (2021b). *Marine and Freshwater Mammal Conservation: Global Evidence for the Effects of Interventions.* Conservation Evidence Series Synopses, Cambridge.

Christie, A.P., Downey, H., Frick, W.F. *et al.* (2022). A practical conservation tool to combine diverse types of evidence for transparent evidence-based decision-making. *Conservation Science and Practice*, **4**(1): e579.

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Available at https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/. Accessed 14 October 2022.

Downey, H., Bretagnolle, V., Brick, C. *et al.* (2022). Principles for the production of evidence-based guidance for conservation actions. *Conservation Science and Practice*, **4**(5): e12663.

Hunter, S.B., zu Ermgassen, S.O.E., Downey, H. *et al.* (2021). Evidence shortfalls in the recommendations and guidance underpinning ecological mitigation for infrastructure developments. *Ecological Solutions and Evidence*, **2**(3): e12089.

Nash, D.J., Humphries, N. and Griffiths, R.A. (2020). Effectiveness of translocation in mitigating reptile-development conflict in the UK. *Conservation Evidence*, **17**: 7–11.

Natural England (2020). Natural England's Science, Evidence and Evaluation Strategy (2020-2025). NE publication 764. Available at http://publications.naturalengland.org.uk/publication/5027096999231488. Accessed 14 October 2022.

Salafsky, N., Boshoven, J., Burivalova, Z. *et al.* (2019). Defining and using evidence in conservation practice. *Conservation Science and Practice*, **1**(5): e27.

Taylor, N.G., Grillas, P. and Sutherland, W.J. (2018). *Peatland Conservation: Global Evidence for the Effects of Interventions to Conserve Peatland Vegetation*. Conservation Evidence Series Synopses, Cambridge.

White, T., Petrovan, S., Bennun, L. *et al.* (2022). Principles for using evidence to improve biodiversity impact mitigation by business. Under review. Available at https://osf.io/427tc. Accessed 14 October 2022.

About the Authors

Thomas White is a PhD student in the Department of Zoology, University of Cambridge. His is researching how to improve the cost-effectiveness of conservation actions and has several years' experience in environmental consultancy.

Email Tom at: Tbw27@cam.ac.uk

Matthew Bowell CEnv, MCIEEM is Associate Director of Ecology at Atkins UK, with over 20 years' experience in consultancy. Matthew has worked on a variety of infrastructure projects, and sits on the advisory board of Applied Ecological Resources.

Email Matthew at: Matthew.Bowell@atkinsglobal.com

Alec Christie is a Research Fellow at Downing College, University of Cambridge. His research looks at the reliability and relevance of the evidence base for conservation actions, and how we can use it alongside local knowledge to improve practice.

Email Alec at: Apc58@cam.ac.uk

Harriet Downey is Conservation Evidence Officer at the Woodland Trust and a visiting researcher at the University of Cambridge. Her work looks to embed evidence to improve the effectiveness of the Woodland Trust's work.

Email Harriet at: HarrietDowney@woodlandtrust.org.uk

Does the Biodiversity Metric 3.1 Discourage the Creation of Priority Habitats?

Oliver Glenister MCIEEM
Mott MacDonald

Keywords: Biodiversity Metric 3.1, Biodiversity Net Gain, BNG metrics, habitat creation, habitats of principal importance, Priority Habitats

This article compares per-hectare habitat unit gain for different created habitats in Biodiversity Metric 3.1. Most of the highest scoring habitats are of medium distinctiveness and do not correspond to Priority Habitat definitions. Creating medium-distinctiveness habitats is usually the most efficient way to achieve Biodiversity Net Gain, and as a result the Metric discourages developers from creating high-distinctiveness Priority Habitats.

Introduction

Prior to the introduction of Biodiversity Net Gain (BNG), legal protections for habitats and species resulted in only a small proportion of developments generating net gains for biodiversity. Most ecological mitigation, compensation and enhancement has historically been targeted towards a limited range of legally protected animal species. As a result, compensation for habitat loss has often been insufficient or inappropriate; for example, installing bird boxes on new buildings to compensate for the loss of scrub and woodland from a housing development.

As it has come into wider use, metric-based BNG has been a game changer for developers and ecological consultants, leading to more habitats being retained, enhanced and created. There has been a rapid increase in the number of developments in the UK required to achieve metric-based BNG in recent years. This trend is set to intensify as the Environment Act (2021) requires that most developments in England from 2023 must achieve a 10% net gain in habitat value according to a recognised net gain metric. When BNG becomes mandatory nationwide there will be even greater opportunities to

Table 1. Comparison of two created habitats to show how distinctiveness, condition and temporal/difficulty multipliers influence units per hectare.

Habitat type	Distinctiveness	Target condition	Temporal multiplier	Difficulty multiplier	Units per hectare generated by creating habitat
Lowland mixed deciduous woodland	6 (high)	3 (good)	0.32	0.33	6 × 3 × 0.32 × 0.33 = **1.9**
Hawthorn scrub	4 (medium)	3 (good)	0.7	1	4 × 3 × 0.7 × 1 = **8.4**

reverse the loss of biodiversity from development in a way that is proportionate and which provides benefits that are more than just the legal protection of fauna.

Natural England's Biodiversity Metric 3.1 is currently the recognised industry standard BNG metric in England and, along with 3.0, is used to demonstrate BNG on nearly all developments where this is a requirement. Defra's technical consultation on Biodiversity Metric 3.1 has now closed and its findings will be fed into 4.0 which is expected to be released in 2023. The value assumptions built into Biodiversity Metric 3.1 have huge implications for how developers and ecologists are currently seeking to achieve and demonstrate net gain. Similarly, the assumptions of 4.0 and its successors will have a huge influence on the way net gain is achieved in the future.

Like its predecessors Biodiversity Metric 3.1 makes different value assumptions for existing and newly created habitats. The relative value of baseline habitats within Biodiversity Metric 3.1 is dictated by their distinctiveness scores, condition and strategic significance. However, the value of created habitats has additional complexity as temporal and difficulty multipliers are also applied to each habitat type. This means that habitat types that are of high distinctiveness, and thus worth the most as baseline habitats, are not necessarily worth the most as created habitats because of difficulty and temporal risks. This article explores the post-development value of different created habitats to understand which score highest in the metric, and which ones developers are therefore most incentivised to create.

Comparing the value of created habitats

Multipliers specific to each habitat type are applied to created habitats in Biodiversity Metric 3.1 based on perceived difficulty of creation (difficulty multipliers) and time to reach target condition (temporal multipliers).

The impact of these multipliers can be explored by calculating a habitat unit per hectare value for each habitat type and target condition. This allows every possible habitat type and condition to be compared to determine which created habitats generate the most units per hectare. For example, creation of the high-distinctiveness habitat lowland mixed deciduous woodland in good condition results in 1.9 habitat units per hectare, whereas creation of the medium-distinctiveness habitat hawthorn scrub in good condition results in 8.4 habitat units per hectare (Table 1).

Which habitats does the Metric incentivise developers to create?

Most terrestrial and freshwater area-based habitats that can be inputted into Biodiversity Metric 3.1 can have a target condition categorised as good, fairly good, moderate, fairly poor or poor, although some, such as introduced shrub, are classified as poor by default. Each habitat type can be ranked by the maximum possible units per hectare it can generate.

Counterintuitively, selecting the best possible condition does not always result in the most units per hectare. Habitats where targeting good condition does not result in the most units per hectare include lowland heathland, lowland dry acid grassland, wet woodland and other woodland; broadleaved (Table 2).

Table 2. Comparison of how condition-dependent temporal multipliers influence units per hectare for a created habitat.

Habitat type	Distinctiveness	Target condition	Temporal multiplier	Difficulty multiplier	Units per hectare generated by creating habitat
Lowland heathland	6 (high)	3 (good)	0.32	0.33	1.9
Lowland heathland	6 (high)	2.5 (fairly good)	0.41	0.33	2.03
Lowland heathland	6 (high)	2 (moderate)	0.49	0.33	1.94

Table 3. Created habitats that generate the highest units per hectare in Biodiversity Metric 3.1, with notable habitat types for comparison.

Habitat type	Distinctiveness	Target condition generating the most units	Units per hectare generated by creating habitat	Ranking (out of 96 habitat types)
Ponds (Priority Habitat)	High	Good	10.09	=1
Temporary lakes, ponds and pools	High	Good	10.09	=1
Ponds (Non-Priority Habitat)	Medium	Good	10.04	3
Open mosaic habitats on previously developed land	High	Good	8.45	=4
Sea buckthorn scrub (Annex 1)	High	Good	8.45	=4
Other neutral grassland	Medium	Good	8.4	=6
Blackthorn scrub	Medium	Good	8.4	=6
Gorse scrub	Medium	Good	8.4	=6
Hawthorn scrub	Medium	Good	8.4	=6
Mixed scrub	Medium	Good	8.4	=6
Reedbeds	High	Good	7.86	11
Other lowland acid grassland	Medium	Good	7.03	=12
Upland acid grassland	Medium	Good	7.03	=12
Traditional orchards	High	Fairly poor	6.3	14
Allotments	Low	Good	5.79	15
Other woodland; broadleaved	Medium	Fairly good	4.9	25
Lowland meadows	Very High	Good	4.64	27
Lowland calcareous grassland	High	Good	2.91	=45
Lowland heathland	High	Fairly good	2.03	=57
Introduced shrub	Low	Poor	1.93	=62
Lowland mixed deciduous woodland	High	Good	1.9	=78
Wood-pasture and parkland	Very high	Good	0.77	=90

For simplicity, the habitat creation unit values presented assume that habitats will be created in areas where the habitat type is not strategically significant. The multipliers associated with strategic significance are generally too small to influence which created habitat type will generate the most units.

Table 3 shows the unit per hectare score for the 15 highest-scoring habitats in the Biodiversity Metric 3.1, with a range of other habitats for comparison (including several Priority Habitats). Distinctiveness scores in the Metric are explicitly linked to Priority Habitat status as defined in Section 41 of the Natural Environment and Rural Communities (NERC) Act (Natural England 2022a).

By a wide margin the three highest-scoring habitat types are: ponds (Priority Habitat), temporary lakes, ponds and pools and Ponds (Non-Priority Habitat). There is therefore a strong incentive for developers to create ponds. However, the difference between Priority and Non-Priority Habitat ponds is so slim that it would likely be irrelevant to achieving BNG. This means that there is almost no incentive to ensure that created ponds will meet the criteria for habitats of principal importance.

In theory, BNG could be achieved most efficiently by creating non-priority ponds as the only semi-natural habitat on a site. However, in practice there are physical limitations on most sites and the *Technical Supplement* for Biodiversity Metric 3.1 (Natural England 2022b) states that individual ponds can only be up to 2 ha in area.

The next seven highest-scoring habitats are all worth a similar number of units per hectare. Of these, two high-distinctiveness habitats – sea buckthorn scrub (Annex 1) and open mosaic habitats on previously developed land – are unlikely to be a viable option on the majority of sites. However, the remaining five habitats are all of medium distinctiveness, consisting of other neutral grassland and four scrub habitats, which could realistically be created on most sites.

After this point there is steep decline in units per hectare, with only four of the remaining habitats generating more than 6 units per hectare. High-distinctiveness habitats such as lowland calcareous grassland and lowland heathland score very poorly, and lowland mixed deciduous woodland scores below introduced shrub, a low-distinctiveness habitat.

These findings highlight that, for most sites, the easiest path to achieving BNG using Biodiversity Metric 3.1 involves creating high-units-per-hectare Non-Priority Habitats including ponds, neutral grassland and dense scrub.

Is this a problem?

A justification for the harsh multipliers applied to most high-distinctiveness habitats is that they disincentive loss of existing high-distinctiveness habitats and ensure compensation is sufficient when these are lost, in accordance with the Metric's trading rules:

- any loss of high-distinctiveness habitat from development must be compensated for by creating habitat units of exactly the same habitat type
- any loss of medium-distinctiveness habitat units from development must be compensated for by creating habitat units of the same broad habitat type.

Because of the severe difficulty and temporal multipliers that apply, when these habitats are removed a much larger area must be created as compensation. This encourages compliance with the mitigation hierarchy (i.e. avoiding impacts before compensating) as it incentivises retention more than compensation.

However, while these trading rules encourage retention, enhancement and high compensation requirements for existing high-distinctiveness habitats, once the requirements have been met developers are encouraged by the Metric to create a limited range of medium-distinctiveness habitats to maximise percentage gain (at the expense of Priority Habitats). Medium-distinctiveness habitats are important in their own right and developments can achieve genuine gains in biodiversity by creating these habitats. However, the limited variety of high-scoring habitats in the Metric encourages homogeneity and, in many cases, does not represent the optimal habitats that could be established.

Land-use changes have the potential to result in unexpected negative impacts, one of which is that converting areas of agricultural land to other uses often results in increased agricultural pressure in other areas (Meyfroidt *et al*. 2022). It is therefore hard to justify large-scale changes in land use to achieve BNG, some of which will take agricultural land out of production, if most of the habitat creation does not even target the Priority Habitats that are most important to biological conservation in the UK. Furthermore, specifically incentivising the creation of medium-distinctiveness and/or poor-condition habitats goes against the principles set out in the Lawton review (Lawton *et al.* 2010) to create bigger, better and more joined up protected areas for nature.

"To incentivise the creation of new Priority Habitat other than as compensation for lost habitat, newly created high-distinctiveness habitats could have additional multipliers applied that take into account their potential non-target and transitional value."

How could the Metric encourage developers to create Priority Habitats?

Biodiversity Metric 3.1 (along with its predecessors) has been extensively tested by practitioners across the country on a wide range of sites, making clearer its strengths and weaknesses. For example, the extent to which the metric may undervalue important invertebrate habitat has already been highlighted in a previous *In Practice* article (Wilson 2021). Biodiversity Metric 3.1 is not intended to be the final version of the Metric, but will be refined further in future iterations, including in 4.0 and subsequent versions. The question that therefore arises is: how can the future Metric versions continue to provide protection for existing Priority Habitat, while also incentivising developers to create new Priority Habitats where possible?

The Biodiversity Metric 3.1 *User Guide* acknowledges that there are instances where high- and very-high-distinctiveness habitats can be created, although justification must be provided on how this will be achieved given local conditions. The importance of this guidance (added since the previous 3.0

version of the *User Guide*) is that it places the burden of proof on developers to demonstrate that high-distinctiveness habitats can feasibly be created on site. While this evidence is essential for ensuring real high-distinctiveness habitat creation, there still need to be incentives built into the Metric to create Priority Habitat where site conditions are demonstrably suitable, or this will not happen.

How could this be resolved?

The reason there is currently a disincentive to create most high-distinctiveness habitats in Biodiversity Metric 3.1 is that their difficulty and temporal multipliers are much more punitive than those applied to medium-distinctiveness habitats. As discussed previously, there is good reason for this when these habitats are created as compensation for lost habitats, as the difficulty and time required to create these habitats presents risks to achieving compensation from like-for-like replacement.

As discussed above, the current multipliers support the mitigation hierarchy by ensuring that any lost baseline high-distinctiveness habitat must be compensated by a much larger area of created high-distinctiveness habitat. To allow the metric to continue to support the mitigation hierarchy, the current difficulty and temporal multipliers should continue to be applied.

Beyond the point where habitat loss is fully compensated, however, the application of these multipliers risks underestimating the value of Priority Habitat creation. This is because, although these habitats are often difficult to create, the current Metric does not account for two key ways in which attempts to create Priority Habitats can generate value, as follows.

1. Non-target habitat value: a habitat that does not reach target distinctiveness does not have zero value for biodiversity. For example, a failed attempt at creating high-distinctiveness lowland calcareous grassland on former arable land may instead generate a medium-distinctiveness habitat such as other neutral grassland. The potential value of created habitats that do not reach the target habitat type can be defined as the target habitat's 'non-target habitat value'. As non-target habitat value is not considered in the Metric, there is a disincentive to even attempt to create lowland calcareous grassland (other than when required to satisfy the Metric's trading rules) as, in Biodiversity Metric 3.1, targeting creation of other neutral grassland will result in twice as many habitat units.
2. Transitional habitat value: created habitats do not have zero value for biodiversity prior to reaching maturity. For example, a newly created lowland mixed deciduous woodland may function as an early successional scrub habitat before maturing to woodland. The value that this habitat has in the interim period before achieving target habitat type and condition can be described as its 'transitional habitat value'. As transitional habitat value is not accounted for in the Metric, targeting mixed scrub as a created habitat results in almost four times the habitat units in Biodiversity Metric 3.1 than lowland mixed deciduous woodland.

Once habitat creation has been undertaken, the required auditing and monitoring surveys will demonstrate the value generated by non-target and transitional habitat. However, the pre-development calculations, which inform which habitats are chosen, cannot account for these factors, and as such will undervalue the benefits of creating or trying to create certain habitat types.

To incentivise the creation of new Priority Habitat other than as compensation for lost habitat, newly created high-distinctiveness habitats could have additional multipliers applied that take into account their potential non-target and transitional value. Importantly, these positive Priority Habitat creation multipliers would not be applied until any lost high-distinctiveness habitat had been fully compensated, thus ensuring that the Metric continued to disincentivise loss of existing high-distinctiveness habitat.

This change has the potential to greatly increase the incentive for developers to attempt to create new Priority Habitats, where conditions allow, while continuing to support the mitigation hierarchy, and thus potentially resulting in major gains to the most important habitats for biodiversity in the UK.

References

Lawton, J.H., Brotherton, P.N.M., Brown, V.K. *et al.* (2010). *Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network*. Report to Defra. Available at http://webarchive.nationalarchives.gov.uk/20130402151656/http:/archive.defra.gov.uk/environment/biodiversity/documents/201009space-for-nature.pdf. Accessed 17 October 2022.

Meyfroidt, P., de Bremond, A., Ryan, C. M., Archer, E. *et al.* (2022). Ten facts about land systems for sustainability. *Proceedings of the National Academy of Sciences USA*, **119**(7): e2109217118.

Natural England (2022a). *Biodiversity Metric 3.1: Auditing and Accounting for Biodiversity – User Guide*. Natural England. Available at http://publications.naturalengland.org.uk/publication/6049804846366720. Accessed 18 October 2022.

Natural England (2022b). *Biodiversity Metric 3.1: Auditing and Accounting for Biodiversity – Technical Supplement*. Natural England. Available at http://publications.naturalengland.org.uk/publication/6049804846366720. Accessed 18 October 2022.

Wilson, R. (2021). Are we delivering Biodiversity Net Gain? Do broad habitat metrics mask biodiversity net loss and can a focus on invertebrates help? *In Practice*, **113**: 36–40.

About the Author

Oliver Glenister BSc, MSc, MCIEEM works for Mott MacDonald as a Principal Botanist and Biodiversity Net Gain Lead. He chairs Mott MacDonald's working groups on botany and Biodiversity Net Gain and has a FISC Level 6.

Contact Oliver at:
oliver.glenister@mottmac.com

Feature

No Consistent Relationship Found Between Biodiversity Metric Habitat Scores and the Presence of Species of Conservation Priority

Isobel Hawkins
University of Oxford

Sophus zu Ermgassen
University of Oxford and Durrell Institute for Conservation and Ecology

Henry Grub
University of Oxford and Imperial College London

Jo Treweek
eCountability and Durrell Institute for Conservation and Ecology

EJ Milner-Gulland
University of Oxford

Keywords: Biodiversity Net Gain, Biodiversity Metric, Ecological Impact Assessment, biological records, species conservation

The extent to which the Defra Biodiversity Metric can be considered a genuine reflection of overall biodiversity is key to the success of Biodiversity Net Gain (BNG). We conducted a preliminary study to explore relationships between Metric scores and other biodiversity data, comparing Metric scores for 110 individual habitats with records of species of conservation concern. We found no consistent

relationship between a habitat's distinctiveness or condition score and the number of conservation priority species. We also demonstrated the value of consultancy site visits, as these data are additional to existing Records Centre data on protected species. Our study highlights that further research is required to evaluate the relationship between Metric outcomes and wider biodiversity, ensuring that the Metric can be relied upon to deliver genuine BNG and that its general application will not have negative unintended consequences on species of conservation value.

Introduction

Reconciling ambitious national development objectives with efforts to reverse ecological declines presents a huge challenge. England now has world-leading ecological policy goals (including the goal of halting wildlife declines by 2030) while also seeking rapid expansion of the nation's infrastructure stocks. This includes a commitment to build 300,000 new homes per year by mid-decade, and >200 major infrastructure projects are in the pipeline (listed on the National Infrastructure Planning website as of 30 August 2022). Addressing these potential contradictory ambitions should be a national policy priority (zu Ermgassen *et al*. 2022).

A key policy for integrating these objectives is the introduction of mandatory Biodiversity Net Gain (BNG) in late 2023. From then, all terrestrial developments requiring planning permission will have to demonstrate they will achieve a minimum 10% gain in 'biodiversity units' relative to the baseline state, determined using the Biodiversity Metric (version 3.1, at time of writing). This will also apply to Nationally Significant Infrastructure Developments from 2025.

The importance of the Biodiversity Metric

To calculate the type and level of enhancement needed to compensate for biodiversity losses, and achieve a 10% net gain, use of a consistent replicable method or metric is needed. Twelve years ago in *In Practice*, Treweek *et al*. (2010) proposed a method for measuring biodiversity losses and gains, in which the area, distinctiveness and condition of UK habitat types acted as a proxy for overall biodiversity. Iterative changes over the subsequent decade led by Defra and Natural England in coordination with professional ecologists, planning authorities and consultancies have led to today's Metric.

The importance of the Metric to the outcomes of BNG cannot be overstated. Developing suitable metrics to support no net loss or net gain policies always presents challenges in terms of practicality of use versus ecological robustness, but it is important to establish the extent of potential error. In a review of the ecological outcomes of biodiversity compensation systems around the world, zu Ermgassen *et al*. (2019) identified that the specific choice of metric was one of the key determinants of whether these systems apparently succeeded or failed to deliver on their stated policy aim of no net loss of biodiversity. This is a finding that is replicated in detailed case studies testing the effect of using different metrics (e.g. Bull *et al*. 2014). In the first evaluation of the reported outcomes of BNG, zu Ermgassen *et al*. (2021) found that the developments in their sample reported achieving a 20% increase in biodiversity according to the Biodiversity Metric. However, this translated into a 34% loss of non-urban open green space, with the vast majority of compensatory biodiversity gains coming from grasslands and shrublands promised on-site and in the future. So, the sample achieved net gain according to the Metric, but resulted in a substantial loss in terms of non-urban habitat area. It will only be possible to observe the detailed, real-world effects of development on biodiversity once developments are complete and habitat restoration/creation has been delivered: this could be many decades into the future. However, it is evident that if the metric used had been area of green space, the outcome would have been very different from that reported by the Biodiversity Metric, illustrating that choice of metric will have a profound effect on the overall ecological outcome.

To understand whether a metric is a good indicator of biodiversity outcomes, it needs to be compared against expected outcomes (Nicholson *et al*. 2012). One approach is to compare it to another indicator based on empirical datasets and see whether the two are congruent. It is essential to consider whether use of a habitat proxy can be relied upon to deliver benefits for biodiversity in all its dimensions, or whether explicit consideration of other measures of biodiversity is needed, such as the status of species populations or implications for genetic diversity across taxa.

Purpose of our study

In this study we made a first attempt at exploring the relationship between the Metric and alternative measures of biodiversity, by comparing BNG scores for a sample of sites with records of species of conservation concern for these same sites. Two sources of biodiversity data were used: presence of species of conservation priority gathered from Biological Records Centres and records of species of conservation priority identified by consultants conducting walkover surveys for Ecological Impact Assessments and Preliminary Ecological Appraisals. Therefore we have attempted to establish the extent to which the Metric scores can be expected to reflect implications for species of conservation concern identified from the two methods above. Our expectation was broadly that more species of conservation concern would be likely to be found in sites in better condition, and in more distinctive habitats.

We were also interested to see the extent to which species presence/absence based on consultant walkovers was consistent with that based on data from Biological Records Centres. This casts light on the reliability of the two data sources for the potential incorporation of priority species into biodiversity assessments.

Table 1. The councils and relevant Biological Records Centres used.

Council	Biological Records Centre
South Oxfordshire District Council	Thames Valley Environmental Records Centre
West Oxfordshire District Council	Thames Valley Environmental Records Centre
Vale of White Horse District Council	Thames Valley Environmental Records Centre
Cornwall County Council	The Environmental Records Centre for Cornwall and the Isles of Scilly
Leeds City Council	West Yorkshire Ecological Service

We used a database of BNG assessments assembled for a set of six early-adopter councils in zu Ermgassen *et al*. (2021). Using planning applications from five councils (Table 1) , we obtained a sample of habitats (the individual habitat patches that came from the sample of developments included in our database) associated with biodiversity unit scores. The geographical spread of these habitats was limited, as four of the five councils used are in the south of England. Although this is an unavoidable limitation in using the early-adopter councils, future research may benefit from expanding the geographical scope once all councils in England are required to use the Metric. We restricted our analysis to habitats assessed using Metric 2.0, as most of the developments in the database were assessed prior to August 2021. The Metric has since been updated to version 3.1, although the core method the Metric used to estimate the biodiversity value of a site remains the same. Our results for Metric 2.0 may therefore be applicable to version 3.1, but the changes made in updating the Metric means caution should be used in applying these conclusions to Metric 3.1.

We restricted our analysis to the broad habitat types of cropland, grassland and woodland as we had sufficient sample sizes for these broad habitat types to support valid statistical analysis. We consulted the Ecological Impact Assessments associated with the paired BNG assessments to identify the exact habitat patch within each development to which each Metric score applied.

We created shapefiles of each habitat patch in GIS, which we submitted to the relevant regional Biological/Local Records Centres (Table 1) to request their data on the species identified within the boundaries of each habitat patch. We cross-referenced these data with species records obtained by consultants during walkover surveys of each habitat patch (reported in the Ecological Impact Assessment or related documentation). This generated a sample of 22 cropland patches, 26 woodland patches and 62 grassland patches for which we had the Metric score, Biological Records Centre data and records of species found during walkover surveys.

To identify species of conservation concern, we cross-referenced the species list against the Joint Nature Conservation Committee's list of UK conservation designations. Species listed under the UK Biodiversity Action Plan, EU Birds Directive, Habitats and Species Directive, IUCN Red List, NERC Act Priority Species, UK Wildlife and Countryside Act or as a Bird of Conservation Concern were considered species of conservation concern in our analysis.

We ran multiple regression models to analyse the relationship between the number of species of conservation concern present at the site and its distinctiveness and condition score. We included other variables in the models which we expected to affect the relationship between these variables, in order to control for them. These were the area of the habitat patch (as larger areas would be expected to harbour more species) and the council from which the BNG assessment came (as a proxy for geographical differences).

Results

There was no significant relationship observed between the number of species of conservation concern within a patch and the overall biodiversity score for the patch, measured using Metric 2.0. (Figure 1). Using generalised linear models, we found no significant relationship between the number of species of conservation concern within a patch and the Metric distinctiveness category of the patch (P=0.315; Figure 2). We found a significant effect of Metric condition category (P=0.026), but not in the direction expected, with preliminary evidence for 'fairly poor' patches having the highest number of species of conservation concern

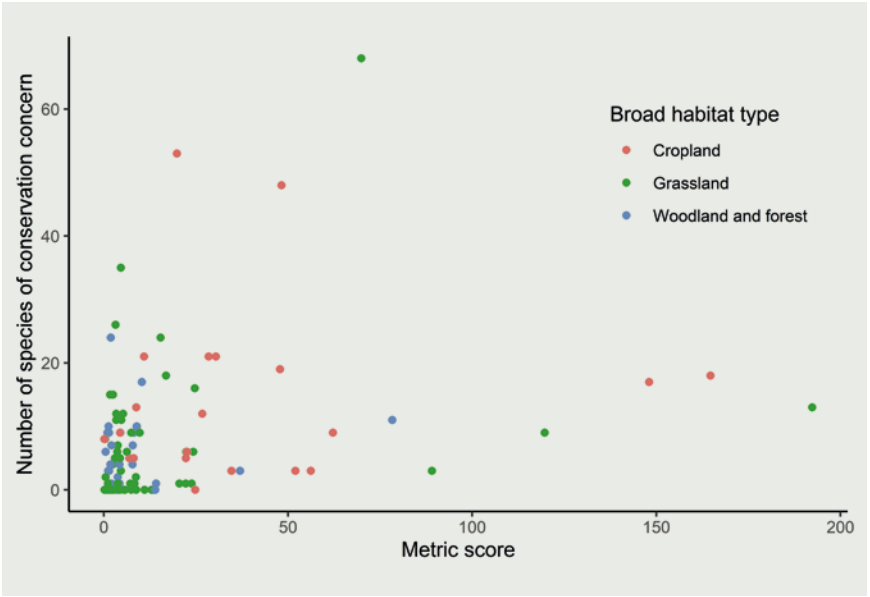


Figure 1. Number of species of conservation concern identified in each habitat, compared to the number of biodiversity units as measured by the Metric 2.0.

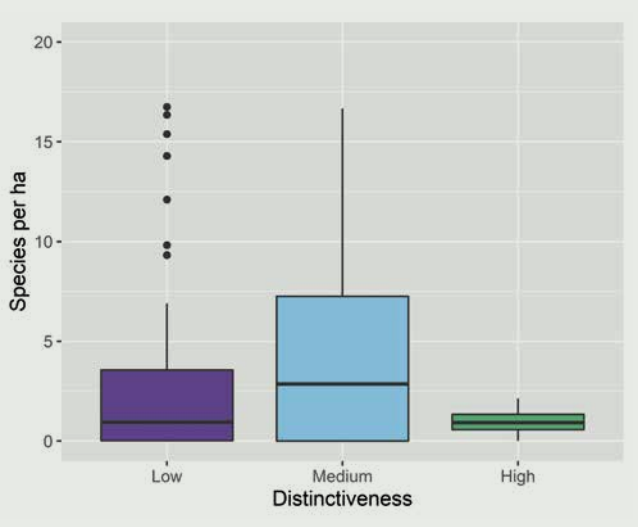


Figure 2. Comparing the median number of species per hectare between habitats of different distinctiveness levels, with extreme outliers removed.

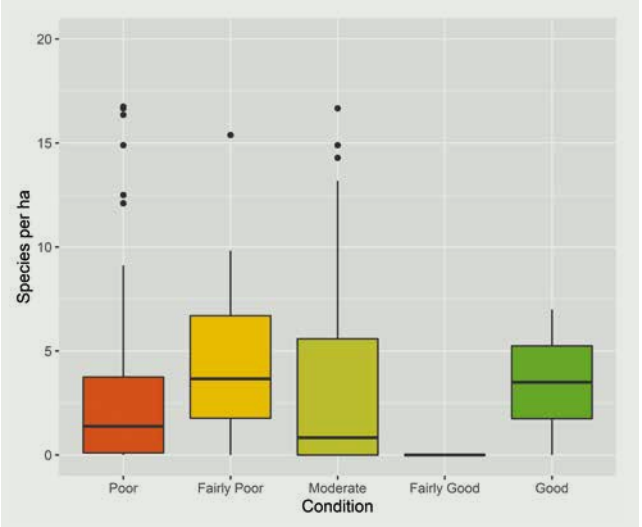


Figure 3. Comparing the median number of species per hectare between habitats of different condition levels, with extreme outliers removed.

(*P*=0.101; Figure 3). This is shown for the broad habitat types in Figure 4.

Our work also demonstrated the value of site-based surveys to identify the presence of species of conservation concern. We found that it would be an insufficient strategy for developers to simply supplement their Metric calculations with an estimate of species found in local Records Centre databases rather than carrying out in-person visits to sites. Species surveys conducted by consultancies detected more protected species than were listed for the same site by the Records Centres in 61% of patches and equal numbers to Records Centres in 31% patches. Records Centres captured more species than consultancy reports in just 8% of patches (Figure 5). Over the whole dataset, consultancies found 581 protected species, and Records centres found 43. Some 31 species were recorded by Records Centres datasets which were not found by consultants.

Conclusions

Our study finds limited evidence that ecological quality of a site, as estimated using the Biodiversity Metric, is correlated with ecological quality as measured by the presence of species of conservation concern. An implicit assumption of BNG is that the Metric is a good proxy for real-world biodiversity, and therefore that increases in the number of units delivered by the Biodiversity Metric will translate into real-world improvements in biodiversity (including populations of species of conservation concern). However, the lack of correlation between the Metric and our alternative measure of biodiversity, the richness of species of conservation concern, indicates that such real-world gains for priority species may not be guaranteed. Therefore, our preliminary study highlights the necessity of further work to understand the relationship between the Metric and alternative measures of biodiversity, to ensure habitat improvements measured

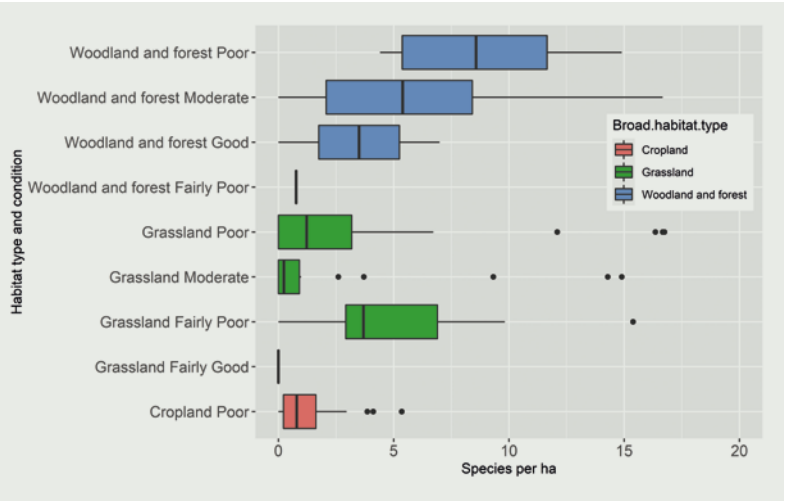


Figure 4. Comparing the median number of species per hectare between cropland, grassland and woodland habitats in different condition levels, with extreme outliers removed.

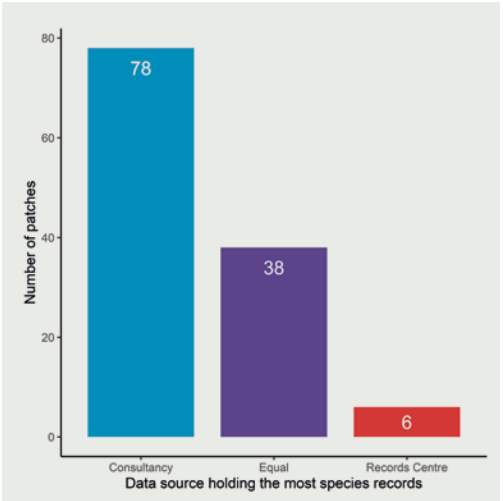


Figure 5. Number of habitat patches in which either consultancies or Record Centres detect more species.

by the Metric do have positive impacts on other aspects of biodiversity.

We recognise the preliminary nature of our study and acknowledge its limitations; many of the species captured in consultancy reports and Records Centres are highly mobile and seasonal, and so further work could look into associations between the Metric and different taxonomic groups to see if the Metric is a better proxy for some than for others. Additionally, our sample size was limited, especially for high-distinctiveness habitats. We focus on comparing the Metric to the richness of species of conservation concern, a single proxy measure of biodiversity. Therefore, future work could investigate the relationship between the Metric and other measures of biodiversity, such as species diversity, overall species richness or functional diversity. However, these preliminary results make the strong case that much more empirical work exploring the ecological robustness of the Metric is needed before we can be confident that achieving BNG's aim of a 10% uplift in biodiversity units (according to the Metric) will actually translate into real-world improvements in species presence and abundance. If this translation does not take place, then BNG as currently measured will not in itself be enough to achieve the government's overarching biodiversity target of halting wildlife declines by 2030. It could even be counterproductive, if habitats designated as poor condition/low distinctiveness are replaced by habitats designated as good condition/high distinctiveness but which harbour fewer species of conservation concern.

An additional implication of this study is that it provides yet more evidence that high-quality ecological expertise is needed in the Ecological Impact Assessment process. Consultancies consistently identify additional species on sites compared to records held by Records Centres. Records Centre data are primarily collected to provide a picture of species distributions and trends; however, these data can also provide a useful baseline for consultants, to inform the nature of on-site surveys. As consultants consistently identify more species of conservation concern than were recorded in Records Centres, this reinforces the necessity of carrying out on-site surveys in addition to data searches, in accordance with best practice. Effort could therefore also be put into encouraging developers to contribute their consultants' records to Biological Records Centres, to improve coverage, or resources could be put into extending ecological assessments into areas with apparently lower-quality habitats, so that their value is documented.

Whereas the Metric could play a role in increasing certainty about the level of ecological mitigation required by planning proponents and streamlining the planning process, this study provides further evidence that quality ecological assessment is required in the development process alongside Metric calculations. This is not just to ground-truth and verify the ecological feasibility of the information reported in BNG assessments, but also to identify and help mitigate threats to threatened species.

"Our study finds limited evidence that ecological quality of a site, as estimated using the Biodiversity Metric, is correlated with ecological quality as measured by the presence of species of conservation concern."

References

Bull, J.W., Milner-Gulland, E., Suttle, K. and Singh, N. (2014). Comparing biodiversity offset calculation methods with a case study in Uzbekistan. *Biological Conservation*, **178**: 2–10.

Nicholson, E., Collen, B., Barausse, A. *et al*. (2012). Making robust policy decisions using global biodiversity indicators. *PloS One*, **7**: e41128.

Treweek, J., Butcher, B. and Temple, H. (2010). Biodiversity offsets: possible methods for measuring biodiversity losses and gains for use in the UK. *In Practice*, **69**: 29–32.

zu Ermgassen, S.O.S.E., Baker, J., Griffiths, R.A. *et al*. (2019). The ecological outcomes of biodiversity offsets under "no net loss" policies: a global review. *Conservation Letters*, **12**: e12664.

zu Ermgassen, S.O.S.E., Marsh, S., Ryland, K. *et al*. (2021). Exploring the ecological outcomes of mandatory biodiversity net gain using evidence from early-adopter jurisdictions in England. *Conservation Letters*, **14**: e12820.

zu Ermgassen, S.O.S.E., Drewniok, M.P., Bull, J.W. *et al*. (2022). A home for all within planetary boundaries: pathways for meeting England's housing needs without transgressing national climate and biodiversity goals. *Ecological Economics*, **201**: 107562.

About the Authors

Isobel Hawkins is based at the University of Oxford, where she completed her MBiol project on assessing how well Defra's Biodiversity Metric performs as a tool for enabling development to achieve Biodiversity Net Gain. Isobel is currently working as a research assistant supporting HM Treasury's Biodiversity Working Group in updating guidance on accounting for and measuring biodiversity.

Contact Isobel at: isobelhawkins99@gmail.com

Dr Sophus zu Ermgassen is an ecological economist working on topics broadly related to biodiversity finance, biodiversity compensation and infrastructure sustainability. He is a postdoctoral researcher at the University of Oxford, a member of Natural England's Biodiversity Metric expert advisory group and a member of the UK Treasury's Biodiversity Economics Working Group.

Contact Sophus at:
sophus.zuermgassen@biology.ox.ac.uk

Henry Grub is a PhD student at Imperial College London undertaking research in environmental policy, with his research focusing on the control of bovine tuberculosis disease in the UK. Henry is generally interested in how people interact with nature, what problems this can cause and what solutions can be found.

Dr Jo Treweek has devoted her career to strengthening the ecological basis for planning and decision-making. Her book *Ecological Impact Assessment* was influential in the UK and internationally, making the case for ecological science to underpin environmental assessment practice. She retains a keen interest in practical applications of ecological evidence to support robust approaches to development and meaningful integration of social and biodiversity considerations in planning and assessment.

EJ Milner-Gulland is Tasso Leventis Professor of Biodiversity at the University of Oxford. Her research group works on a wide range of projects understanding, predicting and influencing human behaviour, and designing, monitoring and evaluating conservation interventions to improve their effectiveness. She has launched a number of initiatives which aim to change the real-world conversation around conservation. She is the Chair of the UK Government's Darwin Expert Committee and a Trustee of WWF-UK.

A New Tool to Help Environmental Consultants with Environmental Impact Assessments

Barn owl (*Tyto alba*).

Simon Gillings
British Trust for Ornithology

Keywords: bird data, British Trust for Ornithology, BTO Data Reports, ecological consultants, GIS, mitigation

Getting the latest and most relevant biological information for an Environmental Impact Assessment can be a difficult and time-consuming task. With this in mind the British Trust for Ornithology (BTO) has developed a new tool to help speed up the process while providing new insights into the importance of proposed development areas. BTO Data Reports provide up-to-date information for birds at a given site, putting it into context on local, regional and national scales.

Introduction

Construction and development projects, ranging from individual wind turbines and housing developments to major road, rail and utilities infrastructure, are required to identify any species and habitats that could be adversely affected by the project. As the custodian of some of the UK's most extensive and longest-running biodiversity data sets, the British Trust for Ornithology (BTO) frequently provides data for such Ecological Impact Assessments. With a renewed focus on ensuring that the data and information we produce is used to benefit people and wildlife, the BTO has been working towards a better system for providing data to consultants, planners and the construction industry.

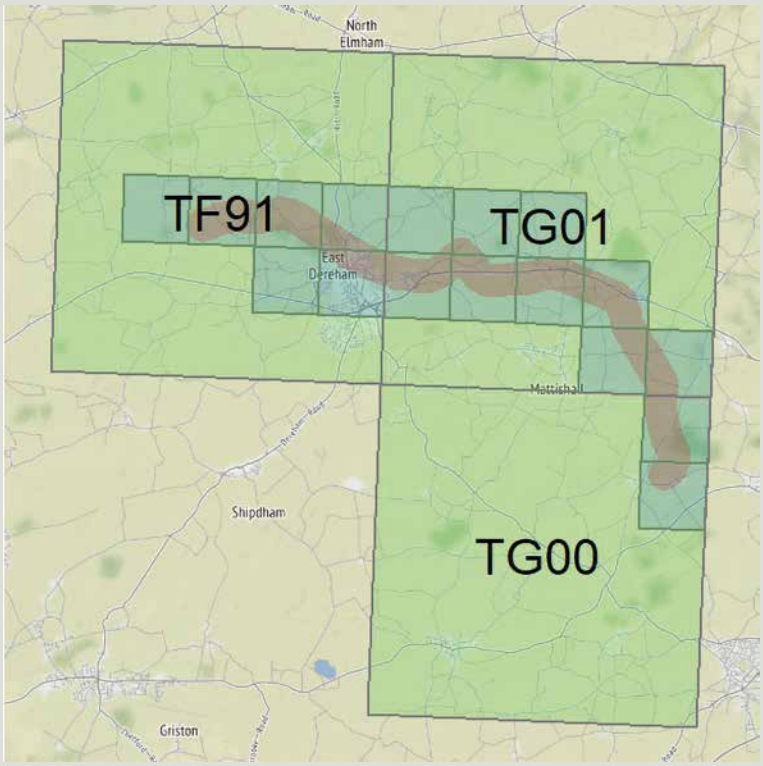
Getting more focused and relevant bird data

Historically, consultants requesting data from the BTO would typically receive an export of all bird records for grid squares in and around the proposed

site. Although this system worked for many years, the BTO and consultants felt it could be improved to provide better insights. For example, it did not provide clear information on survey coverage (was a species actually absent, or was the absence of records explained by limited survey effort?) and did not provide contextual information beyond the site (was the presence of a species regionally significant?). The varied nature of requests also meant it was sometimes time-consuming for the BTO to deliver the data.

To overcome these issues, and to ensure that bird data are more effectively used in planning decisions, the BTO has developed a new service called BTO Data Reports which are available for all parts of the UK. Data Reports have been co-designed with ecological consultants using live planning cases and provide insight into the bird species associated with a proposed development site through a combination of the comprehensive coverage of the BTO's Bird Atlas 2007–11 (a partnership between the BTO, BirdWatch Ireland and the Scottish Ornithologists' Club) with the immediacy of data collected by BirdTrack (a partnership between the BTO, RSPB, BirdWatch Ireland, the Scottish Ornithologists' Club and the Welsh Ornithological Society) and other annual surveys (Figure 1). Obtaining this information in a succinct and timely manner can be important in helping consultants to design appropriate fieldwork to confirm the presence of key species (as recommended in the Bird Survey Guidelines for assessing ecological impacts; https://birdsurveyguidelines.org/). Crucially, the reports draw on the wider pool of bird data that the BTO holds to assess the local, regional and national importance of each species. This enables consultants, developers and planners to focus on the species for which any negative impacts are most likely to have wider consequences.

a



b

Code	Species	S1	A1	RBBP	Amber	Red	S41E	SZA1EW	Tetrad	10-km/20-km/50-km
BZ	Buzzard								Probable	Confirmed
BO	Barn Owl	Y							Confirmed	Confirmed
TO	Tawny Owl				Y				Probable	Confirmed
LO	Little Owl								Confirmed	Confirmed
KF	Kingfisher	Y	Y		Y				Probable	Confirmed

c

Species category	1-km	2-km	10-km	>10-km
All species	48	46	42	11
Schedule 1 UK	0	11	12	8
BoCC4 Red	8	15	12	5
BoCC4 Amber	13	10	17	5
Annex 1	0	6	12	4
RBBP	0	9	19	8
Section 41 England	9	9	12	0
Schedule ZA1 England & Wales	0	0	1	1

Figure 1. Reports include (a) maps showing the area of interest in relation to grid squares used for extraction of bird records, (b) summary tables listing species and their levels of association with the area of interest, including a breakdown by interest features, and (c) full species lists and evidence of breeding at different levels of association with the area of interest. Legal and conservation listings are highlighted where relevant.

Conclusion

Obtaining and summarising biological records for impact assessment desk studies can be a time-consuming task. BTO Data Reports have been designed to make this process easier while also providing wider context at different scales, something that has been difficult to achieve before now. Commissioning a BTO Data Report is a cost-effective way to provide rigorous scientific information to inform fieldwork decisions and desk studies for Ecological Impact Assessments. Pricing of BTO Data Reports starts at £200 + VAT for a small site spanning up to four 10 km squares. For full details and examples of BTO Data Reports and how to commission a report, visit www.bto.org/datareports.

Case study: use of BTO Data Reports by Anglian Water

An example of how Data Reports can be used has been provided by the Strategic Pipeline Alliance, a partnership between Anglian Water, Costain, Farrans, Jacobs and Mott MacDonald Bentley. They used the service when planning Anglian Water's latest infrastructure project, consisting of hundreds of kilometres of interconnecting water pipelines across the East of England (Figure 2).

Leading on from early collaboration between Tristan Folland at Mott MacDonald and the BTO, the Alliance ornithology team worked with the BTO to leverage the potential from BTO data to help deliver Anglian Water's public interest commitments and to demonstrate to each of the local planning authorities that the appropriate actions had been taken to protect and/or provide habitats that support and maintain wild bird populations.

The Alliance used Bird Atlas 2007–11 distribution and abundance data and contemporary species lists from BirdTrack to assess which species were likely to be present on each of the individual pipeline schemes. Breeding evidence associated with these species' records provided the first robust, evidence-based assessment of the risk of encountering birds protected from disturbance (Schedule 1) and Rare Breeding Birds Panel (RBBP) species. This high-level but comprehensive understanding of species presence or likely absence informed the Alliance's approach to conducting scoping surveys for each pipeline scheme and supported the justification for when detailed bird surveys were not recommended.

BTO Data Reports highlighted that one of the routes had historical evidence of Bewick's swan, *Cygnus columbianus*, accounting for at least 2% of the species' abundance in Great Britain. To ensure the Alliance applied a precautionary way of working that would avoid significant disturbance to this declining species, an appropriate survey schedule was implemented so that they could be confident that Bewick's swan would be detected if it was still present. The surveys in the winter of 2021–22 confirmed the findings of the BTO Data Report regarding the presence and notable abundance of Bewick's swan, with a flock of 150 individuals being the highlight of the surveys. The surveys also confirmed the presence and notable abundance of Whooper swan, *Cygnus cygnus*. Together, the BTO Data Report and the field surveys helped to inform the development of a precautionary method of works to avoid and minimise potential disturbance events during construction. The local planning authority requested that this received prior approval from Natural England.

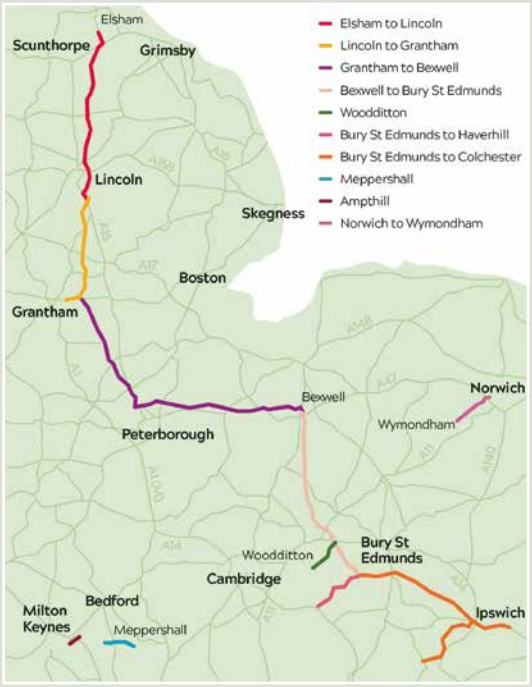


Figure 2. Routes for which data were needed as part of the Strategic Pipeline Alliance. Credit Anglian Water.

Lists all of the bird species for a given site

To request a BTO Data Report, a GIS file of the site needs to be provided. Information on survey coverage, including the grid squares in and around any of the proposed sites, is provided alongside information on the presence or absence of species in the breeding season and in winter. Species are highlighted according to any conventions and legislation relevant to the country in question (e.g. Schedule 1, Schedule 1A, Section 7, etc). For each species Bird Atlas data are used to estimate the percentage of local, regional and national population size associated with the site and immediate surroundings. This provides a mechanism to gauge which species in the site and surroundings are important. Having all of this information in the BTO Data Report saves analysis and interpretation time and can help ensure that any mitigation needed is in the right place and of the right type.

Acknowledgements

We are grateful to Tristan Folland, Tim Hounsome and Mark Lang who were all involved in the co-design process to ensure Data Reports meet consultants' needs. Data Reports draw heavily from data collected for the following two projects: Bird Atlas 2007–11 and BirdTrack. We thank the volunteers who contribute to these projects.

About the Author

Simon Gillings' role as Principal Data Scientist at the BTO involves the development of bird monitoring schemes such as BirdTrack and the Breeding Bird Survey, and the production of data products for different BTO audiences. He works with colleagues to deliver the BTO's bioacoustics work. He is a keen birdwatcher and sound recordist.

Contact Simon at: simon.gillings@bto.org

Skopeo: Sourcing Experienced Citizen Scientists for Commercial Bird Surveys

Jamie Dunning
Skopeo Ltd

Keywords: birds, bird surveys, ecology, conservation, human resources

Birds have, historically, received less attention than other taxa surveyed frequently by commercial ecologists. Recent changes to the way birds are surveyed mean that more bird surveys, and therefore more surveyors, are required to properly understand potential impacts. In this article I introduce a new project to link surveyors with commercial bird surveys in the UK and Ireland.

Where are all the birders?

A recent CIEEM survey on employment and salaries in the ecology and environmental management sector (CIEEM 2022) found that, despite good levels of employment, there is a notable shortage of experienced people for ecologist roles at all levels. Although the survey doesn't go into specific detail, I expect that some of those shortages – the missing experience – relate to dedicated ornithologists, or birders.

Yet, during the same period of 2020–2021, approximately 40,000 volunteer birders contributed more than 1,890,600 hours (or roughly 1250 staff years) to citizen science bird monitoring projects for the British Trust for Ornithology (BTO 2021). Although I couldn't find equivalent data, I also expect that, with some overlap, some of the 12,000 people who volunteer for the Royal Society for the Protection of Birds (RSPB) are also working on specialist species monitoring projects.

So, to address the question posed in the heading above, *where are all the birders?*, they're everywhere: distributed across the country, recording birds and working under highly specialist survey methodologies. Those volunteers collect the data that informs conservation priorities and the subsequent management that we, in the commercial sector, rely on to inform our own survey methods and impact assessments. In this article I will highlight some recent changes to commercial bird surveys, and the gap they will create for birders in the commercial sector. Then I will introduce Skopeo, our new project set up to link experienced ornithologists with consultants in the commercial sector without costing the planet in miles travelled.

Recent changes to commercial bird surveys

The introduction of a standardised bird survey methodology, developed alongside commercial consultants the BTO, RSPB and Natural England (Bird Survey and Assessment Steering Group 2022), is helping to bring commercial bird surveys in line with existing standards for bats, newts and badgers (Abrahams and Nash 2018). This is in addition to the ongoing development of a competency framework for ornithology (see Kohler and Wedge 2021 for an early iteration). Likewise, the BTO have introduced a data tool which will tailor priority species for a local area and at several spatial scales, using their expansive citizen science datasets (www.bto.org/our-science/data/data-reports). In combination, the way we conduct commercial bird surveys has changed, and this new suite of tools has implications for how we plan and conduct surveys, and who carries them out for birds in the future. Perhaps the suggestions with the largest implications, taken from the Bird Survey and Assessment Steering Group guidance (2022), are as follows.

1. A priority species should be defined by its conservation status nationally or locally, or within the context of specific ecology, assemblages or habitats present on a site. Examples include notable aggregations of any species, those declining locally or those for which we do not have sufficient data to define population trends, such as the rock pipit. New survey guidance and data tools provide a route for priority species lists to be standardised between projects.
2. Any priority species present during the breeding season should be treated in the same way as confirmed nest sites, regardless of the location of the nest. For example, grasshopper warbler singing in a

suitable habitat in June is indicative of breeding, but the nest will be very difficult to locate over just six, or often fewer, surveys. Likewise, habitats may be functionally linked to breeding success regardless of the nest site location.

3. All sites that have the potential for priority breeding/non-breeding birds should be surveyed, unless not doing so can be explicitly justified.
4. A minimum of six bird survey visits should be carried out at all sites with the potential for priority breeding birds unless, again, fewer can be justified.

When actioned, the first two points on this list require experience not just in the identification of birds, but also the specific behavioural ecology and local population trends of those species, and will require some assessment of competency. The final two, which relate to survey planning, are likely to result in bird surveys at more sites and in greater number, creating additional demand for experienced people.

Dedicated guidance for commercial bird surveys will improve the data we collect and, combined with the upcoming review of surveyor competency by a CIEEM-appointed panel, will ensure high survey standards. However, the commercial sector is yet to address where the experienced people who are needed will come from and how we support their skills in the context of commercial birds surveys.

Using citizen scientists for commercial bird surveys

As I have alluded to above, there are many people qualified to conduct a bird survey to a high standard in the UK and Ireland. They are from conservation or academia, or are hobbyists, but relatively few of those people conduct surveys professionally. Although few have reported data for a commercial client, they design and follow complex bird survey methodologies using experience built up outside of the commercial sector.

In early 2022 we set up Skopeo Ltd to link experienced, local ornithologists with consultancies who require additional support with bird surveys, follow-up mitigation or interpretation of results. We hope that, in doing so, we will improve the standard of commercial bird surveys by using experienced, local people. We also hope that by using local experience we can cut the mileage and carbon cost between bird surveyors and survey sites. Our intention is not to act as a recruitment agency, a dating app nor a stand-alone consultancy, but something in between, providing support, where possible, to others who require specific ornithological expertise.

Birders from across the country have opted to join our directory and continue to do so. We assess their competency against previous commercial or non-governmental organisation (NGO) experience. We also assess competency against a concept competency framework broken down by habitat type that has as much a focus on ecology as it does on identification. We then act as intermediary between the client and the surveyor, which allows us to ensure that the data collected are to a high standard and comply with the most up-to-date survey guidance, mentioned above.

When a client, usually a commercial consultancy or NGO, approaches us with a project, we offer the field work to the nearest qualified person in our directory. We provide guidance on methodology and interpretation of results to the client, and quality assurance on the data collected. Any person undertaking surveys does so on our behalf and under our insurance.

During our first field season, a test period for our project, we carried out 30 (to the time of writing, September 2022) bird surveys between Glasgow and the south coast of Essex. Our surveyors travelled an average of 97.4 km (60.5 miles) to a survey site (4–273 km, or 2.5–170 miles). For context, the BTO has recently started to consider the carbon footprint of their own surveyor effort (Gillings 2022) and estimated that their Breeding Bird Survey (BBS) volunteers travelled on average 22 km (14 miles; in 2019) to a survey site, suggesting broad surveyor coverage. Of course, BBS surveys and commercial bird surveys are not directly comparable, with the former distributing survey sites randomly across the country. I couldn't find any equivalent data on the distance covered by commercial ecologists (but see Morris and Hamilton 2020).

However, from personal experience, the carbon cost of moving surveyors to field sites is currently substantial; we would welcome meta-analyses looking at the carbon cost or field effort of commercial surveys, data that which appear to be unavailable at present.

We are now hoping to expand our project for the upcoming bird survey seasons. If you are a birder interested in taking part in our project or want to speak to us about survey design or using local surveyors for an upcoming bird survey, please visit www.skopeo-eco.com or email contact@skopeo.co.uk.

Acknowledgements

I would like to thank Aidan Marsh, Jamie Woollam, Tim Hounsome and Paul Watts for early support for our project, and Paul Watts, Emma Robson and an anonymous reviewer for useful comments on this article.

References

Abrahams, C. and Nash, D.J. (2018). Do we need more evidence-based survey guidance? *In Practice*, **100**: 53–56.

Bird Survey and Assessment Steering Group (2022). Bird Survey Guidelines for Assessing Ecological Impacts, v.0.1.7. Available at https://birdsurveyguidelines.org, https://birdsurveyguidelines.org/introduction/. Accessed 11 October 2022.

BTO (2021). Trustees' Annual Report & Financial Statements 2020/21. Available at www.bto.org/sites/default/files/bto_annual_report_accounts_2020_21.pdf. Accessed July 2022.

CIEEM (2022). Ecology and Environmental Management Employment and Salary Survey. Available at https://cieem.net/cieem-publishes-2022-employment-and-salary-survey-report/. Accessed July 2022.

Gillings, S. (2022). Sustainable surveying. *BTO News*, **343**: 16–17.

Kohler, M. and Wedge, D. (2021). The ornithological skills pyramid: creating a benchmark for the ecology and consultancy community. *In Practice*, **111**: 36–39.

Morris, T. and Hamilton, J. (2020). Sustainable transport in the ecology sector – finding a greener way. *In Practice*, **109**: 50–53.

About the Author

Jamie Dunning is an ornithologist interested in the behaviour of birds who is currently studying towards a PhD at Silwood Park, Imperial College London. Formerly he worked for CSA Environmental. He sits on the Bird Survey and Assessment Steering Group and co-developed the bird survey guidance for commercial applications that is referenced in this article.

Contact Jamie at: j.dunning19@imperial.ac.uk

New Expert Volunteering Platform to Support Community Nature Restoration Projects

Caroline Croft
The Southwood Foundation

Keywords: community, restoration, volunteering,

The Nature Action Hub is a new volunteering platform for environmental specialists. Set up by The Southwood Foundation, the platform links experts with community nature restoration projects looking for much-needed guidance, ranging from one-off advice to longer-term mentoring and support. Eastbourne Treebourne, described in this article, is one such project, involving the planting of over 2000 trees with advice from specialist volunteer Orlando Campbell.

Introduction

Principle 10 of the Rio Declaration states that "environmental issues are best handled with the participation of all concerned citizens". When it comes to local wildlife, citizens constitute a force in the fight back against biodiversity loss in their local area. Community environment groups are springing up across the country, taking things into their own hands to protect and restore nature in the face of unprecedented decline in the natural world.

The Southwood Foundation, set up to convene action on biodiversity and climate change, observed that people mobilising for biodiversity at the local level often find it difficult to access the expertise they need to achieve the best outcomes. This was confirmed by conservation charities, who report a worrying lack of resources to respond to the crisis and a growing number of requests for advice.

Reflecting on how best to make the most of people's determination to act, the Foundation researched environment-related opportunities on volunteering portals, to see if positions for specialist advice were available. We found that environmental listings predominantly request administrative or manual help. It became very apparent that specialists wanting to volunteer their expert advice, and community groups looking for guidance, have no easy way to find each other.

With a strong background in the environment sector, The Southwood Foundation has arrived at a solution, notably the Nature Action Hub, that it is hoped will address this issue and help the environment sector play its full part in making a difference. The Nature Action Hub links expertise with action at the local level to maximise the impact and sustainability of all the efforts being made. The Hub specifically supports community groups that would not otherwise have the resources or connections to access expert advice for their nature restoration projects.

Nature Action Hub support in action: Eastbourne Treebourne

When community group Eastbourne Treebourne, based in Eastbourne in East Sussex, decided to take action on climate change and biodiversity loss locally, they didn't lack ambition. Given the opportunity to create woodland on a plot of land on the edge of the town the group took it upon themselves to plant over 2000 native trees. Over 250 volunteers of all ages signed up to help.

Treebourne is one of several environmental community groups in Eastbourne formed as a result of the local council's 2030 Net Zero pledge in 2018. The changes required to achieve a carbon-neutral town are monumental and the ambition undoubtedly ignited the grassroots community response in the seaside town.

Eastbourne, like many coastal towns, has tree cover that is well below the national average. Eastbourne Treebourne prioritised sites with particularly low tree cover that are easily accessible by people of all socioeconomic backgrounds, making sure not to displace other ecologically valuable habitats. The group is made up

of volunteers from a wide variety of backgrounds and ages, with a range of skills and varying amounts of spare time squeezed into busy lives. They do not have a member with a background in arboriculture and found that there is a lot of conflicting information on the internet. They needed direct answers from an expert in the field to provide clarity and confidence.

This is where the Nature Action Hub came in. Ecologist Orlando Campbell is one of many experts who have volunteered through the Nature Action Hub. An experienced arboriculturalist, Orlando was able to advise the Eastbourne group on the best methodology for tree planting, pre-planting management and post-planting maintenance of the site. He also gave advice on specific problems that they had not considered, such as strong winds on the South Downs and pests and diseases in the area.

Eastbourne Treebourne's plans were approved by council ecologists and the South Downs National Park, who supplied the trees. On an unseasonally sunny weekend in February 2022, over

Figure 1. Ash dieback led to the clearance of the project area on the Ratton estate. Clear fell was ordered due to the proximity to footpaths and houses, with a restock clause in the felling licence.

Figure 2. The Ratton estate after 2000 saplings were planted by 250 local volunteers in 2022.

250 volunteers arrived to plant the trees. The sessions were fully booked within 48 hours. The following weekend, local schools brought more children than they had spades for. Project leaders reported an insatiable demand for tree planting in this town: a real desire to do something.

The year 2022 has not been an easy on during which to plant trees, given the severe drought experienced. Teams were set up to care for the trees after planting. Elm, hornbeam, hawthorn and hazel are doing noticeably better the most. As the landscape develops, Eastbourne Treebourne are adapting their plans, taking stock and seeing what takes.

From the volunteer's perspective, Orlando said he was pleased to be able to help such an inspiring group of people. He feels that what they have achieved is a real example of community in action and shows what a difference people can make when they decide to mobilise for nature.

Call to action

Chair of Trustees at the Southwood Foundation, Mark Southwood, believes strongly in collaboration and feels that a collective response from the environmental sector is needed to address the biodiversity crisis. Many sectors have a volunteering arm, and the environmental sector, with its wealth of knowledge, experience and passion for the natural world, has a unique and vital contribution to make. Communities are mobilising and with the right support can make a huge difference in addressing one of the biggest challenges of our times.

The Nature Action Hub works through a registration system whereby experts volunteer, providing details of their areas of expertise, location, time available and volunteering preference in confidence to the Hub. The Nature Action Hub administrators then provide details of community biodiversity projects that are looking for advice in their area of interest and facilitate a matching process to make sure relationships and arrangements are clear.

Some experts have just a few hours to give, so offer advice by phone, for instance, while others may be able to carry out a survey or do some mapping. Some enjoy longer-term relationships supporting and mentoring the local community group as a project develops. The Southwood Foundation covers travel costs where needed.

Governance of the Nature Action Hub is provided by a steering group chaired by The Southwood Foundation trustee John Turzynski, a former Director at Arup. Members are environment experts and ecologists, including CIEEM Fellow Andy May. Andy has been a strong advocate of the project over its 18 month development, believing the Nature Action Hub has all the ingredients needed to be a significant game changer.

Steering Group member, CIEEM member and founder of The Ecology Consultancy John Newton believes this is a fantastic opportunity for ecologists to volunteer, where their impact will be immediate and tangible. He feels that semi-retired and recently retired ecologists are particularly well placed to help, having a wealth of knowledge, a deep concern for the state of nature and perhaps a little more time to help in volunteering activities.

The Nature Action Hub started in Sussex, working in partnership with the Sussex Wildlife Trust. Expansion plans into London and South East England are now progressing. The facility is growing and will shortly be web-based on the Southwood Foundation website.

> **"The Southwood Foundation, set up to convene action on biodiversity and climate change, observed that people mobilising for biodiversity at the local level often find it difficult to access the expertise they need to achieve the best outcomes."**

We are currently recruiting more expert volunteers and have many community groups on our books looking for help and advice for their environmental projects. These include requests for help with bat and invertebrate surveys, plant surveys and guidance on woodland management, support on pollinator highways, advice on wildflower meadow creation and requests for mapping of parish nature surveys.

We would urge all environment experts to join us, even if you only have a few hours to give, so that measures taken by communities are as effective and timely as possible. Community groups are keen to find guidance and experts want to help. There is a diversity of opportunities so everyone can find a match that works in terms of skills and time available.

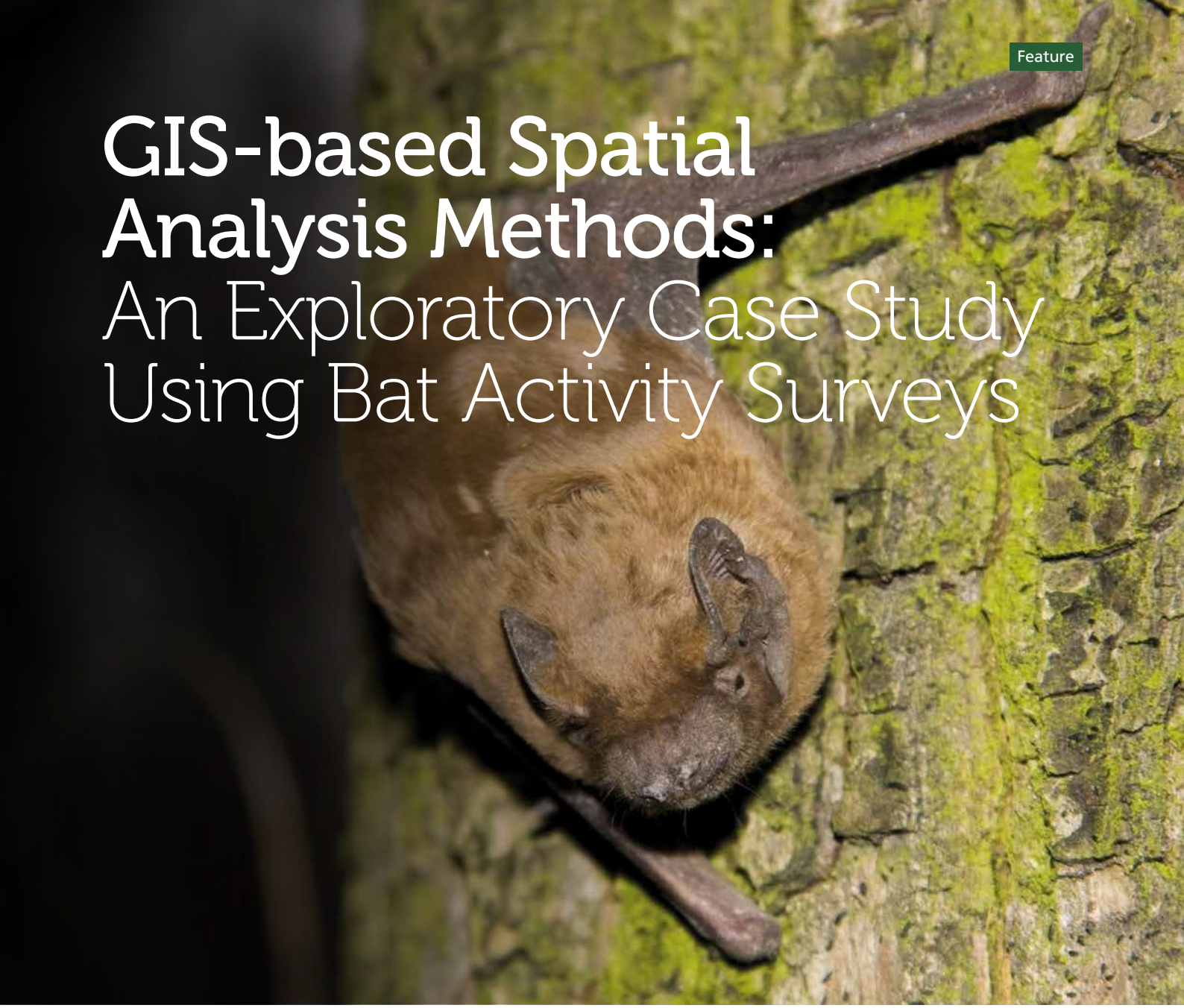
Experts interested in participating in this initiative are encouraged to make contact. For more information about how to volunteer and opportunities available, please contact the author of this article or visit www.southwoodfoundation.org.

About the Author

Caroline Croft MA Hons BEM is Operations Manager at The Southwood Foundation and is responsible for the development of the Nature Action Hub alongside a number of other initiatives.

Contact Caroline at:
caroline.croft@southwoodfoundation.org

GIS-based Spatial Analysis Methods: An Exploratory Case Study Using Bat Activity Surveys



Common Noctule (*Nyctalus noctula*).

Robert Pelc ACIEEM
Focus Environmental Consultants

Keywords: spatial analysis, bat activity data visualisation, GIS

This article discusses a real case study of how the open-source geographic information systems (GIS) software QGIS could be used to analyse bat transect survey data to explore spatial patterns to better understand the spatial distribution of bats at a study site. Recently GIS packages have made a noticeable impact on the analysis of survey data by allowing ecologists to apply a wide range of spatial-statistical techniques.

Introduction

Spatial data analysis has become much more accessible to professionals and allows users to turn raw data into information useful for answering spatial and temporal questions and identifying priorities for conservation management.

Spatial data analysis applies statistical techniques for measuring spatial autocorrelation and analysing spatial patterns (clustering or dispersion). Exploratory analysis of the spatial arrangement of data points containing geographical coordinates allows the user to answer specific questions such as:

- How are the recorded points distributed across the survey area?

- Do clusters of points occur within the survey area?
- Is there a connection between the recorded point distribution and whether the observations are similar or dissimilar?

Line transect sampling is one of the techniques for assessing bat activity in a study area. There are many approaches and methods to present the results of transect surveys and activity levels spatially and temporarily. Therefore, to achieve effective data analysis and clear survey results, practitioners should combine several methods to examine spatial patterns of bat activity.

Kernel density estimation

One technique recommended in published guidelines (Collins 2016) to visualise bat transect data is kernel density estimation (KDE), often referred to as a 'heat map'. The KDE function creates a colour-ramp map based on point density and specified parameters, producing a density surface (e.g. a smoothed distribution of bat activity). In essence, KDE counts observations (e.g. the location of individual bat records) and calculates the density of points at a given location. However, the result of KDE could vary considerably depending on the choice of parameters (e.g. smoothing parameter/bandwidth) (Yin 2020). There is no general rule to determine the correct bandwidth; however, if the bandwidth is too small the estimate is too noisy, while if bandwidth is too high the estimate may miss crucial elements of the point pattern due to oversmoothing (Scott 2009). The pros are that:

- the KDE method is fairly simple procedure to perform in a GIS
- the results presented are visually attractive.

The cons are that:

- the result of KDE varies depending on the choice of kernel function or kernel bandwidth
- results resulting from the KDE map are not statistically significant.

Hotspot analysis

Another spatial analysis technique explored in this case study is a method of spatial association. The method was introduced by Getis and Ord (1992) is often referred to as 'hotspot analysis'. The method works by analysing each recorded point (the bat record in our case) in the context of the neighbouring points (other bat records) and identifies spatial clusters. Therefore, it identifies whether high values (high numbers of bat records or other selected values) tend to be located near other high values, medium values near other medium values, etc., as presented in the grid cell example in Figure 1. Hotspot analysis also reports a *z* score and a *P* value, both of which represent statistical significance of clustering.

11	135	75	44	102	24	6	14	17	8
19	48	226	169	84	88	48	10	4	1
25	10	133	89	110	155	119	2	34	9
14	2	4	64	115	117	209	12	5	17
16	3	1	5	1	2	2	4	4	10
5	1	3	2	3	1	3	1	2	2
13	6	7	4	3	3	5	2	1	11

Figure 1. The grid cell example of clustering where the high values tend to be located near high values (red), medium values near medium values (white) and low values near low values (blue), which can help make the resulting maps less subjective.

A high positive *z* score determines the more intense clustering of high values whereas a high negative *z* score determines intense clustering of low values. A *z* score near zero indicates no apparent spatial clustering. Computation is done in the context of neighbouring feature values. To be a statistically significant hotspot, a feature will have a high value and be surrounded by other features with high values as well. The local sum for a feature and its neighbours is compared proportionally to the sum of all features. The pros of this method are that:

- the method examines spatial autocorrelation
- the results indicate statistically significant clusters of high and low values.

The cons of the method are that:

- additional processing and several steps are required to undertake the analysis
- results are also sensitive to neighbourhood size, or the distance over which each feature is compared to all others
- results aren't reliable with fewer than 30 features.

The detailed implementation of both methods is not covered here but is widely covered in many textbooks and online resources.

Methods

Below I present an example of bat transect analysis completed using (1) heat map (KDE tool) and (2) hotspot analysis (Hotspot Analysis plugin), both methods available in geographic information systems (GIS) QGIS software (https://qgis.org/en/site/). To ensure comparability of results between different methods, comparable parameter settings for the KDE bandwidth and grid size in hotspot analysis were used. Please refer to the QGIS user guide (https://docs.qgis.org/3.22/en/docs/user_manual/index.html) for a detailed implementation of the method.

Both methods allow rapid exploration of bat activity data, finding out the spatial association of bat records and

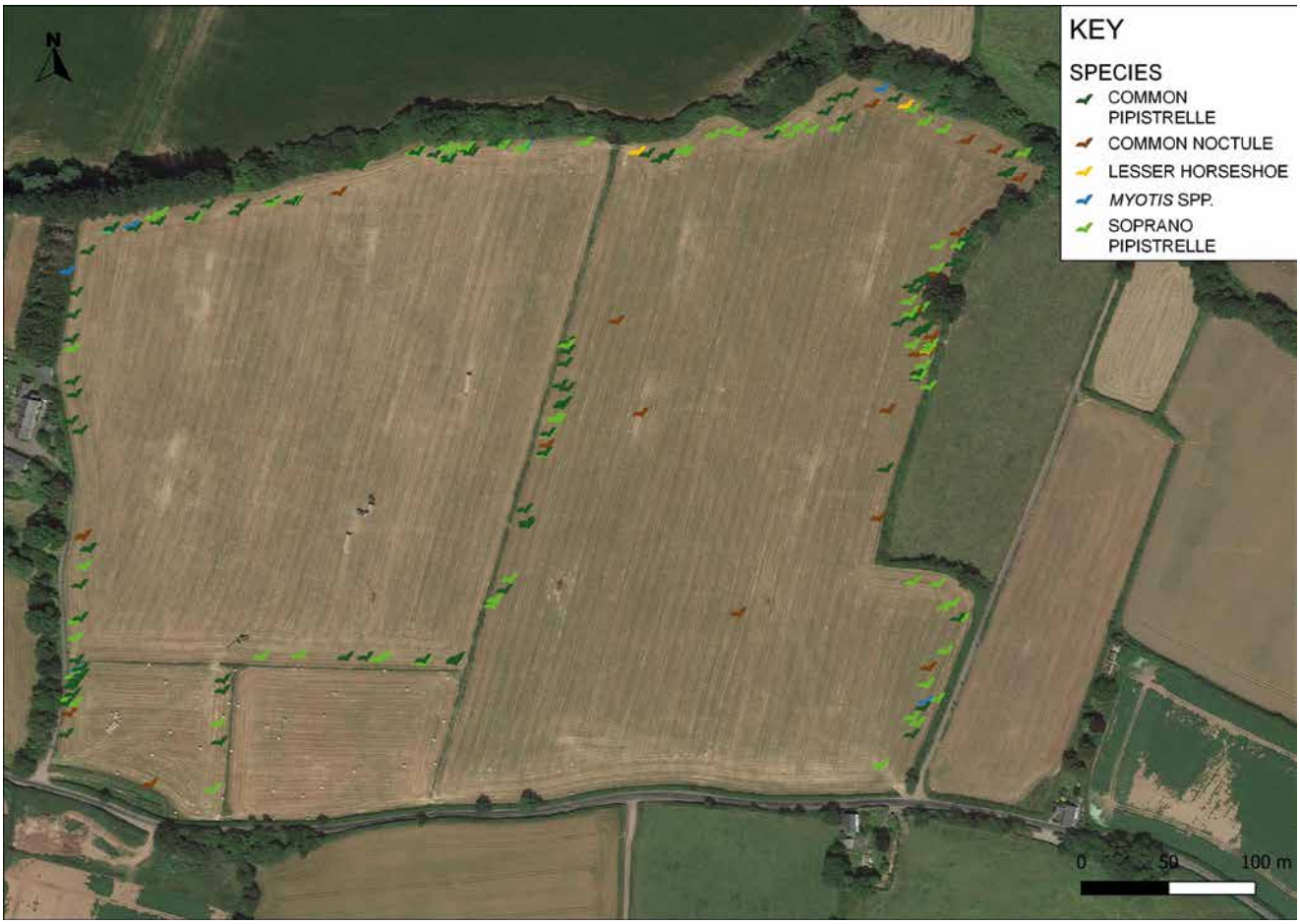


Figure 2. Locations of the recorded bats with colour-coded points representing different bat species.

highlighting places that may be of certain importance for foraging and commuting bats.

Continuous walked transect bat detector surveys were undertaken to record foraging and commuting activity on a monthly basis between May and September. The walked surveys were undertaken from sunset and were 3 hours in duration, thus covering the site, which incorporated a mixture of the habitats with potential for use by commuting and foraging bats, and a period of peak activity for bats at dusk in accordance with the latest Bat Conservation Trust survey guidelines (Collins 2016).

The recorded bat records consisted of latitude and longitude information and were uploaded to the QGIS software. A bat record is defined as a single or several bat calls emitted during a fixed interval. The spatial distribution of bat records is shown in Figure 2.

Based on the plotted locations of the recorded bat records a kernel density map was produced to indicate areas of lower and higher density of bat records, as shown in Figure 3.

“Bats adapt their echolocation calls based on the surrounding habitat, with bats flying in open space producing longer pulses and longer intervals between the pulses.”

To answer the question of whether high or low bat activity is located close to other high or low levels of activity, and whether recorded bat activity is clustered based on the number of bat records, hotspot analysis was used.

For the purpose of analysis, it is essential to have a numerical variable of high and low values (such as the count of bat records in grids or the number of pulses in a single bat record).

Therefore, the bat records overlaid on the map were aggregated into grids to count the number of bat records in each grid as the variable to infer the statistically significant hotspots and coldspots (i.e. areas with a particularly high and low numbers of bat records). An example, including the results of the bat records aggregated into grids, is presented in Figure 4.

An additional approach was explored as to whether the results of analysed acoustic recordings, such as the number of individual calls/pulses, could be used as an input field variable for the analysis.

Bats adapt their echolocation calls based on the surrounding habitat, with bats flying in open space producing longer pulses and longer intervals between the pulses. In contrast, the pulse repetition rate increases during the approach phase used to detect the prey and it reaches the extreme values during the terminal phase of the feeding buzz immediately prior to capture (Griffin *et al*. 1960).

The bat pass duration and the number of pulses in a single .wav file potentially contains information about site quality and suitability of the site for foraging/

Figure 3. Results of KDE analysis with smoothed areas of higher and lower density of bat records at the site.

Figure 4. Results of hotspot analysis with two statistically significant hotspots of bat passes at the site.

Figure 5. Areas with statistically significant hotspots and coldspots of soprano pipistrelle bats based on the number of pulses.

commuting bats (Kerbiriou *et al*. 2017). Therefore, the number of pulses in each file (a bat pass) was used as a suitable numerical variable for the analysis of clusters of hotspots and coldspots.

It should be noted, however, that the number of pulses in each file will vary depending on bat species and its detection. Thus, pulses from a *Nyctalus* should not be compared with pulses of *Pipistrellus*.

To provide an example, soprano pipistrelle records were extracted as the representative species and the points were uploaded to QGIS. The soprano pipistrelle bat data comprised 100 individual files, with call pulses ranging from 1 to 178 in the files. The output from this analysis indicated clustering (e.g. bat activity with a higher number of pulses than if randomly distributed) and coldspots (where bat activity shows a lower number of pulses than if the data was random; Figure 5).

“As methods of spatial analysis become more commonplace in GIS, the field of GIS can be envisioned to play a major role in narrowing the gap between theory and practice and accelerating the use of increasingly sophisticated spatial analytical techniques.”

Evaluation of results

General bat activity

As shown by the KDE heat map in Figure 3, the density of bat passes was generally concentrated along the north-eastern section of the boundary with similar density of passes in the northern and south-western and along the central hedgerow of the site. Kernel density attempts to adjoin spatially clustered areas with smooth shading between identified areas of a high density of bat passes.

Figure 4 shows the hotspot analysis. To reject the null hypothesis, practitioners need to make a subjective judgement regarding the degree of risk they are willing to accept for being wrong (for falsely rejecting the null hypothesis). Therefore, the confidence level of 99% might be the most reliable in this case, indicating that to reject the null hypothesis the probability that the clustering was created by random chance is really small (less than a 1% probability).

Two areas of hotspots with 99% levels of significance are shown on the map, on the north-eastern section and the central hedgerow. No coldspots were identified, and the rest of the site was classified as not significant, due to the bat records in those locations being distributed randomly with no significant patterns.

In this case study, the functionality of hotspot analysis was demonstrated as an approach for evaluating statistically significant clusters of bat activity at the site. Therefore, the hotspot to the north-east and along the central hedgerow (with 99% confidence) indicates that the high number of bat passes in these areas have a ≤1% chance of the activity being random.

Analysis of soprano pipistrelle activity

The results presented in Figure 5 suggest that there is a clear difference between the number of pulses in soprano pipistrelle bat records along the northern section of the central hedgerow. Therefore, the hotspot to the north of the site with 99% confidence indicates there are ≤1% chance activity levels comprising a high number of pulses would be this high if bat activity with a high number of pulses were distributed randomly across the site. Coldspots were identified along the central hedgerow ($P \leq 0.05$). There were no significant differences in other parts of the study area and soprano pipistrelle pulses occurred were distributed randomly in those locations.

Discussion

The objective of this article was to present two methods of spatial analysis based on the bat activity transect case study and to present the capabilities of GIS. The methods presented might help practitioners analysing survey data (1) to better understand the spatial clusters of bat activity at a site and (2) to provide a more detailed site assessment and understanding of species behaviour at a site.

However, it should be noted that all spatial clustering approaches, regardless of their theoretical underpinning, statistical foundation or mathematical specification, have limitations in accuracy, sensitivity and the computational effort required for identifying clusters (Harris *et al*. 2017).

All three dataset analysis approaches described here provided a better understanding of how bat records are distributed across the site, with hotspot analysis inferring statistically significant areas of high or low numbers of bat records. Since the identified hotspot areas were statistically significant, the visualisation of clusters of bat records at the site is less subjective compared to KDE heat map method. The designation of an area as a hotspot can therefore be expressed in terms of statistical confidence and provides a more detailed understanding of species distribution at a site as well as further insights into the importance of the hotspot areas being used by bats in contrast to other areas of the site.

A disadvantage of the hotspot analysis method is that clusters comprising few observations may inflate the results and thus it should be combined with other methods. On the other hand, the KDE smoothed distribution method is not statistically significant, and different kernel functions or kernel bandwidth may affect the results. Considering our case study objective, we suggest that KDE should be used in conjunction with hotspot analysis to increase efficiency and efficacy in interpreting results.

The capacity to combine and analyse survey data using various spatial methods and presenting the results in a form of a clear map provides a greater understanding of the results and incorporates a valuable tool into the decision-making process. As methods of spatial analysis become more commonplace in GIS, the field of GIS can be envisioned to play a major role in narrowing the gap between theory and practice and accelerating the use of increasingly sophisticated spatial analytical techniques.

Acknowledgements

I wish to thank Graham Davison and Grace O'Donovan for their valuable comments to complete this article.

References

Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines*, 3rd edn. Bat Conservation Trust, London.

Getis, A. and Ord, J.K. (1992). The analysis of spatial association by use of distance statistics. *Geographical Analysis*, **24**(3): 189–206.

Griffin, D.R., Webster, F.A. and Michael, C.R. (1960). The echolocation of flying insects by bats. *Animal Behaviour*, **8**: 141–154.

Harris, N., Goldman, E., Gabris, C. *et al*. (2017). Using spatial statistics to identify emerging hot spots of forest loss. *Environmental Research Letters*, **12**: 024012.

Kerbiriou, C., Bas, Y., Le Viol, I. *et al*. (2017). Potentiality of the bat pass duration measure for studies dealing with bat activity. *Bioacoustics*, **28**(2): 177–192.

Scott, D.W. (2009). *Multivariate Density Estimation: Theory, Practice, and Visualization*. John Wiley & Sons.

Yin, P. (2020). Kernels and density estimation. In: Wilson, J.P. (ed.), *The Geographic Information Science & Technology Body of Knowledge*, 1st Quarter 2020 edn. Available at https://gistbok.ucgis.org/bok-topics/kernels-and-density-estimation. Accessed 12 October 2022.

Further reading

ESRI Development Team. ArcGIS Desktop. Spatial Statistics toolbox, an overview. Available at https://desktop.arcgis.com/en/arcmap/10.3/ tools/spatial-statistics-toolbox/hot-spot-analysis.htm. Accessed on 12 October 2022.

Oxoli, D., Prestifilippo, G., Bertocchi, D. and Zurbarán, M. (2017). Enabling spatial autocorrelation mapping in QGIS: the Hotspot Analysis plugin. *Geoingegneria Ambientale e Mineraria*, **2017**: 45–50.

Oxoli, D., (2017). Hotspot Analysis with QGIS User Guide. Available at https://github.com/danioxoli/HotSpotAnalysis_Plugin/blob/master/test_data/Hotspot_Analysis_UserGuide.pdf. Accessed 12 October 2022.

QGIS Development Team. QGIS Geographic Information System. Available at www.qgis.org. Accessed on 12 October 2022.

About the Author

Robert Pelc MSc, ACIEEM is a Senior Ecologist at Focus Environmental Consultants. His particular focus includes bat ecology, a range of bat survey techniques and spatial analysis.

Email Robert at: Robert@focus-enviro.com

Woodland Roost Resource: An Alternative Licensing Approach for Large-scale Developments?

Jessica Hinds MCIEEM
Arcadis

Ian Davidson-Watts MCIEEM
Davidson-Watts Ecology

Keywords: advanced licensed bat survey techniques, barbastelle, bats, breeding site, licensing

The roost resource approach is an alternative licensing approach in which baseline data are collected through advanced licensed bat survey techniques and woodland habitat is licensed as a 'roosting resource' rather than individual confirmed roosts. This approach provides mitigation beyond that traditionally undertaken, which often only compensates for a very small

Figure 1. Barbastelle bat in flight. Photo credit: Davidson-Watts Ecology.

proportion of trees used by the relevant bat populations. It has the potential to minimise project delays if previously unidentified roosts are discovered during tree clearance works. This approach to licensing has the potential to provide better outcomes for tree-dwelling bats by recognising the nature of some trees as roosts that would otherwise go unrecognised.

Introduction

Legislation makes it illegal to damage or destroy a breeding site and/or resting place of a bat. For development, removal of habitats suitable for roosting bats (i.e. structures and woodland) can be required. Where it is deemed necessary, derogation licences issued by statutory nature conservation organisations (SNCOs) permit unlawful activities and make certain actions such as the felling of trees with confirmed bat roosts legal.

Where areas of woodland removal is required, the 'traditional' approach to licensing is to license the loss of an individual confirmed tree roost. However, this approach does not fully take into consideration the ecology of bats. Increasing evidence suggests that many tree-dwelling bat species switch roosts regularly and despite industry-accepted levels of survey effort, bat roosts in a woodland habitat may not be easily identified during survey. The bat mitigation guidelines (Mitchell-Jones 2004) state 'consultants should have a … thorough grounding in bat ecology which can be crucial to good survey and mitigation planning' and yet, when large-scale developments require clearance of areas of woodland and hedgerows, ecologists often use traditional surveying approaches which may find a subset of roosts rather than take full consideration of the wider woodland roost resource.

An approach referred to as the 'roost resource' approach is an alternative to mitigating for the loss of an individual confirmed tree roost. It takes a habitat-based approach to mitigate for the loss of roosting habitat in woodland where not all roost locations may feasibly be identified, with the intention of providing better outcomes for bats.

Roost resource approach

The roost resource approach is a concept originally developed for licensing by Davidson-Watts Ecology in partnership with AECOM for woodlands affected by linear infrastructure (see Davidson-Watts 2021). Following acceptance by Natural England of this approach in 2018, 12 organisational licences have been obtained. However, these have been predominantly for common woodland bat species, and not yet fully utilised for rare woodland species. In 2021, Arcadis further developed the roost resource approach to licensing for rare Annex II barbastelle, *Barbastella barbastellus*.

The approach takes into consideration the regular roost switching, fission and fusion behaviours of tree-dwelling bats (see Box 1) and the challenges of bat encounter rates using standards survey methods (Bat Tree Habitat Key 2018). The behaviour of tree-dwelling bats can make determining usage by bats during survey of individual trees particularly difficult where large-scale developments require woodland clearance to facilitate construction. This can make licensing difficult in terms of providing adequate mitigation for loss of suitable bat habitats or when encountering an unexpected tree roost which requires felling. Works would be required to cease while derogation licences were amended, leading to programme delays.

How does it work?

For a large-scale development, the principles associated with traditional licensing still apply. Sufficient survey information must be gathered, which provides a baseline of bat species, their breeding status and subsequent characterisation of the 'roost' or in this case the 'roost resource' which would include the woodlands'/breeding sites.

To establish the roost resource a combination of ground-level and tree-climbing assessments (to determine the potential roosting features) in the woodland should be undertaken, with advanced licensed bat survey techniques (ALBST) to determine bat species/characterisation of roosts. Where roosts

Box 1. What are fission and fusion behaviours?

Fission and fusion are behavioural characteristics of tree-dwelling bat species. Fusion can be summarised as all individuals of a bat colony being present in one roosting area, forming a fused population. Fission occurs during roost switching, when bats leaving the fused population/roosting area split into smaller sub-groups, or where individuals intersperse with bats from other social groups (Nadˇo and Kaňuch 2015). Roost switching likely occurs due to changes in microclimatic conditions of the roost, which become unsuitable (Kerth *et al.* 2001) or where features are temporary in nature (i.e. lifted or loose bark). Roost switching or roost cycling behaviour can be very frequent, occurring almost daily (Popa-Lisseanu *et al*. 2008).

Figure 2. Suitable bat roosting feature in a tree. Photo credit: Arcadis.

Table 1. Bat box compensation ratios.

Species	Roost type	Number affected directly	Compensation ratio	No. of compensatory roost mitigation features required
Pipistrellus pipistrellus	Day	1	2:1	2 (all bat boxes)
Barbastella barbastellus	Maternity	0	4:1	0 (all bat boxes)
Myotis nattereri	Hibernation	1	2:1	2 (all bat boxes)
NA	High, moderate and low potential roost features	100	1:1	100 (at least half created through tree veteranisation)
Myotis spp., Plecotus auratus, Barbastellus barbastella, Eptesicus serotinus, Nyctalus leisleri, Nyctalus noctula, Pipistrellus pipistrelle, Pipistrellus pygmaeus	Roost discovered during proposed vegetation clearance/tree felling works	NA	Compensation will follow above ratios dependent upon species and roost type	As informed by compensation ratios and additional roosts encountered during tree felling works (Woodland Roost Resource)

do not occur in the affected woodland, ALSBT can provide context and opportunities to inform wider mitigation including Biodiversity Net Gain, which considers the landscape needs of bats rather than being limited to the roost resource within the red-line boundary, which can constrain effective mitigation strategies in maintaining the favourable conservation status (FCS) of local bat populations.

In summary, this approach (Davidson-Watts 2021) provides the following:

- species assemblage of the site and bats likely to be encountered during works
- known roost locations on and off site
- potential roost features in trees affected by the development as part of the same roost resource
- breeding site/roost characterisation (e.g. breeding or non-breeding site).

Using ALBST data and the potential tree roost data, both the confirmed/known roosts and trees offering suitable potential for roosting bats are taken forward for licensing under the roost resource approach, along with the bat species known to use the site. Trees with features offering suitable potential for bats are considered part of the same 'roost resource' available for use by bats and given the same licensing status as confirmed roosts. Roost mitigation is provided for the loss of trees with suitable features and confirmed roosts. This approach provides mitigation beyond that traditionally undertaken, which often only compensates for a very small proportion of trees used by the relevant bat populations. It provides better outcomes for tree-dwelling bats within the licence areas for large-scale developments.

How does the roost resource approach inform mitigation?

The roost resource approach informs licence mitigation in two parts. First, prior to tree felling works every tree with roost potential in the impact area would be inspected for bats. If bats are found to be absent the tree is felled the same day, or potential roosting features removed. If required, bats would be suitably excluded at the appropriate time of year. Where they are unsafe to inspect, emergence/return surveys are undertaken, followed by soft felling processes at the appropriate time of year. Second, to address loss of the roost resource, a count of trees with suitable roost features for bats forms the baseline data upon which the mitigation is applied. The number of potential roosting features that would be lost associated with the tree clearance works would be mitigated through the installation of bat boxes and veteranisation of retained trees. The removal of confirmed tree roosts and those with potential to be occupied (i.e. a proportion of those trees with potential roosting features) would be estimated for licensable purposes. Ratios of replacement roost features to be installed would be agreed through consultation with the SNCO. For the purpose of this article, an example of potential replacement ratios is provided, but these may alter depending on the habitats and species concerned:

- 1:1 potential roosting features
- 2:1 low-status roost of common species
- 4:1 maternity roosts of common species
- 4:1 roost of Annex II species.

Details of confirmed roosts, potential roosting features to be lost and ratio of replacement features should be calculated to obtain the number of compensatory roost mitigation features required. Table 1 shows an example of the calculated compensatory features required to mitigate for loss of the roost resource.

An example in practice

To facilitate the construction of a proposed development, vegetation clearance is required. Through careful planning using the mitigation hierarchy

(CIEEM 2018) large areas of woodland and hedgerow habitats are retained. However, a total of 100 trees with bat roosting potential and two known roosts are identified to be removed. Through ALBST methods, the areas (retained and affected) are primarily characterised as supporting breeding populations of barbastelle, Natterer's and brown long-eared bats.

In the absence of mitigation, the following impacts on the woodland roost resource in the licence area of the example site would comprise:

- 100 trees with bat roosting potential (destroyed)
- 1 common pipistrelle (*Pipistrellus pipistrellus*) day roost (destroyed)
- 1 Natterer's hibernation roost (destroyed).

Following the roost resource approach and the replacement ratios as agreed with the SNCO, the mitigation outlined in Table 1 is provided for loss of woodland roost resource, as a result of felling works.

If additional confirmed roosts are discovered during bat rescue procedures these would be compensated by additional bat boxes or similar mitigation features as per the ratios detailed above. All roost mitigation features would be erected/created in suitable habitats within or adjacent to the licence area. Rescue bat boxes to be erected adjacent to the impacted area under direct supervision of the named ecologist/ accredited agents, are recommended.

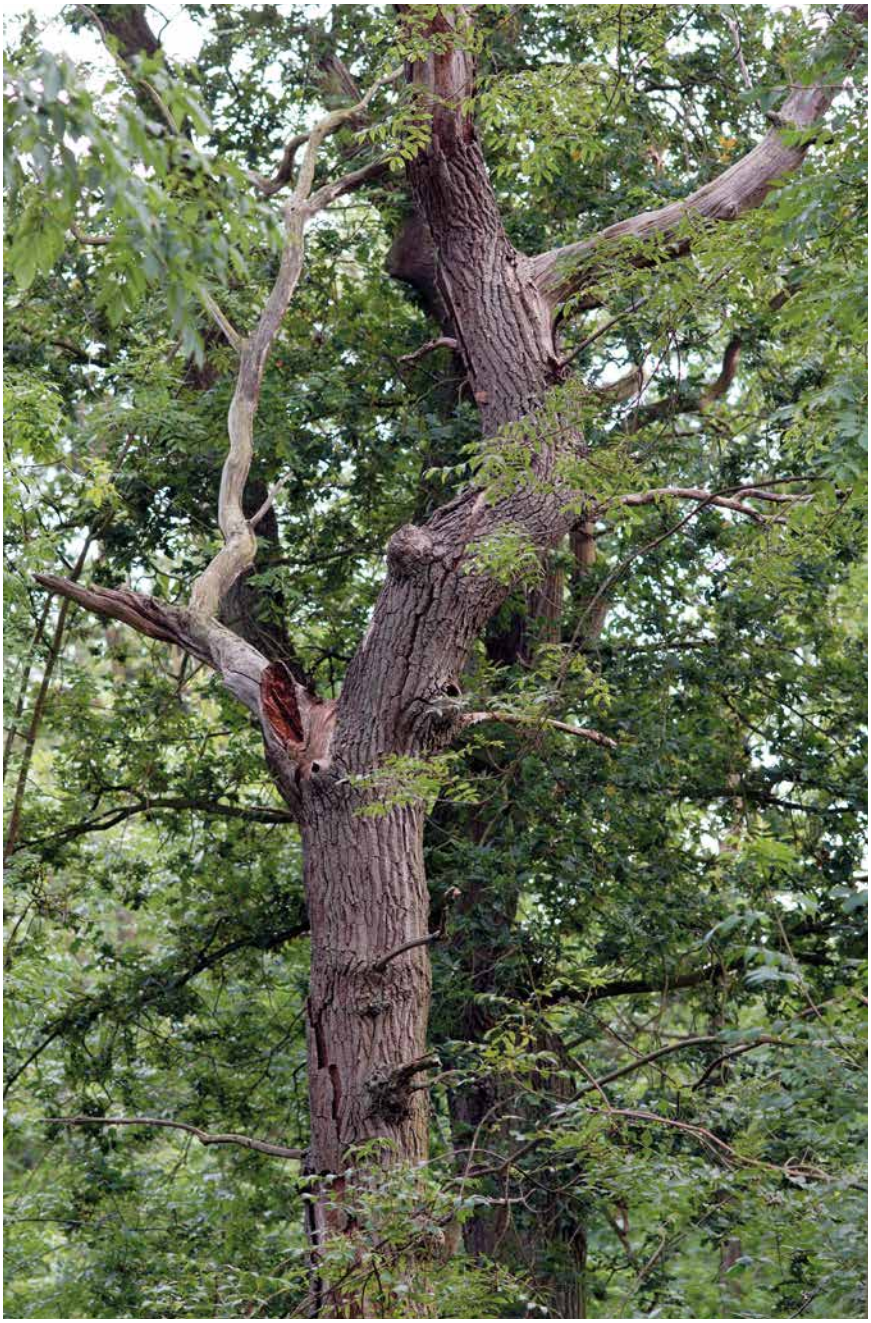


Figure 3. A potential bat roost tree. Photo credit: Davidson-Watts Ecology.

"The roost resource approach may be beneficial when working on large-scale developments where large areas of woodland of high value to bats require removal and where detailed design information is limited."

This approach maintains the roost resource available through compensatory features and the FCS of bats within the local vicinity of the development as mitigation is provided for the loss of the potential woodland roost resource rather than the individual tree.

Are we licensing a non-licence scenario?

The aim of the approach is to account for the wider roost resource, as well as minimising the risk of uncovering a roost that was not previously identified and having to delay works to obtain licences. However, are we increasing licensable restrictions associated with the works for the proposed development?

Under a traditional approach, trees with potential roosting features would be subject to the recommended survey effort, checked by Ecological Clerk of Works prior to felling and, if roosting bats were absent, then felled without a licence. That is, the felling would not be licensable and would not be restricted to seasonal windows (providing absence was confirmed). Under the roost resource approach, all trees with roosting potential are treated subject to licence requirements.

Licensing the woodland means that there is greater restriction to works, such as no or limited licensable work on trees with potential bat roosting features during hibernation and maternity periods (even if currently unoccupied by bats). However, restrictions to licensable works would be dependent upon the importance/ status of the affected bat population (i.e. maternity) present. For example,

Figure 4. Bat boxes installed in a tree. Photo credit: Arcadis.

tree clearance activities may be limited to outside the maternity period, where an area of a woodland is identified as a maternity roost resource. All trees offering suitable roosting potential for bats within this defined maternity roost resource area would therefore be considered under licensable restrictions. These restrictions may be addressed through timing the works appropriately and/or blocking/removing suitable features in advance of proposed tree clearance.

Operating under the roost resource approach has at times been complex and often perceived as limiting our efforts to deliver works from a construction programme perspective than would be expected under traditional licensing approaches. However, previous licensed experience (Davidson-Watts 2021) has shown that with a well-supervised programme, using high numbers of specifically trained accredited agents, the felling works can be completed quickly and efficiently within suitable timeframes. Ultimately, this approach has the potential to lead to better outcomes for the FCS of bats on site compared to traditional approaches. See Box 2.

Conclusions and next steps

The roost resource approach may be beneficial when working on large-scale developments where large areas of woodland of high value to bats require removal and where detailed design information is limited. The roost resource approach minimises programme delays, client costs and paperwork associated with identifying an unknown roost during tree clearance works. The approach can lead to better outcomes for bats, taking into consideration tree-dwelling bat ecology, which is crucial for effective mitigation strategies. It is considered that further work is required to develop the methodology and provide data on the relative use of potential roosting features as a result of roost switching. Next steps may include developing a metric upon which the proportion of trees offering suitable potential roosting features for bats can be used to estimate the maximum number of roosts expected to be directly impacted by the works associated with a large-scale development.

Box 2. Benefits, limitations and lessons learned.

Benefits

- Better outcomes for bats, mitigating effectively against loss of woodland roosting habitats rather than individual confirmed tree roosts. Intelligent use of more effective survey techniques and consideration of bat ecology reduces ineffective survey effort and increases effectiveness of mitigation.
- De-risks programme: if a roost or species is encountered (that was not anticipated) during tree clearance this is covered under the woodland roost resource licensing approach whereas with traditional licensing methods works would stop, and further consultation with the SNCO and amendments/new licences required.

Limitations

- Greater mitigation is required: providing bat boxes or tree veteranisation for the loss of potential roosting features is above and beyond what is traditionally required. A greater number of bat boxes/tree veteranisations are likely and comes at an increased cost to the client.
- Extension of licensable activities: all trees with suitable roosting features located in a defined roost resource area are treated like confirmed roosts. This can lead to increased restrictions and delays if the approach is not understood or carefully considered with appropriate works schedules and resources to enable tree clearance works.

Lessons learned

- The importance of baseline data: the roost resource approach still requires up-to-date baseline data on bats. It is considered that ALBST are the most efficient survey techniques to obtain baseline data for large-scale development. The roost resource approach cannot be used in lieu of up-to-date surveys. The nature and type of mitigation roost feature is still informed by survey information. Adequate survey effort is required to understand bat assemblage, presence, foraging and commuting behaviours in habitats that will be impacted by the development.
- Mitigation: to compensate for the loss of confirmed roosts and trees offering suitable potential for bats, while tree reprovisioning should be made, to replace immediate roosting features it is recommended that 50% of features are replaced by bat boxes and 50% through tree veteranisation. Following best practice, three bat boxes can be installed on an individual tree (Mitchell-Jones 2004). For tree veteranisation works, on the appropriate tree up to eight features can be created. Therefore, small areas of suitable habitat can provide a high volume of features suitable for bats to deliver the mitigation required under the roost resource approach. Radiotracking surveys identify key activity and roosting resource areas; where possible mitigation should be installed in these areas or within suitable habitat functionally linked to these areas. Provisioning of connecting habitat should be considered. A range of bat boxes offering suitability for different bat species and roost types in combination with tree veteranisation and translocation of existing features are likely to better mitigate the loss of woodland habitat.
- Holistic approach with communication: strong and effective communication with the client and sub-contractors is key to facilitate the construction of the development. It is important that the proposed programme for development is consistent with the roost resource approach, especially where there are other ecological species constraints that may impact clearance activities (i.e. nesting birds). Where there are other species constraints associated with clearance activities, it is important to share the roost resource approach with the wider team. This will ensure that trees offering suitable potential for bats will only be removed following the conditions set out in the roost resource licensing approach. It is important to make the wider team aware of the roost resource licensing approach to avoid clearance of trees with features suitable for bats that would ordinarily be removed following traditional licensing approaches.

About the Authors

Jessica Hinds MCIEEM is a Principal Ecologist at Arcadis, holding survey licences in England (Class 2). Jessica specialises in bats and is experienced in managing the ALBST elements of various nationally significant infrastructure projects.

Contact Jessica at: Jessica.Hinds@arcadis.com

Ian Davidson-Watts MCIEEM is a Director of Davidson-Watts Ecology Ltd and specialises in advanced survey methods for bats. Ian continually seeks to improve survey and assessment approaches for challenging bat species to enable better decision-making.

Contact Ian at: Ian@dwecology.com

References

Bat Tree Habitat Key (2018). *Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology professionals.* Pelagic Publishing, Exeter.

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. CIEEM, Romsey.

Davidson-Watts, I. (2021). Advanced Bat Surveys for Woodland Licensing (presentation to UK Bat Steering Group 2021). Available at www.bats.org.uk/our-work/project-collaborations-partnerships/uk-bat-steering-group. Accessed 20 October 2022.

Kerth, G., Weissmann, K. and König, B. (2001). Day roost selection in female Bechstein's bats (*Myotis bechsteinii*): a field experiment to determine the influence of roost temperature. *Oecologia*, **126**: 1–9.

Mitchell-Jones, A.J. (2004). *Bat Mitigation Guidelines*. English Nature, Peterborough.

Nadˇo, L, Kaňuch P (2015). Swarming behaviour associated with group cohesion in tree-dwelling bats. *Behavioural Processes*, **120**: 80–86.

Popa-Lisseanu, A.G., Bontadina, F., Mora, O. and IbÁñez, C. (2008). Highly structured fission–fusion societies in an aerial-hawking, carnivorous bat. *Animal Behaviour*, **75**: 471–482.

Addressing the Impact of Large-scale Reroofing on Bats: A Sheffield Case Study

Brown long-eared bat (*Plecotus auritus*).

Daniel Best MCIEEM
Ecus Ltd

Keywords: bespoke survey, Licensing Policy 4, mitigation

Large-scale council-led reroofing schemes are widespread across the UK, with some local authorities undertaking reroofing on thousands of properties in a given year. However, protected species including roosting bats and nesting birds can also inhabit roofs in need of repair. Adequately assessing, and mitigating for, the impact of reroofing on protected species can be challenging given the sheer scale of such reroofing schemes, which would render 'standard' survey methodologies disproportionately expensive and unworkable. This article presents an approach developed by Ecus, in collaboration with Sheffield City Council, which utilises bespoke survey methodology, licensing and mitigation design, to legally address the impact of reroofing of more than 5000 properties across Sheffield on roosting bats and nesting birds.

Introduction

In 2019 Sheffield City Council planned a large-scale reroofing project which would see more than 5000 properties, distributed among various estates across the city, reroofed over a 5 year period. The majority of the properties were built in the early 1950s and their roofs are reaching the end of their serviceable lives. When such large numbers of properties are proposed for reroofing, it is a near certainty that roosting bats and nesting birds would be present in a proportion.

For a given stand-alone roof, a 'standard' approach (Collins 2016) for addressing potential impacts to roosting bats and nesting birds would typically comprise:

- undertaking an external and internal inspection of the property to determine suitability for bats and birds, and search for evidence of these species
- where there is roosting suitability, undertaking up to three nocturnal surveys (depending on the level of suitability) in the active season to determine presence or likely absence of bats, and undertaking hibernation surveys (where appropriate), and
- where roosting bats are confirmed, the surveys undertaken should be of sufficient quality to fully characterise the roost(s) to assess the likely impacts of the proposed works.

The early 1950s properties in Sheffield are mostly of a similar construction, typically comprising two-storey brick-built semi-detached dwellings with pitched and hipped roofs and open eaves (Figure 1). With these properties having been built within a few years of each other, the majority are in a similar state of repair and initial inspections identified that the vast majority display at least some suitability for roosting bats. This is predominantly on account of repeated gaps at the wall plate on the underside of open eaves, and, to a lesser extent, gaps beneath missing or broken roof tiles. The open eaves also provide suitable nesting locations for bird species such as house sparrow (*Passer domesticus*), house martin (*Delichon urbica*) and swift (*Apus apus*). There are a few variations to the property types with some being configured as flats, others being bungalows and a very limited number with cross-gable roofs, although these variations had limited meaningful implications for their value to wildlife relative to the standard property design.

Figure 1. A typical semi-detached property with a pitched and hipped roof and open eaves.

For a scheme such as this, which entails reroofing about 1000 properties per year, it is evident that adopting the 'standard' bat survey approach to assess the likely impacts of reroofing would not be feasible, nor would it be proportionate or appropriate. For example, assuming that all properties display suitability for bats and that each was subject to a single dusk emergence survey with two surveyors per property, it would equate to 2000 surveyor nights for each year of the scheme. That is broadly equivalent to 25 bat surveyors undertaking a dusk emergence survey every week night from the start of May until the end of August each year!

Bespoke survey methodology

A bespoke survey methodology was therefore developed and was used during the summers of 2020 and 2021 to inform Years 1 and 2 of the reroofing scheme. At the time of writing, surveys for Year 3 are currently ongoing. The aims of the surveys are: to determine the suitability of the properties to support roosting bats, to gather a high level of nocturnal survey information to determine the prevalence and type of bat roosts present and to determine other bat activity including foraging behaviour. The survey results are then used to inform an assessment of impacts and mitigation design. The survey methodology adopted comprises the following elements.

- Desk study: a data search extending 2 km from the boundaries of the housing estates was undertaken with the local biological record holders. Residents were also contacted via letter and asked to provide any known records of bats or birds at their property.
- Preliminary Bat Roost Assessment (PBRA): exterior inspection of all properties in the scheme in a given year, with an internal inspection of a representative sample of approximately 10% of the properties.
- Level 1 nocturnal surveys: all properties were grouped into housing zones whereby a given zone could be ring-fenced by surveyors to view any bats moving in or out of the zone as far as possible (Figure 2). Dusk emergence and dawn re-entry surveys were undertaken in each zone with surveyors positioned both on the exterior and interior of the zones. Surveyors were mobile and walked back and forth repeatedly at a quick walking pace, covering a pre-determined route which was up to 200 m in length (but typically shorter), actively surveying for bats at all times. The walking routes utilised pathways and other public rights of way and were designed to maximise visual coverage of all properties included in the scheme. All properties were subject to nocturnal survey utilising the Level 1 methodology with the aim of identifying roosts, areas of bat activity and flight paths to inform further targeted survey effort.
- Level 2 nocturnal surveys: this included standard dusk emergence and dawn re-entry survey to determine the presence/likely absence of roosting bats and characterise roosts at: (a) roosts confirmed during Level 1 surveys, (b) properties assessed as displaying greater than 'low' suitability to support roosting bats during the PBRA and (c) properties where behaviour indicative of roosting was observed during Level 1 but where a roost was not confirmed (such as prolonged foraging adjacent to

Figure 2. Example of a housing zone for Level 1 survey methodology.

a building after typical emergence times). These were undertaken in accordance with standard guidelines (Collins 2016), with surveyors typically being stationary and focusing on aspects of properties with roosting suitability, although back-tracking methodology was also employed where appropriate.

- Level 3 nocturnal surveys: properties with confirmed roosts were subject to a third dusk emergence or dawn re-entry survey, in cases where additional survey effort was considered to be required, to fully characterise the roosts. Level 3 surveys were undertaken as per standard guidelines (Collins 2016) with surveyors being stationary.

The Level 1, 2 and 3 nocturnal surveys are cumulative. The terminology (i.e. survey 'Levels') does not appear in current survey guidelines (Collins 2016) and was chosen as a deliberate differentiation from a standard approach.

Natural England's Licensing Policy 4 was considered when developing the survey approach and is particularly relevant for projects of this scale. Licensing Policy 4 states that a bat licence application may be accepted with a lower than standard survey effort where "the costs or delays associated with carrying out standard survey requirements would be disproportionate to the additional certainty that it would bring; the ecological impacts of development can be predicted with sufficient certainty; and mitigation or compensation will ensure that the licenced activity does not detrimentally affect the conservation status of the local population of any European protected species". The bespoke survey methodology addressed the first two requirements, with the mitigation approach detailed in the remainder of this article.

Survey findings

To date the survey methodology has been used to inform Years 1 and 2 of the reroofing scheme with reroofing having subsequently commenced under Natural England mitigation licences, issued in 2021 and 2022 respectively. The findings of surveys undertaken for Year 1 and Year 2 were broadly consistent with each other. For example, during Year 2 nocturnal survey effort comprised a total of 253 surveyor nights. Some level of bat activity was confirmed during the majority of surveys (bat activity recorded during 96% of surveyor nights at dusk and 79% of surveyor nights at dawn), demonstrating that bat activity is widespread across the housing estates. General bat activity recorded during the surveys typically comprised low or very low levels of foraging activity, averaging 5.9 bat registrations for a given survey.

Bat roosts were identified in approximately 6% of the properties in the reroofing scheme and all related to common pipistrelle (*Pipistrellus pipistrellus*) day roosts, occupied by individual or low numbers of bats. The majority of the identified roosts were accessed at the underside of open eaves, with some roosts accessed beneath missing or broken roof tiles.

Bats were typically observed in low numbers primarily as individuals, with sightings of more than one bat at any given time being infrequent. Common pipistrelle comprised the species most frequently recorded by far (accounting for 95% of all bat registrations) and it was widespread, but generally at low levels. Noctule (*Nyctalus noctula*), soprano pipistrelle (*Pipistrellus pygmaeus*), *Myotis* bats and brown long-eared bat (*Plecotus auritus*) comprised the remaining 5% of bat registrations, with all of these species recorded either infrequently or very rarely.

The bespoke survey methodology met the survey aims and enabled us to gauge the importance of the survey areas to local bat populations without needing to identify every single roost (it is accepted that some roost locations will be missed). Appropriate mitigation was designed that is responsive and accounts for roosts not explicitly identified during surveys.

Mitigation and licensing

Proposed works under the reroofing scheme included the replacement of roof coverings (comprising all roof tiles, ridge and hip tiles and any underlining, where present) on all properties, with a new 'dry' roof system whereby new roof tiles are fitted without using mortar. The timber frames of the roofs were or will be retained *in situ*.

The survey findings demonstrated that bats could roost in any property within the scheme but they certainly don't roost everywhere. In view of the survey findings, and accounting for the limitations of the survey methodology adopted, the following mitigation strategy was devised.

- Retention of all potential bat and bird access points at the underside of the open eaves on all properties

(Figure 3; many reroofing schemes 'box off' open eaves with new soffits, and thereby block access points for wildlife).

- All roofs to be lined with hessian-backed Type 1F bituminous felt (a bat-friendly lining), irrespective of whether bats were recorded as present or not (a very progressive decision by Sheffield City Council).
- Installation of bespoke bat access tiles designed in collaboration with Marley specifically for this project on 25% of the roofs (including all confirmed roosts and properties displaying greater than low suitability') to compensate for existing potential roosting features such as broken or missing tiles (Figure 3).
- Ecological Clerk of Works (ECoW) with all contractors trained in bat-friendly working methods with regular supervision, an ecologist directly supervising the stripping of a proportion of the roofs and the installation of bat mitigation features throughout the lifetime of the project, with supervision having a particular focus on confirmed roosts and properties with greater than low suitability for bats.
- An on-call telephone service employed at all times when the ECoW is not present.
- Timing restrictions for properties with confirmed roosts and those displaying greater than low bat roosting suitability. A precautionary approach is adopted and consequently any property falling within this category is treated as if it were a maternity roost with no works undertaken between May and September inclusive.

Box 1 Survey findings in context

There appear to be few studies which have extensively surveyed for bat roosts at the scale of entire settlements with *The Ecology and Conservation of Bats in Towns and Villages* (Simon *et al*. 2004) being one such study. Settlements in the Marburg-Biedenkopf region of central Germany were surveyed extensively for bat density and the number and type of roosts present. Common pipistrelle was the most abundant bat species and a given settlement, comprising approximately 500 buildings, on average supported a single maternity colony with upwards of 50 other summer roost locations (roost occupation in 10% of dwellings). The Marburg-Biedenkopf region is highly suitable for bats, with forest and agriculture in approximate equal proportions and forming 85% of the total land area. The region supports a very large common pipistrelle summer roost and winter hibernaculum at the centrally located Marburg Castle (up to 30,000 individuals visit the area over the summer and 5000 hibernate over winter). This study provided a useful baseline for comparison, but it is acknowledged that the distribution and abundance of bat roosts in this region of Germany is unlikely to be directly comparable with those associated with the lower-quality foraging and roosting habitats of the suburban Sheffield housing estates we surveyed.

Figure 3. (a) Typical gaps retained at the underside of open eaves suitable for bats and (b) a bespoke bat access tile.

This mitigation solution is intended to ensure that the works do not detrimentally affect the conservation status of any bat populations present, addressing the third part of the Licensing Policy 4 requirement. This approach was presented to Natural England and consented under bat mitigation licences granted for Years 1 and 2 respectively to date. The terms of the granted licences are responsive to the needs of the reroofing scheme in that they allow for the discovery of bats not previously recorded during pre-works surveys. For example, if a common pipistrelle bat is uncovered beneath a roof tile at a property where a bat roost had not previously been recorded, the bat can legally be transported by an ecologist under the licence to a bat box and works may continue without having to seek a licence modification (subject to all conditions of the licence being fulfilled). The mitigation solution is similarly adaptable. In the stated example, where an unexpected bat roost is found, the property is designated a confirmed roost and bat access tiles are installed with mandatory supervision of the remainder of the roof strip. Some of the conditions of the existing licences are precautionary and account for a 'reasonable worst-case scenario' in that they allow for impacts to considerably greater numbers of bat roosts than were identified during the surveys, with Natural England guided in licensed impacts by Simon *et al.*'s (2004) study, in the absence of other comparable studies.

The extended levels of roost mitigation provided, with every property being safe for use by bats in the long term (as a result of the use of hessian-backed Type 1F bituminous felt), open eaves features being retained and bat access tiles provided in all roosts and 25% of the total properties, would not have been achieved if standard surveys had been used. Were a standard approach to survey and licensing adopted then it is anticipated that roost mitigation would be restricted to those properties from which roosts were identified during pre-works surveys.

The first monitoring surveys of the mitigation features already installed will be undertaken in summer 2023. We expect that retention of the open eaves

Common pipistrelle (*Pipistrellus pipistrellus*).

will be of particular benefit to the local bat populations, as we have already recorded nesting birds (including house sparrows and swifts) returning to nest during summer 2022 in properties that were only reroofed in winter 2021.

Conclusions

There is much to learn from this project. By necessity, the nocturnal surveys had to deviate from standard guidelines given the number of properties involved. We consider that the survey design enabled an appropriate assessment of impacts, as evidenced by the granting of bat mitigation licences specifically covering the discovery of bats in any of the properties across the housing estates, subject to conditions. In licensing terms this is quite unique (although some of the conditions of the licences, such as the numbers of bats to be impacted, are somewhat precautionary). We have developed a pragmatic mitigation solution on a large scale that facilitates reroofing while also safeguarding individual bats in the short term through sensitive working practices, and populations of bats in the long term via use of bat-friendly materials, retention of suitable roosting features on every single property and installation of additional compensatory bat tiles on a large proportion. This novel approach required considerable perseverance with Natural England during licensing, but it has resulted in excellent outcomes for bats under a scheme that is also workable for the roofing contractors. Early engagement with the relevant stakeholders and simplicity in implementation 'on the ground' is critical for successful delivery of mitigation at this scale.

As we continue surveying throughout the 5 year Sheffield scheme we are continuously striving to refine the survey methodology and mitigation to deliver the best outcomes for protected species and the Council. With the knowledge and site-specific data gained from Years 1 and 2 we will be reducing aspects of the ongoing survey effort where this doesn't change the end mitigation result.

This survey methodology and mitigation design could be adopted on large-scale reroofing schemes across the UK, but each scheme should be assessed on its own merits and will require site-specific amendments or adaptations. There is a clear desire (and legal requirement) among local authorities to appropriately account for the legal protections afforded to bats in reroofing, and this project outlines one of the pathways available.

Acknowledgements

We are grateful for the ongoing support of our colleagues at Sheffield City Council, particularly Mikhail Ishaq, Belinda Wiggs and Nesreen Lowson, and Avonside Roofing, led by Bob Ireland, who have wholeheartedly engaged with and helped to deliver the project.

References

Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists. Good Practice Guidelines*, 3rd edn. The Bat Conservation Trust, London.

Simon, M., Hüttenbügel, S. and Smit-Viergutz, J. (2004). *Ecology and Conservation of Bats in Villages and Towns*. Schriftenreihe für Landschaftspflege und Naturschutz, vol. 77, Bonn.

About the Author

Daniel Best MCIEEM is a Principal Ecologist at Ecus Ltd with over 8 years' professional experience. Daniel provides advice for a broad range of clients and project types and has a particular passion for all things bats.

Contact Daniel at: daniel.best@ecusltd.co.uk

Feature

Habitat Suitability Modelling for Bats

> **“Bats are mobile animals, with large core sustenance zones.”**

Greater horseshoe bat (Rhinolophus ferrumequinum).

Greg Slack
MCIEEM
Middleton Bell Ecology

Matthew Whittle
Jacobs

Beth Ellis
Mott MacDonald

Keywords: Environmental Impact Assessment, targeted mitigation, landscape scale assessment, MaxEnt, predictive modelling

Habitat suitability modelling (HSM) is a widely used approach in academia but it has rarely been applied within the context of Ecological Impact Assessment. In essence, HSM is the process of using species location data and environmental data to model the relationship between a species and its preferred habitat. It is similar to the great crested newt Habitat Suitability Index (HSI) assessment that many are familiar with, but HSM uses predictive modelling to generate habitat suitability maps on a much broader scale. Here we set out an example of how HSM has been used to inform the Ecological Impact Assessment of a large linear infrastructure scheme on bats. On schemes such as this, HSM offers a cost-effective means of assessment in an objective and quantitative way, applicable for bats and other species.

Introduction

Anglian Water's Strategic Pipeline Alliance (SPA) will create hundreds of kilometres of new, interconnecting drinking water pipelines to allow the movement of water from wetter to drier parts of the region and protect water supplies for the East of England. The geographical scale makes this one of the largest infrastructure projects in the UK. A key challenge for any project of this scale is attaining a practical survey approach and robust baseline. On large-scale linear infrastructure projects, bat survey work can be very labour-intensive, which significantly drives up cost and, as often happens during the life of a project, the linear route will often change during the iterative design process of Environmental Impact Assessment. Surveying the wider landscape using traditional methods is cost-prohibitive so reroutes can lead to abortive work or gaps within the baseline. In the context of these challenges, habitat suitability modelling (HSM) was identified as the best solution based on previous academic applications (Bellamy *et al*. 2013, Brown 2013, Bell 2020).

What is habitat suitability modelling?

HSM is a method for predicting the suitability of a location for a species, or group of species, based on their observed relationship with environmental conditions (Rowden *et al.* 2017). In practice, this generally involves using species occurrence (biological records or survey data) and environmental data (climate, vegetation coverage, etc) to build a model and predict a species' distribution across a wider area.

HSM follows a standardised sampling procedure; it requires a lower level of survey effort per unit of area; and it *can* work with pre-existing data (e.g. from local records centres). It provides us with an objective and quantitative means to *inform and evidence* decisions about the avoidance, mitigation and compensation of a development's impact(s).

Methodology

HSM broadly involves the following steps: data collection and preparation, modelling and making predictions. This section describes the process and key considerations. For a more detailed understanding of HSM, *Mapping Species Distributions* (Franklin 2010) covers the subject comprehensively.

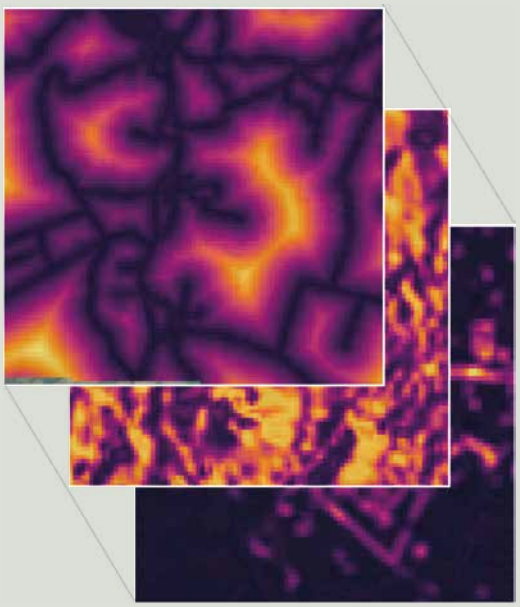
Environmental data

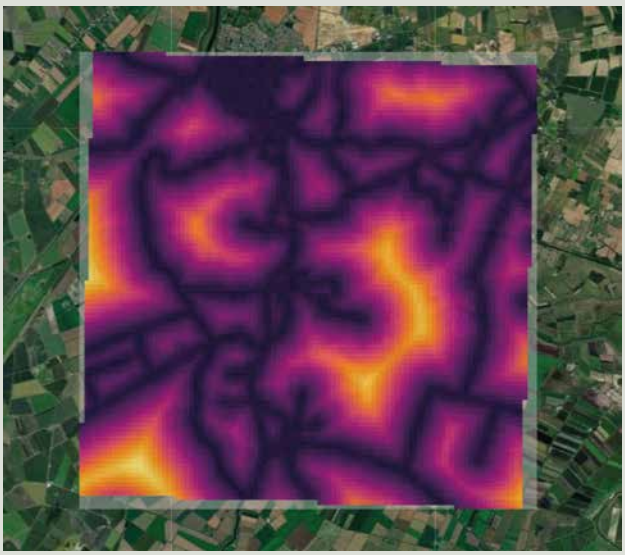
The first component of HSM is the environmental variables. These are the biotic and abiotic factors that are thought to influence a species' distribution. It is important to consider a variety of these factors. For bats, this might include the coverage of woodland (a biotic factor) or the average rainfall during certain seasons (an abiotic factor). Some variables can act as proxies for others which are difficult to measure. For example, minor roads may be important because they could indicate the presence of trees and hedgerows.

It is also important to consider factors acting across a wider landscape. Bats are mobile animals, with large core sustenance zones. The coverage of an environmental variable across this wider area (for example, within a 2.5 km buffer) is likely to influence whether a bat uses a particular location or not (Bellamy *et al*. 2013).

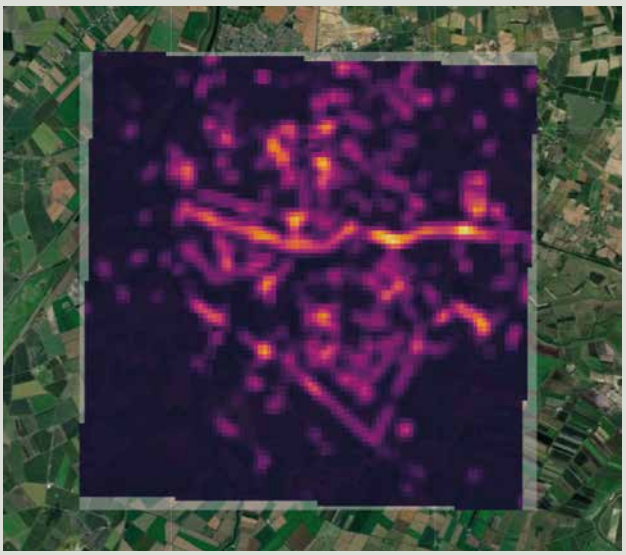
"Our application of HSM demonstrates that the modelling technique can be used in industry to provide a robust basis for Ecological Impact Assessment."

Aerial photo – Hilgay Fen, Cambridgeshire, UK

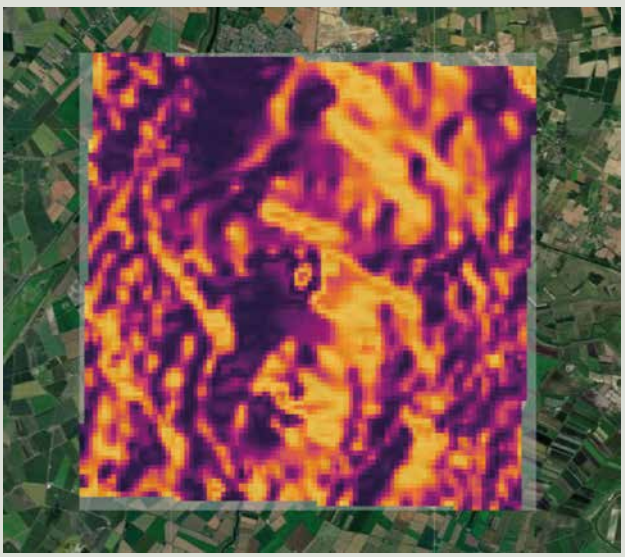




Distance to minor roads



Woodland edge density (with 300mmm)



Aspect: Eastness

Figure 1. HSM requires us to represent our environmental data as rasters, a GIS data format made up of georeferenced gridded values. Each cell represents the value of a variable at that location. To represent multiple variables, we can 'stack' the rasters on top of each other. This diagram displays three of the environmental variables used in the SPA modelling represented as rasters: distance to minor roads, aspect (eastness) and woodland edge density within 300 m. The variables in combination describe the environmental conditions to the model.

Practically, these factors must be represented as raster layers in your GIS to use in HSM (Figure 1). A raster is a grid where each 'cell' contains a value representing the variable at that location. A familiar example is a colour photo, which is made up of three layers representing red, green and blue light intensity at each pixel. You can do this using any GIS software, we used open-source tools including R (R Core Team 2021), Python (www.python.org) and a variety of their geospatial libraries.

The resolution of the raster data (the size of each cell) is important. It will be constrained by the resolution of your source data and available computing power. It also determines the resolution of model predictions, so you should consider whether the resolution is correct for your use case. For example, a low resolution of 10 km may be appropriate for assessments at a national scale, but it is unlikely to help determine the impacts of a 20 km road scheme.

For SPA we used 28 different environmental variables to represent a range of biotic and abiotic factors at varying spatial scales (including woodland, waterbodies and ditches, major and minor roads, terrain and climate). These were influenced by the work of researchers at the University of Leeds (Bellamy *et al*. 2013, Bell 2020). Like these studies, we did not include any variables to represent the influence of hedgerows. While they are widely considered an important feature for bats, there aren't reliable data on them to use in modelling. A HSM model will always be limited by our understanding of the features that influence a species' distribution and the data available to represent them (Franklin 2010).

Species occurrence data: bat survey design

The second component of an HSM is the species occurrence data. Traditional monitoring surveys aim to capture the relative bat activity levels across specific locations throughout a study area (Collins 2016). This requires monitoring throughout the year to characterise bat activity. In comparison, HSM aims to describe the suitable habitat of a species based on the environmental conditions where they have typically been detected. Species occurrence data can either be presence only (species A was here) or presence/likely absence data (species A was here, and *it was probably not there*). This can be collected through familiar survey methods like transects and static detector monitoring. Our modelling was based upon presence-only data collected via static detector monitoring surveys. We favoured this over transect surveys because it offers better detection of quiet bat species.

We found that monitoring was required at a minimum of 35 locations to build up a comprehensive enough sample. We estimated that 10 nights of monitoring at each location, in suitable weather conditions, would be sufficient to have reasonable confidence that we would detect a species if present. This was based upon a study by Matthews *et al.* (2016). Once this had been achieved, the static detector could be moved elsewhere.

Surveys should aim to comprehensively sample different vegetation types, as well as the other factors you have identified as environmental predictors across your study area. For example, if your study area ranges in elevation from 0 to 200 m, then the surveys should also aim to cover this range (and its extremes). This gives the model a comprehensive picture of where bats are present.

We found that comparing histograms for each environmental variable between the survey sample and the study area (Figure 2) helped us to understand if our surveys would give a comprehensive sample. This approach gives a visual indication of where you are under or over-sampling a particular variable. It could be expanded to include some statistical testing to determine if the two distributions are similar enough.

Overall, you should aim for a survey sample distribution that is as similar as possible to the study area, recognising the practical constraints of survey work such as land access, resource availability and weather.

Modelling

Once you have collected and prepared enough data you can begin modelling. This is an iterative process which requires alterations to the model at each stage until you are happy with the results.

Model selection is important, and for the SPA project we used a maximum entropy model. This is a popular approach and is used in much of the academic literature on HSM for bats (Bellamy *et al*. 2013, Brown 2013, Bell 2020). They can be built using the software package Maxent (Phillips *et al*. n.d.).

In building the model, it is important to partition your survey data into one subset for training the model and another for testing it. The best approach to this is using cross-validation, where you make multiple copies of the dataset, partitioning different training and testing subsets for each copy. This enables you to validate the predictions of the model, without going out and collecting more data.

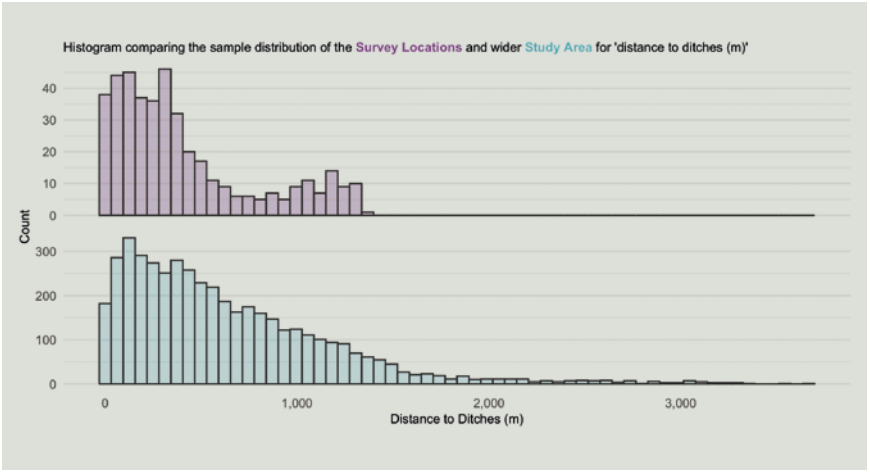


Figure 2. Histograms of the survey locations (top) and the wider study area (bottom). The distribution of the variable distance to ditches is broadly similar between the samples. They are a similar shape but the surveys would benefit from some locations further away from ditches. This was difficult to achieve within the range of our land access, a common constraint of large projects.

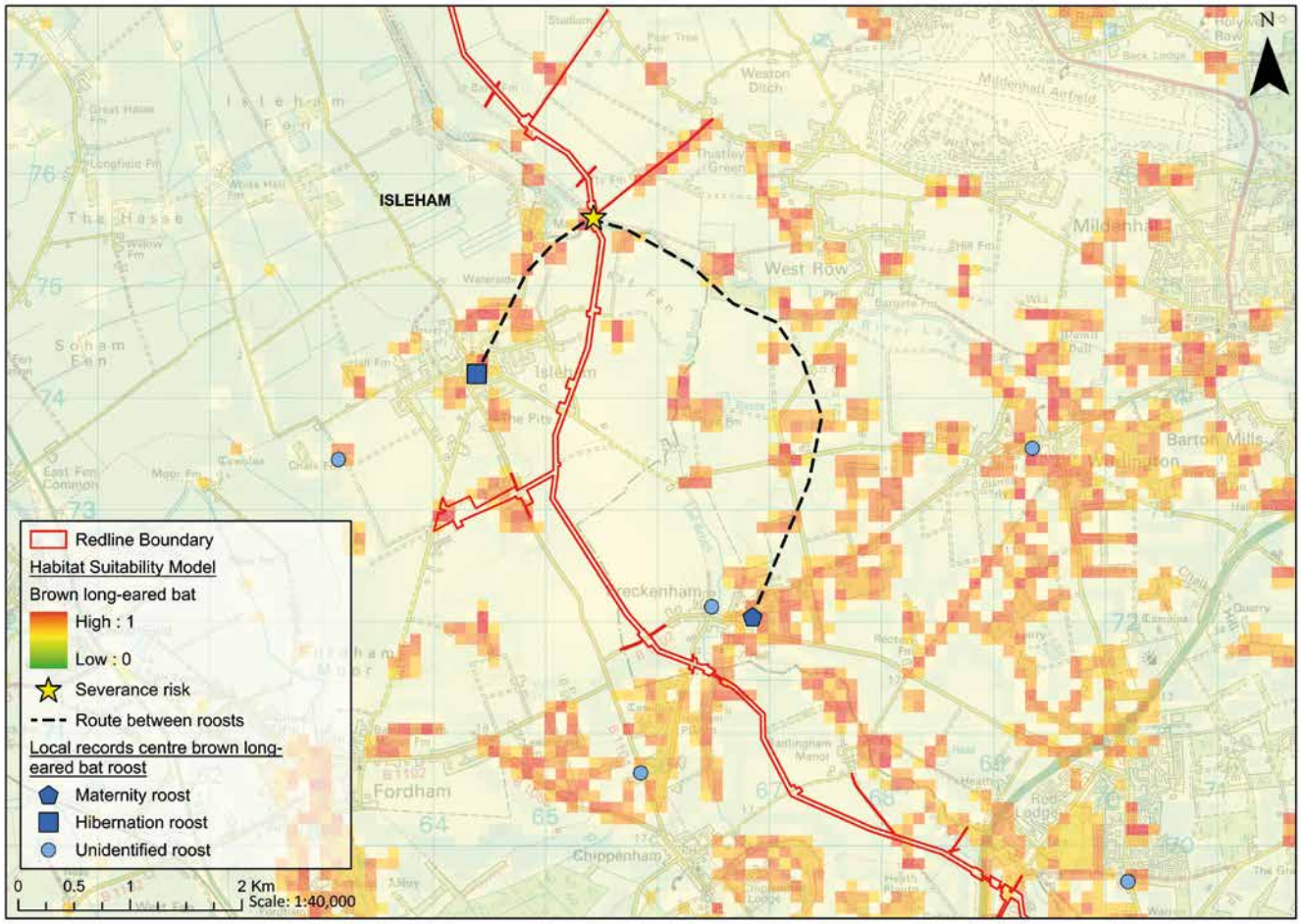


Figure 3. HSM predictions when displayed as a heat map can be used to identify the impacts of a piece of linear infrastructure on bats at a landscape scale. Here, the proposed route of the SPA pipeline crosses between a maternity and hibernation roost for one of the species studied. Using a map of HSM predictions we can identify where removal of hedgerow would affect a route bats are likely to use when travelling between these roosts and target our mitigation accordingly.

We partitioned our data manually, being careful to select groups which don't cluster together spatially (to avoid overfitting). A better approach would be to use spatial block cross-validation to partition the data with the blockCV R package (Valavi *et al.* 2019).

The Maxent output provides a *P* value for each subset. This can be used to identify whether the model is able to predict or just describe the presence distribution. The average performance of the model across all data subsets is then used to evaluate its predictive power, allowing you to get the most out of your available data.

At each model iteration, you should prune out explanatory variables which are highly correlated with each other (termed collinearity) and/or those which have a lower influence on the model. This is an important step in improving model performance. Overall, you should aim to build your optimal model with the most powerful subset of explanatory variables that have the lowest collinearity.

Maxent automatically generates predictions each time it builds a model. These are estimations of habitat suitability (between 0 and 1) generated in a grid, like the environmental predictor rasters. The predictions can be presented in a 'heat map' in a GIS. An HSM is only as good as the data used to train it. It is important to be aware of any limitations when interpreting model predictions. As George Box, a famous statistician, once said, "all models are wrong, some are useful".

Figure 3 is an example taken from SPA which shows a brown long-eared bat (*Plecotus auritus*) hibernation roost, just south of Isleham, and a maternity roost for the same species to the south east. Using the HSM predictions, we were able to determine the likely key connecting routes between these roosts and therefore where the severance impacts were most likely to occur. The hotter colours in Figure 3 identify areas of higher suitability for brown long-eared bats. This HSM output layer can be overlaid onto aerial photographs of the landscape to provide additional detail which can be helpful when determining locations where mitigation will be required. For the SPA scheme the mitigation targeted the most suitable locations in each local area as defined by the model, and considered the known roosts within 7 km of the scheme.

Of course HSM can also be used to identify areas that are less suitable for a

"Given the mobility of bats, it has long been recognised that projects should consider impacts on them in areas beyond the scheme boundary."

species. A large area of the scheme to the east of Bexwell was identified as relatively unsuitable for many bat species. In locations where a lot of the landscape was identified as relatively unsuitable, maintaining connectivity in the suitable habitat that was present was arguably even more vital.

Project outcomes and future applications

Our application of HSM demonstrates that the modelling technique can be used in industry to provide a robust basis for Ecological Impact Assessment. We hope that others will explore its practical applications.

HSM gives us a quantitative means to understand bat habitat suitability at a landscape scale. For SPA, this was particularly useful in identifying the key connective locations which could be affected by the project. HSM is less vulnerable to land access refusals and design changes, which cause gaps in survey data, project delays and additional costs.

HSM will typically require a lower survey effort than the sole use of traditional methods which depend on static monitoring and/or transect surveys. It allows us to understand relative habitat suitability with only static monitoring surveys.

Using HSM reduced bat survey effort by 50% on SPA, saving the project approximately £500,000. It also enabled us to avoid the health and safety risks associated with night work. While HSM is a powerful technique, the model and its predictions are only as good as the data which inform them. The survey design, data preparation and modelling directly influence the quality of the model predictions. It is key to ensure your survey data provides the model with enough information on where bats were recorded. This includes both the number of sample locations and their coverage across the range of each environmental variable. Without this, your model can't make accurate predictions. You must consider the entire HSM process when evaluating if it is appropriate for a project. Your survey methodology should be designed with HSM in mind, not the other way around.

Given the mobility of bats, it has long been recognised that projects should consider impacts on them in areas beyond the scheme boundary. Until now the consideration of 'off-site' data has had its limitations. HSM presents an exciting opportunity to develop a more robust and quantifiable approach to bat assessments.

Acknowledgements

Thank you to Ric Sandifer and Jon Barnes who helpfully commented on draft versions of this article. Thank you also to Fran Lynn who produced the maps included in this article and provided GIS support across the whole project.

References

Bell, R. (2020). Sheffield Habitat Suitability Modelling Project: the city's use by feeding bats. *British Island Bats*, **1**: 67–83.

Bellamy, C., Scott, C. and Altringham, J. (2013). Multiscale, presence-only habitat suitability models: fine-resolution maps for eight bat species. *Journal of Applied Ecology*, **50**(4): 892–901.

Brown, E. (2013). *Multiscale Habitat Suitability Models for Bats in the Yorkshire Dales. Are Site-specific Models More Accurate than those Transferred from Other Geographic Regions?* Masters dissertation, Leeds University.

Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines*. The Bat Conservation Trust.

Franklin, J. (2010). *Mapping Species Distributions: Spatial Inference and Prediction*. Cambridge University Press, Cambridge.

Mathews, F., Richardson, S., Lintott, P. and Hosken, D. (2016). *Understanding the Risk to European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management*. Report by University of Exeter for RenewableUK.

R Core Team (2021). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna. Available at www.R-project.org/.

Rowden, A.A., Anderson, O.F., Georgian, S.E. *et al.* (2017). High-resolution habitat suitability models for the conservation and management of vulnerable marine ecosystems on the Louisville Seamount Chain, South Pacific Ocean. *Frontiers in Marine Science*, **4**: 335.

Phillips, S.J., Dudík, M. and Schapire, R.E. (n.d.). Maxent Software for Modelling Species Niches and Distributions (Version 3.4.1). Available at http://biodiversityinformatics.amnh.org/open_source/maxent/. Accessed on 20 October 2022.

Valavi, R., Elith, J., Lahoz-Monfort, J.J. and Guillera-Arroita, G. (2019). blockCV: An r package for generating spatially or environmentally separated folds for k-fold cross-validation of species distribution models. *Methods in Ecology and Evolution*, **10**: 225–232.

About the Authors

Greg Slack MCIEEM is a Principal Ecologist with Middleton Bell Ecology and led the development of Habitat Suitability Modelling on SPA.

Contact Greg at:
greg@middletonbellecology.co.uk

Matthew Whittle is a Senior Data Scientist at Jacobs (with a background in ecology) and supported the development of Habitat Suitability Modelling on SPA.

Contact Matthew at:
matthew.whittle@jacobs.com

Beth Ellis, an Associate Ecologist with Mott MacDonald, is the SPA Ecology Lead and a EcIA/HRA Lead, providing technical support to the SPA bat team.

Contact Beth at: bEllis@anglianwater.co.uk

The Important Ps when Considering Sustainability in Invasive Knotweed Reduction

“With the input of ecological detection dogs trained in finding invasive knotweed roots, early detection is possible and quality control of treated sites is improved.”

Lonneke Klein-Aarts
HOEK

Keywords:, biodiversity, microbiology, sustainability, natural resources, invasive species, oxygen, detection dogs, scent, maintenance regime, conservation works

With the cascading costs of invasive species spread and treatment it is important to find infections as soon as possible. With the input of ecological detection dogs trained in finding invasive knotweed roots, early detection is possible and quality control of treated sites is improved. In treatment processes themselves sustainability and biodiversity issues are increasingly being considered. This article focuses on updates on proven methods and how incorporating monitoring with dogs can prevent further spread.

Introduction

Working as an invasive species consultant for HOEK I have come across many sites in a wide variety of habitats and with a diversity of related problems. After seeing so many sites you start to discover the likelihood of cause, presence and spread. As with all problems, prevention is better than cure. Acting at an early stage has now been made cheaper and easier when working with dogs. This approach is better for the carbon footprint, biodiversity and finances. From that perspective I would like to share the eight Ps of invasive knotweed control.

My Ps of importance while considering sustainability in invasive knotweed reduction are: prevention, people, planning, protection, plants, place, process and problems. It all starts with the most important P, that of prevention.

Figure 1. On the depot of the Nieuwe Kern project with treated soil. You can see healthy soil with a wide variety of herbs that have grown on top. Photo credit: HOEK.

1 Prevention using detection dogs

High-risk sites for invasive knotweed are places where soil has been disturbed; for example, on or near landfill sites, areas of newly laid cables and wires topped-off with contaminated sand/soil, major infrastructure projects for roads and railways and former waste land being used illegally to dump unwanted garden species.

When buying a plot or starting works it might be wise to inspect the area for presence of invasive species. A basic habitat survey by a professional ecologist/botanist is a good start. There are some limitations as plants may be covered up by other vegetation or not easily visually detectable in the dormant stage, and roots can be covered by disturbed layers in demolition of buildings. To overcome the limitations of visual monitoring scent-based monitoring increases the ability to find small plants in high vegetation and in soil with covered roots without upper plant parts. In the UK, Kat Janzur of Canine Detection Solutions uses her team of detection dogs. This provides valuable information required when selling property with historical invasive knotweed infection or as a guarantee of non-presence.

When a site is clear you want to keep it clear. That means that the material you bring in needs to be clean. Machinery previously used on a removal project can cause an introduction. Caterpillar tracks are difficult to clean but dogs regularly detect material on the tyres of trucks, shovel buckets, steps to the driver's cabin or the trailers used for transport. Unfortunately, much work is done by private contractors unaware of transfer risks.

Companies selling soil, compost and sand can increase their reliability using periodic controls with a detection dog and when receiving suspect material. Other possible methods are DNA samples but there are limits to the samples taken whereas a dog gives instant results and can easily search the whole load.

Example

On a 3 ha site someone recognised knotweed in a picture used in an older report. Demolition of buildings had taken place, with transport in all directions, and a top 10 cm layer had been ploughed. There were no upper plant parts to see as it was winter time and the developer was about to start construction.

The full site was checked by walking transects. Infected areas were indicated and excavated to different depths depending on the roots detected by qualified staff. Soil was sent away for treatment at an off-site location. Dogs were used to control the excavation, with a few extra scoops just outside and on the edges of the excavation followed by a final check. Within a month the situation was cleared and resolved.

2 People

A major component of prevention is people, both those who are working with soil, as mentioned above, but also in general. People are important for the recording of invasive plants. The more people are able to recognise and report knotweed the more and earlier that authorities can get a grip on the spots in public and private spaces. Having a webpage on the local authority website and an easy-to-use recording system to report knotweed presence or fly-tipping

Figure 2. On the Nieuwe Kern project, controlling the deeper layers of the depot. Outside control had already taken place 3 months earlier. Photo credit: HOEK.

helps. Information needs to be provided on bins so knotweed does not get mixed with composting material that is not treated under a controlled process in which all root remains will die.

A public authority can assist households with information, subsidies or taking in the material at a specific treatment or amenity site at reduced cost. Employers need to ensure that people are well trained and encouraged to follow the correct procedures. The right people, procedures and proper planning enhance successful treatment.

3 Planning

Everything starts with a masterplan. For example, for large-scale infrastructure projects or green urban spaces it is recommended to start a priority plan for all known sites and install alarm messages and pop-ups in geodata for works relating to other departments. When working in busy cities like Amsterdam, minimal use of traffic routes is key. Machinery is left on site for the duration of the works, and is cleaned and checked for root fragments prior to being moved. Creating an off-site treatment location that rotates material with similar local soil conditions can speed up the treatment of different sites. Each spot needs to be indicated as one to be treated or one that is contained within boundaries. Containment is an option if there are budget limitations. A well-placed and -connected root barrier is a secure way to protect adjoining properties or objects/sites of special interest.

Project management on sites with invasive plant material should be similar to sites with chemically contaminated soil: with well-marked and divided clean and contaminated areas. That means clear risk assessments, work protocols and instructions that are signed for. Embracing basic procedures is important; for example, make it part of a routine for people working on site or doing a survey to use a boot-cleaning facility on site or have a cleaning kit at hand in their car.

It is important with vulnerable material to have an organised control loop in place. Check routes, surrounding areas and vehicles on the day after work is completed. In case of widely spread small plants you can take out scoops and have staff trained to recognise the edges of the excavations on site, without the need to go unnecessarily deep as you can use dogs to check the spot on the following day. Without a dog a site needs to remain monitored and left untouched for 4 weeks in the growth season, April–September. In the months before or after this growth patterns are too variable due to weather and local conditions. If you have or hire dogs trained to detect roots you can prolong the season in which you carry out checks. With mild winter conditions this can be nearly year-round, but inspections by dogs are limited by very low temperatures, heavy downpours and wind.

4 Protection of the contaminated area

As soon as a location of knotweed is known it needs to be fenced off. Too often someone with poor instructions or without knowledge will pass by with a mower or digger and take root material elsewhere. If you know what grows on site you know what needs to be protected during works, such as rare species of plants, trees or fauna, or relics of historical importance. That means planning ahead, mitigating and often dividing the site into parts that can be fully treated and parts that require a unique method to save what must not be damaged.

The area around and the drive towards the site need to be fully protected with road plates and tarpaulins to prevent spillage. Even upper plant parts can grow roots when cut material ends up in waterways.

5 Plants

In the Netherlands different hybridised plants were found to be able to reproduce seed in standard growth conditions as far back as 2008 (Duistermaat *et al*. 2008). A test I ran in 2021 on seeds found in monitored locations showed the problem is more widespread than assumed and that knotweed produces viable seedlings in other provinces of the Netherlands as well. On mature sites knotweed seedlings will be outcompeted by light later in the season but other vectors that cause spread, such as visitors, birds, the coats of mammals and transport through the air, can cause further uncontrolled spread away from the original location. Therefore, learning to recognise male plants and eliminating them before pollination of flowers takes place should be on the to-do list in any plan, regardless of whether the site is treated.

Knotweed is able to be dormant as rhizomes over winter and for several years even if conditions are not optimal for the plant, so treatment should always involve root biomass reduction. Usually the process is split into an initial treatment and a secondary one. Whether a method is successful depends on local soil conditions and the stability of the treatment conditions during the treatment process. For example, if you want to limit root development by causing wet rot, the full site needs to be inundated even during a heatwave in the summer. As soon as the waterline retreats the plants start to re-emerge.

6 Place

Each place is unique. I advise always looking around what resources are available: soil profile, a 3D profile, obstructions and the presence of fresh or salt water. Stressing the plant or root by using the elements is sometimes easily done if time is available. The more time, the more sustainable options that are open to you.

7 Process

With rising energy costs and a focus on climate-sustainable methods it is important to elect the most suitable option for the site conditions with the lowest energy/carbon footprint. The methods 'we' have come across over the years with proven real-world field results are in Table 1. They are dived in full treatments, primary root mass reduction and secondary treatments.

Example

In project Nieuwe Kern, a former sludge and soil depot for the city of Amsterdam, two large depots had soil contaminated by invasive knotweed as well as several spots outside that were near earlier excavations. The area had been visually inspected for over a year. It was the first operational field work for root detection dogs Bliss and Bruce. They indicated spots in an area where sand had been added. Roots and trunks of removed trees also held knotweed

Table 1. The most practical treatments for removing knotweed from soil.

Method	Time available	Type	Size	Soil type	Proximity to water needed?	Cost	Energy
Inundation	At least 1 year	Full	Any	All; best on loam/clay	Yes	£	Solar pump
Root reset	7 months	Field, full	>100 m2	All	Yes or watertank	£	Tractor
Root reset	5 months	Depot, full	Any	Sand; clay easier in situ	Yes or watertank	££	Tractor
JD-killer	from 1 day	On-site plant	40 m3/day	Sandy	No	£££	Biodiesel
Electrocution	3 years+	Primary	100 m2/day	All	No	£££	Generator/diesel
Electrocution	1 year+	Secondary	100 m2/day	All	No	£	Generator/diesel
Heat injection	2 years+	Primary and secondary	100 m2/day	Sand	If practical	££	Diesel
Biological psyllid	Long term	Secondary	Unknown	All	No	£	No
Ecosystem resilience	Long term	Secondary	Any	All	No	£	For excavation and planting

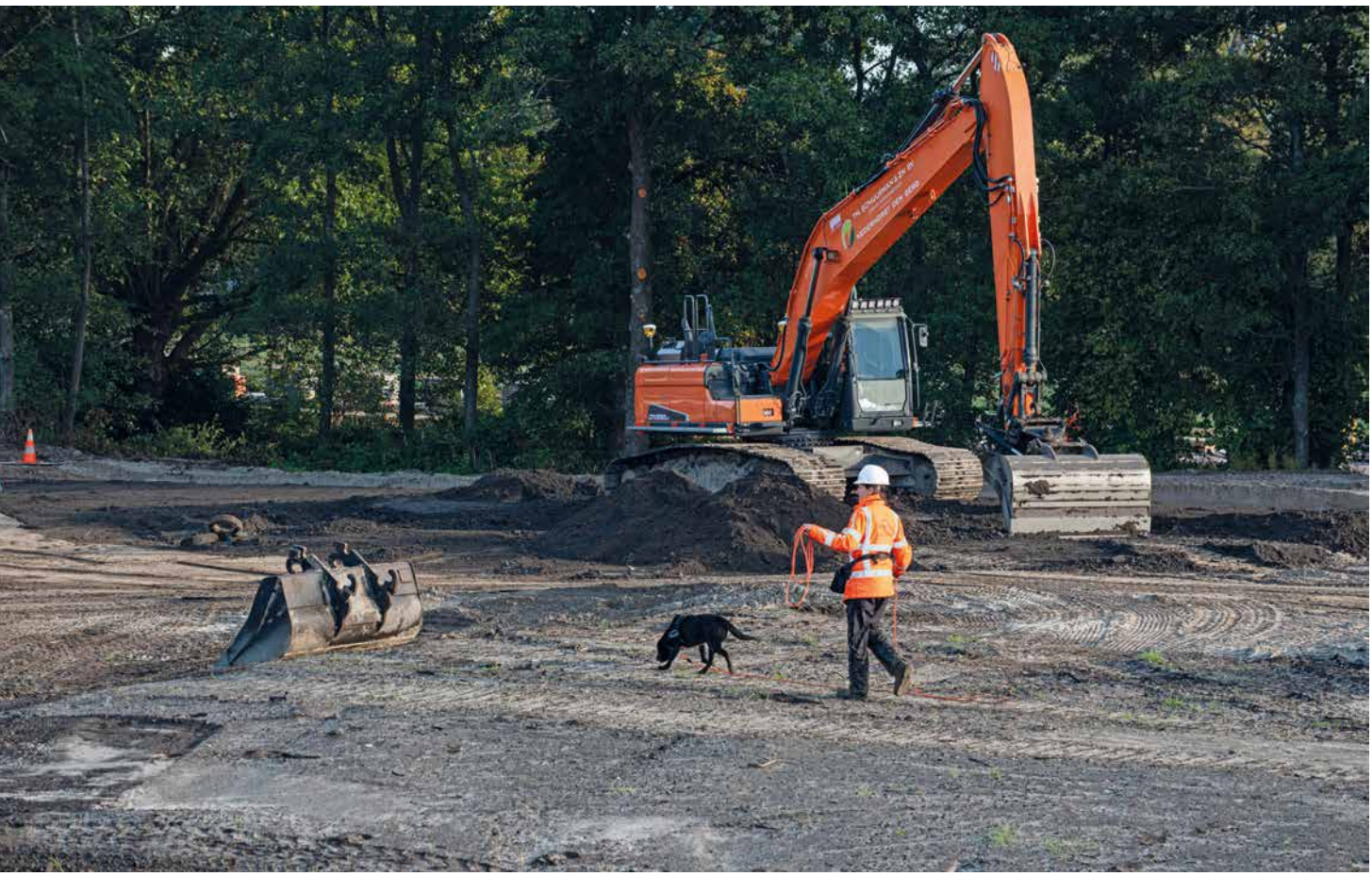


Figure 3. On the Nieuwe Kern project, checking soil that has already been spread to ensure that there is no site contamination. Photo credit: HOEK.

roots and so needed to be treated accordingly. On the day after excavation the site was checked to see if removal had been successful.

After the area in which sand transport had started was cleared, the roots reset method (Table 1) was used to treat the depots and the extra material from last-minute excavations. Roots reset is a unique biological method, making use of the plant-based CleaRoot granulate, which is incorporated into the soil followed by covering the soil and making it oxygen-tight. CleaRoot feeds specific microbes already present in the soil. As a result, these microbes grow rapidly and consume all the available oxygen in the soil. Within 2 days the oxygen level drops to less than 1%. In the absence of oxygen, further fermentation takes place. This process is harmful to the roots of invasive plants; the roots die within 6 months. Currently projects are still monitored until 4 months after finalising the process for extra security. This is suitable for on-site treatment with few obstructions or for use at depots. It is a cost- and energy-efficient natural option, works on heavy soils and only requires normal contractors' machinery. But it is also essential that the application is applied correctly and can be disturbed by wildlife or people. Sites need to be well protected during the treatment process. The 8500 m3 in this project were left consolidated for 7 months and were ready for re-use in June 2022 without any regrowth of knotweed but with lots of flowers and wildlife.

JD-killer

Instant on-site result when little time at hand. Can run on bio-oil. Need space around the treatment spot of 20 by 10 m for the treatment plant set-up. Based on sieving coarse material, heat treatment of residue that can be placed back directly. Suitable for sandy soils.

Inundation

Inundation can be used if the treatment period of a year is an option, even in an extremely dry summer. We ran trials on mature sites with positive results. Twelve months are required to fully kill roots over 25 mm in diameter. It is also practical as a secondary treatment after excavation in the wet winter season, for example. It can eliminate deeper-situated small rhizomes and small roots. Trees like willow and elm can survive the treatment. It is a low-cost option and we used a pump that worked on solar panels with little noise to avoid disturbing wildlife.

Ecosystem resilience

Ecosystem resilience (Bargerveen 2019) is based upon increased plant competition using native species. This is an option where containment is elected after initial biomass reduction in the top layer. It works with shade-tolerant competition in all layers with trees or shrubs for example with beech, lime tree, hazel and hop. In mature sites brambles reduce the speed by which knotweed horizontally spreads over the season but it does not push back mature knotweed.

8 Problems

Trees of high historical or ecological value create special challenges as you want to differentiate between roots that need to thrive and those that must die. Electrocution is an option but requires over five return visits if you are unable to reduce the knotweed root biomass first. Success depends on root biomass and interconnection and always involves repeat treatments. Some deciduous tree species are well adapted to pollarding and then it is easier for the tree to deal with some root reduction or enclosure to prevent horizontal spread. The disadvantage for the tree is that it cannot spread naturally but that counts for the knotweed as well. We ran trials combining horizontal and vertical root barriers with a 20 cm top layer of clean soil to create downward pressure. Horizontally placed barriers placed for long periods should made of material that allows oxygen and water to cross them. Barriers need to stay in situ for 6 years so the end results are not yet known. The site can be made to look presentable using native flora during the treatment period.

Another problem is that in the search for space, roots often find drainage, water or sewage pipes, or use underground cables to spiral around and grow along. Dogs have been shown to be helpful in finding roots much further down along pipework when the location of the upper plant parts is visible.

Conclusion

In the control of knotweed progress is being made in sustainable on-site methods that reduce transport emissions and reuse of material. There are more options on large sites for contractor's machinery to be treated with little need for soil handling. Even when excavation is required use of trained staff and dogs can limit the amount of soil to be taken and a high success rate still be achieved. There is evidence that the nineth P, pesticides, can be moved from the number one method in the UK towards the bottom of the list of options available, as environmentally friendlier, more sustainable methods are taking over.

Future challenges are in the prevention of further spread of knotweed by controlling and limiting transport of contaminated soil, incorporating invasive species surveys, implementing control in major infrastructure works and making priority plans for large land owners. Dogs are valuable in the period after infection takes place but before growth on site and an exponential rise in costs. This work can create a diverse site with native species to be proud of.

References

Bargerveen, S. (2019). Preventing dominance of alien invasive species by strenghtening the resilience of native forest and nature. Available at www.resilias.eu/wp-content/uploads/2022/05/BrochureExoten-LIFEResilias-Engels-definitief.pdf. Accessed 19 August 2022.

Duistermaat, H., Soes, D.M., Van Valkenburg, J. *et al.* (2008). Actuele verspreiding en risico's van mannelijk fertiele Fallopia japonica (Polygonaceae) planten [in Dutch]. Available at www.buwa.nl/fileadmin/buwa_upload/publicaties/AE/Rapport_Japanse_duizendknoop_buwa.pdf. Accessed 14 August 2022.

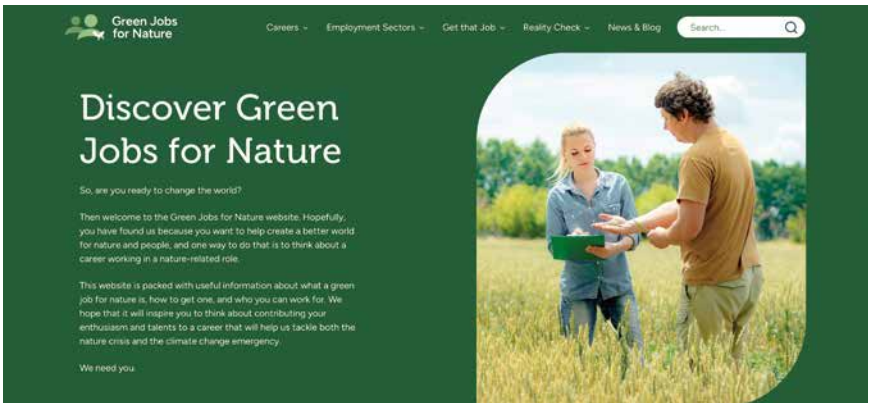
About the Author

Lonneke Aarts works as an invasive knotweed consultant and handler of trained detection dogs for HOEK. Her areas of expertise are natural processes, plants, trials and protocol writing. She was asked to extend earlier lab experiments to a Living Lab location on a chemically contaminated site on the outskirts of Amsterdam. This government-funded testing involved several methods on a large scale, monitoring the results and its ecological impact.

Contact Lonneke at: lklein@hoekgroen.nl

Green Jobs for Nature Website Launched

Sally Hayns
CEcol FCIEEM
Chief Executive Officer, CIEEM



We are delighted to have launched our new Green Jobs for Nature website (www.greenjobsfornature.org) as the first step in our new campaign to promote careers in ecology and environmental management to a new and more diverse audience.

This wouldn't have been possible without the support of our partners – RSK Biocensus, WSP, Green Environmental Consultants Ltd, Arup, Mott MacDonald and Atkins. Thank you.

Whilst our own CIEEM website contains a lot of useful careers information, this new standalone site is careers-focused only and is designed to encourage other relevant professional bodies and careers organisations to contribute their own information and advice, making it a one-stop-shop for all those interested in a career supporting nature recovery. Thank you to the very many of you who have already contributed your own job profiles, the website provides lots of useful information about the range of roles available, what they do, who the employers are, and how to get those jobs. The latter section allows us to promote accredited degrees and degree pathways as well as the range of apprenticeship and other vocational route opportunities available.

There is also a 'reality check' section which talks about some of the best bits and challenging bits working in our industry, some advice on good working practices (and a reference to our Registered Practices commitment to these standards) and a section on equality, diversity and inclusion (EDI) within the profession. The EDI information will become increasingly important as we expand our work in this area.

Next steps

Over the coming months we will be developing further content for the website and putting the final touches to our outreach campaign. It is all very well having the website, but we need to implement a programme of activity to engage young people and potential career changers, especially those from under-represented backgrounds, and signpost them towards the information that can help them take the next step.

Much of the campaign will be via social media, using the best channels to reach our target audiences. We plan to recruit some environmental champions from music, TV, art, fashion and sport to help provide some social media content and we will also be producing podcasts and short videos to interest and inspire the next generation of ecologists and environmental managers.

We will also be producing lots of new career resources and working with agencies and organisations that can help us to get our messages into schools, colleges and job centres. Part of the campaign will be working with STEM Learning to bring employers and students together.

You can help

If you have not done so already, now is the time to fill in a job profile (https://cieem.net/green-jobs-for-nature/). We are aiming to build up a comprehensive library of job profiles so that we can keep updating/rotating the content on a regular basis. It takes just 5 minutes to do. We need job profiles that are geographically diverse but also represent different employment sectors. Unusual roles and interesting stories are especially welcome, as are profiles from early career members and non-members.

Please also get in touch if you can send in a short video doing something unusual or exciting, especially if it uses whizzy technology or features charismatic animals and/or plants. Drop us a line at greenjobs@cieem.net.

We will be writing again next year to tell you more about our outreach activities and opportunities for members to get involved. We know that many of you share our vision to make our profession one that is accessible and inviting to everyone. Green Jobs for Nature is part of that journey and we look forward to travelling it with you.

A Delicate Balancing Act

Richard Handley
CEcol MCIEEM
President, CIEEM

They say that a week is a long time in politics and perhaps that has never been more true than during the week of 19 September when, for those of us in the UK, and particularly England, the Government in Westminster turned years of hard won progress on environmental legislation, policy and scheme design on its head with the announcement of new legislation and policies that appear to undermine everything we have been working for.

Described by many environmental commentators as 'an attack on nature', the Brexit Freedoms Bill and the so-called Investment Zones unfettered by perceived environmental constraints outlined in the Growth Plan were political dynamite. Environmental organisations have been united in their vocal opposition to the Government's plans which, as first described at least, seem to fly in the face of commitments to tackle the biodiversity crisis and climate emergency. The governments of devolved nations were also highly critical of this change of direction from Westminster and the unwelcome implications for their own environmental ambitions and constitutional powers.

I do not propose to discuss the proposals here, other than to note that, at the time of writing, the Government does seem taken aback by the strength of opposition to their proposals and are hopefully having a rethink. We have an area on our website (insert weblink) discussing the implications in more detail and our response to them. But these events did make me reflect on CIEEM's role in such difficult times and how difficult it can be to get the balance right between our individual and collective concern and our role as a professional body.

Whilst CIEEM does seek to influence environmental legislation and policy, we are not a political campaigning organisation. We represent professional practitioners working in all employment sectors (including the public sector) whose work effectively puts legislation and policy into practice. This gives us a unique perspective, a different voice, but one that can often be used to encouragingly good effect, especially when we can back up our arguments with sound evidence.

In recent years we have made significant progress in our ability to engage with and influence civil servants and politicians of all hues. Those relationships are standing us in good stead now as we work behind the scenes to try and get things back on course and make the case for a sustainable green growth agenda. It takes time and perseverance, but I am convinced that our approach is one that, in tandem with the excellent campaigning work of our environmental NGOs, can win the day.

But let me be clear. This does not mean that CIEEM can or should be publicly silent on these matters. We represent your professional voice in the same way that an environmental NGO may reflect your personal voice. Where appropriate we have added our weight to collective NGO calls for action, for example through our work with Wildlife LINKs, and by collaborating with other professional bodies that together form the Environmental Policy Forum. We will also publicly challenge and be critical of political narratives that we believe undermine the need to tackle our environmental crises and where we think that politicians are not listening.

It is a difficult balance to achieve and I am aware that some members would much rather see CIEEM calling members to arms, organising protests and chasing after media headlines. Not only is that not our role, but it could also draw attention away from the organisations that can really benefit from such an approach whilst compromising our ability to challenge and influence in the ways we can do most effectively.

I am sure that, on a personal level, many of us have already taken steps to make our concerns known to our MPs. Thank you. Please also be assured that our Policy team and CEO are being very proactive on your behalf and the Governing Board is committed to investing in this area of work over the coming months. These are difficult and challenging times, a real setback on the path to delivering nature's recovery and tackling the climate emergency. But I do believe that the weight of scientific evidence and public concern will positively impact the political narrative. Thank you, as ever, for your support.

Policy Activities Update

Amber Connett ACIEEM
Policy Officer, CIEEM

Since our last update, the UK Government has made several announcements including a Growth Plan and a new Planning and Infrastructure Bill which both seek to speed up delivery of infrastructure, and a Retained EU Law (Revocation and Reform) Bill which introduces an expiry date of December 2023 on retained EU law, such as the Habitats Regulations and Environmental Impact Assessment regime and associated caselaw, unless otherwise preserved.

We are writing this shortly after the announcements were made and there has already been significant backlash from environmental organisations, land associations and members of all major political parties. We expect the proposals will be reviewed prior to publication of this article so we will update further in the next issue and on our social media channels.

On a positive note, the UN Biodiversity Conference, COP15, is taking place this month from 7-19 December. We have published a position statement followed by letters to Prime Minister Liz Truss and resent to Rishi Sunak and the Irish Taoiseach. The letters urged leaders to attend COP15 and show high ambition for financing and the new global biodiversity framework.

UK and England

In response to the announcements above, we used our contacts in Parliament to raise specific issues on why these proposals ignore evidence, threaten nature protection and are unworkable.

We asked the All Party Parliamentary Group (APPG) for Nature to question the proposals in Parliament and collaborated with environmental organisations, through our membership of Wildlife and Countryside Link and the Environmental Policy Forum, to write to the Prime Minister directly from a position of joint strength. We will continue to engage on the issue, drawing on the expertise of our members.

In October, we collaborated with the Floodplain Meadows Partnership to deliver a parliamentary reception for the APPG for Nature. We discussed challenges in realising the full potential of the UK's floodplains, and opportunities to address these through Environmental Land Management Schemes and other policy options.

Scotland

Our Scotland Policy Group has continued to be very busy responding to consultations including the new Biodiversity Strategy, Land Reform proposals and proposals for a new Agriculture Bill.

We were also approached by Ariane Burgess MSP to provide our views on what should be included in the budget to support the delivery of the Programme for Government. We responded calling for government to fund nature-based green jobs and address early career entry barriers, to ensure all Local Authorities have in-house ecology expertise, and to expand opportunity mapping for the creation of a Nature Network across Scotland.

Wales

In October, we joined up with Welsh Government to present our briefing paper on their approach to net benefits for biodiversity at the Wales Biodiversity Conference. We urge members working on development projects in Wales to read and share the briefing with your networks: https://cieem.net/resource/cieem-briefing-welsh-governments-approach-to-net-benefits-for-biodiversity-and-the-decca-framework/.

Our Wales Policy Group responded to Welsh Government's *Further national milestones to measure our nation's progress* consultation and is, at the time of writing, developing our approach to engaging with the Agriculture (Wales) Bill.

Ireland

In November, our Ireland Policy Group responded to the government's consultation on Ireland's fourth Biodiversity Action Plan. We are also being represented by Aebhin Cawley CEnv MCIEEM on the National Biodiversity Forum where we contributed to the development of the draft plan.

The Ireland Policy Group also submitted views to the Citizen's Assembly on Biodiversity Loss highlighting the threats posed by capacity gaps in the ecology sector.

The Biodiversity in Planning sub-group of the Ireland Policy Group is currently preparing a draft Policy Guidance Note on the topic of Biodiversity Net Gain in Ireland.

Future priorities

Our priority for the coming months will be engaging with the UK Government's announcements to ensure that environmental protections are not rolled back and the importance of nature to both the economy and wider society is recognised. We will continue to take this work forward in collaboration with other environmental organisations and professional bodies.

This will be my last policy update as (by the time you are reading this) I have now left CIEEM. I would like to take the opportunity to thank all of our policy volunteers and members who support our policy work and I wish you and the Policy team all the best in your endeavors!

All of our briefings and consultation responses can be found in our Resource Hub (www.cieem.net/resources-hub) under 'Policy Resources'.

Contact the CIEEM Policy team at:
policy@cieem.net

CIEEM is grateful to the following organisations for investing in our policy engagement activities:

ARCADIS Design & Consultancy for natural and built assets
RSK biocensus EXPERTS IN ECOLOGY
EPR ECOLOGICAL EXPERTISE, EVOLVED
Stantec

Obituary: Dr Julie A. Fossitt

Richard Nairn and Katharine Duff MCIEEM

Julie Fossitt, BMod, PhD, FCIEEM, who died in August 2022 aged 57, was best known as the author of the key reference work, *A Guide to Habitats in Ireland* (Fossitt 2000). This established, for the first time, clear definitions and codes and became the standard reference used to identify, describe and classify habitats in the island of Ireland.

Julie was born and grew up on a farm in County Offaly, surrounded by the raised bogs that she loved. She received a primary degree in botany from Trinity College Dublin where she developed a lifelong interest in vegetation history, as revealed by the remains preserved in peat bogs. She moved to Cambridge University where she completed a PhD and then worked as a postdoctoral researcher with Dr Keith Bennett. Her publications on the history of vegetation of Ireland and Britain established authoritatively for the first time the ancient changes in woodland and peatland along the western seaboard from Donegal to the Western Isles, linking with work by other colleagues. She used pollen analyses and radiocarbon dating of cores taken from sediment in small lochs. She also studied the remains of trees preserved in the blanket peats of the region, work that she continued in recent years. Julie was an inveterate and enthusiastic fieldworker, in all landscapes and weathers, walking many miles across wild landscapes searching for suitable lochs and tree remains.

In the late 1990s she returned to Ireland where she was commissioned by the Irish Heritage Council to prepare the new classification and guide to habitats, which is still widely used. In the early 2000s she worked as an ecologist with Natura Consultants and was then appointed as a Divisional Ecologist with the National Parks and Wildlife Service in the west of Ireland. For almost 20 years she was known for her command of the EU laws protecting nature and for her courage in standing up to vested interests who wanted to ignore them. She also found time in her busy life to inspire young ecologists with her knowledge and integrity. She was recently elected as a Fellow of CIEEM in recognition of her contribution to ecology. This showed how much she was valued by her friends and colleagues and how important her contribution has been. She will be remembered for her courage, humour and loyal friendship as well as her dedicated commitment to nature conservation in Ireland.

Ethical Dilemmas

This is our series of problems and conundrums that can face members during their professional practice. The purpose of the feature is to encourage you to reflect on and explore scenarios that you may face during the course of your work and to consider the appropriate ways to respond to ensure compliance with the *Code of Professional Conduct*.

In the September 2022 issue of *In Practice* we described a situation where you are a newly promoted ecologist working under a new line manager. Not yet confident in your role, you are keen to impress and demonstrate your potential. In one of your first assignments, you undertook a Preliminary Ecological Appraisal (PEA) for a proposed development site. You found that there are a combination of factors which would make it impossible to adequately avoid, mitigate or compensate for the direct and indirect impacts on protected sites and species. These are varied but include falling within very close proximity to a Special Protection Area, where the best available evidence suggests that impacts cannot be avoided. As a result, your PEA highlighted the considerable constraints and clearly states that even with additional survey work, which would be necessary to inform any subsequent planning application, it may not be possible to identify measures sufficient to offset the impacts to the satisfaction of the decision-maker.

You had submitted your report to your manager for quality assurance and sign off, but your manager requested that you amend your report to focus on avoidance, mitigation and compensation suggestions, noting the need for additional surveys and removing some of the emphasis on the considerable constraints of the site.

Your manager strongly disagreed with your suggestion to advise the client that it may not be possible to offset the impacts and indicated that they will not sign off a report with this conclusion. We asked what you thought you should do in this situation.

Our thoughts

As a member of CIEEM, your professional judgement and integrity are very important and feature prominently in the Code of Conduct. This situation is awkward and may feel very difficult to address given your lack of experience and confidence in the new role. However, whilst it is sensible to check your conclusions with another trusted colleague or mentor, you should not comply with your manager's request automatically.

Assuming you remain convinced that your conclusions are correct, you should discuss the case with your line manager, setting out your rationale and asking them to explain their conclusion. It should become clearer whether their issue is with your conclusion or with the way you have communicated it. The discussion may reveal areas where compromise could be acceptable and enable you to identify a resolution which does not leave you in conflict with the Code. You should take the necessary time (and maybe advice) to properly consider any compromise.

There are a number of relevant considerations to explore with your manager. These include, but aren't limited to:

- The PEA is a client facing document and should be used to set out the level of risk and highlight issues which need further consideration and survey should the plans progress. It is therefore critical that it is a wholly accurate account of the survey and your conclusions from it.
- The moral acceptability of advising a client to commission further survey work where the best available evidence suggests it will not be possible to avoid and mitigate the impacts.
- Potential to advise the client to seek pre-application advice from the Statutory Nature Conservation Organisation and/or Local Planning Authority prior to commissioning any further survey work.
- Include information about the Habitats Regulations and the stepwise assessment process. Although you should step back from drawing any definitive conclusions, highlight the possible risks, e.g. project delay, challenge or refusal if the relevant tests cannot be met.

If, after this discussion, you have not been able to identify a compromise form of words which enables your manager to sign off the report without deviating from your professional opinion, you may wish to consider using your organisation's whistleblowing policy. This situation raises key questions of business ethics which could have reputational impacts for both the business and you – advising further survey work if there is little or no chance of achieving planning permission is very poor practice, as is altering another person's work without appropriate justification. If a public inquiry were to result in this case, you could be asked to defend proposals which you believe are indefensible – an ill-advised situation for both you and your employer.

Where these efforts have not led to resolution, you may need to request that you are named as undertaking the baseline survey, but not as author of the report. Your professional integrity and judgement will underpin your reputation: any resolution must respect that.

The next dilemma

As a level 2 Bat licence holder you are commissioned by a person renovating a barn into a new home for his family to undertake a bat survey of the premises. He has been told of the requirement by the council. You are sent photos of the premises in the tender process. The client accepts the tender but states there is no wildlife within the premises.

On arrival with a colleague, you meet the owner's partner. On looking at the barn you see immediately that it is likely to need further bat surveys as there are key features evident.

You then complete the inspection with your colleague and conclude that the building has moderate potential to support roosting bats due to gaps beneath lots of the roofing tiles, a small number of gaps leading behind the wooden boarding below the roofing overhang and missing mortar on a hip tile. These features all provide opportunities to crevice dwelling bat species.

The next day you write to the owner informing them of this. He responds by stating that he no longer wishes to employ you and will only pay for the fieldwork element and that he thinks that the stated potential for bats is simply a ruse to take more money from him.

How do you respond to this? How might you have dealt with this client differently? What is the professional approach to ensure that appropriate surveys are indeed undertaken of the premises?

Complaints Update

Breaches of the *Code of Professional Conduct*

At two professional conduct hearings held on 20 October 2022 Ms Elizabeth Kenyon was found in breach of clauses 3, 4, 6 and 10 of the *Code of Professional Conduct* in respect of her ecological survey, assessment and reporting work and her supervision of others. Ms Kenyon has been reprimanded with sanctions as regards to improving her standard of work. Ms Kenyon has resigned her membership.

Social Media Advice Note

Sue Bell CEnv FCIEEM and Ellie Strike CEnv MCIEEM
Professional Standards Committee, CIEEM

CIEEM has published a new Advice Note for all members on the use of social media. It has been produced as a result of concern from the Professional Standards Committee of the rising prevalence of social media issues in professional conduct inquiries.

In the Advice Note we talk about the use of social media platforms in a professional capacity. However, it is worth noting that even when posting in a personal capacity, this can still have potential impacts for members professionally, especially where there is crossover between personal and professional networks.

Social media in this Advice Note refers to all the publicly available digital platforms that are used for social networking, and to create and share content publicly online, such as LinkedIn, Facebook, Instagram and Twitter.

Why use social media as a professional?

Social media can have many benefits for our profession, for individuals, for organisations and indeed for CIEEM. As an individual effective use of social media can enable you to:

- Raise your personal professional profile, and/or that of your organisation and CIEEM
- Raise the profile of our profession as a whole
- Build your professional networks
- Develop and share professional skills and knowledge
- Share, and have improved awareness of events, projects/initiatives, and job/development opportunities
- Share ideas and get involved in conversations relevant to your profession

Because of all of this, we actively support our membership to make good use of social media. It is an important form of communication and carries some very real benefits when used appropriately.

The Advice Note describes some of the potential pitfalls of using social media and covers the following areas and key messages:

- Consideration of why you are posting on social media. Being clear on the reason will enable you to post with clarity, consistency and achieve the intended impact.
- The importance of understanding who your intended audience is and the risk of unintended recipients. Once your post is in the public domain it is hard to take back and may be viewed more widely than you intended.
- The need to avoid blurring the lines between your personal and professional lives. You are more likely to project a strong and professional image if your posts are all related (albeit loosely), to professional matters. This may be easier to achieve if you have separate personal and professional accounts.
- Your choice of social media platform. It is generally accepted that different social media platforms tend to lend themselves to different types of messaging.
- The use of privacy and safety settings. If you are using social media to boost your professional profile, you may wish to minimise the privacy settings. However, you should not rely on privacy settings when writing a post.
- Following your organisation's social media policy if one exists. Members should remember that they are still representing their organisation if their place of work is stated in their profile or posts.

What are you posting?

The content you share on social media can vary hugely, from short posts to longer articles, blogs/vlogs and sharing other people's content. It may be opinion or based in fact. The Advice Note emphasises the need to think about content – both in terms of your intent, and in terms of how it might be perceived by others. Being discrete and not posting confidential information is key.

You should also employ courtesy and respect in posts. The informality and immediacy of social media can lead to individuals being more blunt and less polite than they would usually be in face-to-face conversations. It is also important that you avoid making defamatory or potentially libellous comments or be interpreted as harassing or bullying behaviour.

Avoid judging others. CIEEM has been notified of instances where one member has commented unfavourably on work undertaken by other members of the profession. All members have a duty, under the Code of Professional Conduct, to uphold the reputation of the profession, not bring the profession into disrepute, and protect the public interest. As such, the Institute supports members in identifying instances of poor professional practice. However, the correct procedure is to raise a complaint with the Institute, rather than instigate a trial by social media. Rarely will the person commenting be in possession of the full facts and context for the survey on which they are commenting. As such, their observations may be unfair and not supported by the circumstances. It is worth noting that by acting unprofessionally in a public forum, such as social media, you may find yourself on the receiving end of a complaint.

The Advice Note has been written on behalf of CIEEM by Sue Bell CEcol CEnv FCIEEM and Eleanor Strike CEnv MCIEEM and is available to download (https://cieem.net/resource/social-media-advice-note/).

From the Country Project Officers

Elizabeth O'Reilly – Ireland Project Officer

Nollaig Shona Dhuit / Merry Christmas

On behalf of the Irish Section Committee, I would like to wish you all a good Christmas season. Hopefully everyone can get a well-deserved break with your family and friends. Over the last few months, we were delighted to have offered a series of successful events here in Ireland. We heard from birdwatch Ireland on the best way to use I-WeBS data, the Environmental Protection Agency updated us on the Land Use Evidence Review and we got an insight into the behaviour change mechanisms involved in climate action from a behavioural psychologist. These events are all recorded and available to rewatch for free, just email me to get the links.

We also ran student career events in UCC and Queens. I would like to extend a huge thank you to our members who participated in these events, they are invaluable to promoting our sector and supporting the next generation of ecologists.

As we head to the end of the year, organisation of our Annual Irish Section Conference is under way. The 2023 theme is 'Aiming for a Nature Positive Ireland' and our Call for Papers will be open soon! Have a look on our website for more information and we would be delighted to hear from you.

So, as we close off 2022, I would like to thank everyone for their input, engagement and membership of the CIEEM Irish Section. It was a pleasure working with you all and I look forward to 2023 and the exciting developments ahead.

Merry Christmas and Happy New Year!

Liz

Contact Elizabeth at:
Elizabeth@cieem.net

Mandy Marsh – Wales Project Officer

S'mae pawb/Hello everyone

After a summer lull, the Wales Member Network Committee is hard at work producing a programme of autumn and winter events. I started this role in the middle of a lockdown and have had little opportunity to get out and meet members, so it was great to get out recently on a guided walk, led by Robert Duff, to see the great work done on the LIFE Mosses project on the Wales/England border. We also hosted a fascinating talk on Sound ID of small mammals. Keep an eye out on our website for future events, and don't forget that CIEEM members can access all past recorded talks – just email me for details. By the time you read this I will have had a stand at the Cofnod conference on 10 November 2022. Hopefully I will have seen some of you there!

We are hoping next year's Wales conference will be in Cardiff – our first in-person conference for three years. We are working with CIEEM's Marine and Coastal Special Interest Group on a marine theme, so please keep an eye out for the Call for Papers.

As always, a big thank you to all our volunteers and speakers – CIEEM really couldn't do what it does without you. There is currently no one from Wales sitting on the *In Practice* Editorial Board or our Student Focus Group, so we'd be delighted to hear from you if this interests you.

Nadolig Llawen a Blwyddyn Newydd Dda / Merry Christmas and Happy New Year

Mandy

Contact Mandy at:
MandyMarsh@cieem.net

Annie Robinson – Scotland Project Officer

Merry Christmas and a Happy New Year to you all

What a busy year it has been with events, policy work, career events, training and conferences. It is great to be doing even more joint events with partner organisations.

Since the September *In Practice*, we have had four member network events and the Autumn Conference. See the Member Network News pages (pages 74-75) for a write-up on Urban Green Infrastructure in Action event. We look forward to visiting more GI sites in the spring.

This was followed by a policy event on National Parks which CIEEM co-hosted with the British Ecological Society's Scottish Policy Group. Thanks to all the speakers for their reflections and insights which stimulated lots of debate among a really engaged cross sectoral audience and fantastic timing with the National Parks consultation opening on the same day. Thanks also to CIEEM Scotland Policy Group and Scottish Section Committee members who facilitated the breakout sessions. A blog and report from the event is on the CIEEM website.

We hope you have enjoyed the events on offer in 2022, and we look forward to seeing you at more events both online and in-person in 2023. Finally, I would like to say a huge thanks to all our volunteer members across Scotland who contribute so much time and enthusiasm, and to everyone for their continued support, engagement, and membership of the Scottish Section.

I hope you all have a restful and enjoyable festive period.

Thanks, Annie

Contact Annie at:
AnnieRobinson@cieem.net

It Is All About You

Craig Willcock
Professional Development Manager, CIEEM

New Year is a great time to focus on you and your goals for the year.

Maybe you are looking at changing your role, seeking a promotion, applying for membership or perhaps you are looking at expanding your knowledge and upskilling. Whatever your goal may be, focussing on your Continuing Professional Development (CPD), is key to helping you achieve your potential.

CPD helps you maintain and improve your knowledge and skills, and develop the personal qualities required in your professional life. With changes to laws and policies, new working practices and technology, maintaining your CPD ensures that you are fulfilling the needs of your role and keeping up to date with the latest developments in the sector.

The CIEEM training programme provides a great opportunity to undertake structured CPD. The programme features a range of courses for members and non-members from beginner to advanced level on a variety of topics.

Each course is aligned to the CIEEM Competency Framework, which sets out the range of competencies relevant for people working in the sector and sets the levels required for different roles and membership grades. This enables you to identify the competences required for specific roles so that you can plan your CPD.

The courses are delivered by trainers with specialist skills and expert knowledge. The programme includes in-person field based practical courses, classroom-based courses and courses delivered online. In addition, CIEEM can tailor bespoke courses for you and your team.

Some upcoming highlights over the next few months include:

- **Preliminary Ecological Appraisal (09:30-13:00 on 10 & 11 January)**
  Delivered online by Mike Dean CEcol CEnv FCIEEM. This course will focus on providing an introduction to the process of Preliminary Ecological Appraisals (PEA). The course will equip delegates with an understanding of the purpose of PEA; how to set an appropriate scope of work for PEA in different scenarios; being able to differentiate between PEA and Ecological Impact Assessment (EcIA); and to make proportionate recommendations for design changes, further survey, mitigation and enhancement in different scenarios.
- **Positive Planning for Biodiversity (10:00-13:00 on 24 & 31 January)**
  Delivered online by Sarah Dale MCIEEM. This course discusses legal compliance, best practice approaches and policy compliance. The course will equip delegates with an understanding of what is required for ecological surveys, mitigation and reports to comply with legislation, policy and good practice; the function of protected species licensing in the development process and the requirements for a protected species license; understanding the requirement for Habitat Regulations Assessments and Appropriate Assessments; application of biodiversity net gain in the development planning process; how biodiversity obligations can be secured and enforced the planning process and some of the challenges involved.
- **Train the Trainer for Ecologists (30 & 31 January, London)**
  This unique two-day training course, which is delivered by Paul Losse, has been created to support ecologists and environmental professionals in developing techniques for designing and delivering field and classroom-based training courses. The training course is suitable for experienced trainers wishing to enhance their skills, as well as for those new to training wanting guidance in achieving a professional standard of tuition.
- **Beginners QGIS for Ecologists and Conservation Practitioners (Ireland)**
  (9 & 10 February, Ireland)
  This course, delivered by George Smith, introduces you to the open source (free) QGIS software which is now an industry standard in the ecological, conservation and consultancy sectors. It is suitable for complete beginners to GIS. The course is designed to enable you to become a competent GIS operator with a practical focus on producing survey maps and analysing data derived from your surveys.
- **Red Squirrel Ecology and Surveys (8 & 9 March, Scotland)**
  This two day training course, which is delivered by Adrian Davis, will provide an introduction to red squirrel behaviour and ecology with scientific research papers and actual site visits to see and witness red squirrel behaviour and ecology. Delegates will learn to identify the characteristics of main habitats during the winter months and plan surveys for the following summer season. This will involve excursions (weather permitting) to a range of red squirrel habitats. Methods of appraisal for ecological habitat assessment in relation to red squirrels and appropriate land management is discussed and debated.

Early Careers Training Programme

At the end of October, our second intake of the Early Careers Training Programme began in Birmingham with 16 participants from across the sector, the UK and Republic of Ireland. If you would like to be part of the Spring 2023 intake, or would like further information, please email us at training@cieem.net.

To view a full list of training courses we have to offer visit www.cieem.net/events

The STEM Ambassador Programme

The twin environmental crises we are facing of biodiversity loss and climate change mean that the work of those in the sector is ever more important. However, the sector is often invisible to young people, especially if they lack a role model or are not aware of the opportunities available.

To address this, last month CIEEM launched the Green Jobs for Nature website (www.greenjobsfornature.org) to raise awareness of the roles available, skills needed, and how to get a job in the sector (see more on page 58).

As part of this outreach, we are working with STEM Learning to raise the profile of careers in ecology and environmental management amongst secondary school pupils to help attract more young people into the sector and to help address the future skills gap.

We are encouraging CIEEM members and those working in the sector, to sign up to become a STEM Ambassador to increase the representation of ecologists and environmental managers and help inspire the next generation.

Across the UK there are over 37,000 STEM Ambassadors working with young people to raise the profile of careers in Science, Technology, Engineering and Mathematics (STEM). However as just 1% of these are working in the ecology and environmental management sector; our sector is vastly underrepresented.

STEM Ambassadors are positive role models who give their time and enthusiasm for free to help bring STEM subjects to life. They do this by sharing knowledge and experience to help inspire others. STEM Ambassadors work with schools, colleges, youth and community groups to inspire young people and make them aware of the range of opportunities and career pathways available.

Since September 2021, STEM Ambassadors in the sector have undertaken over 90 activities to almost 10,000 participants, volunteering over 320 hours. During this period, 271 schools have been engaged including 46 primary, 166 secondary, 20 further education and 39 others.

STEM Ambassadors visit or host primary and secondary schools, colleges, youth and community organisations; show how STEM subjects apply in the real world; and share knowledge and experience to help inspire others. They take part in and deliver a range of in-person and online activities including: career fairs and talks, practical workshops, host school trips, after school clubs, judge school STEM competitions, take specialist equipment into schools, provide mentoring support, assist with mock job interviews and CV writing, create short videos about their job to help bring it to life, and deliver CPD sessions for teachers to help upskill them.

STEM Ambassadors include people from a range of disciplines and backgrounds, who bring a new and inspiring perspective to STEM lessons and career opportunities.

You would be required to undertake at least one activity a year. Typically, many Ambassadors decide to do more, but it is based on your flexibility and what your volunteering commitment is. You can volunteer for one hour, a few hours or more, weekly or monthly to fit around your own work and home commitments. It is as flexible as you need it to be allowing you to volunteer in a way that suits you. Even if you volunteered for just one hour; that hour could inspire a young person into STEM in their future.

Benefits to you:

- Receive training and support from STEM learning
- Free access to the Stem Ambassador Community to collaborate with others, share ideas and best practice, top tips,
- Support from your regional STEM Ambassador Hub
- Meet other STEM Ambassadors at local events
- Meet others outside of the sector
- Develop new skills and enhance existing skills
- Gain confidence in delivering activities to groups and new audiences
- Add experience to your CV
- Gain valuable CPD through volunteering

There is a wealth of support for STEM Ambassadors from the regional Ambassador Hubs who coordinate volunteering opportunities across the UK and provide a local point of contact for you where you can also meet other local Ambassadors. The STEM Learning website has a wealth of resources including top tips, downloads and templates. There are various free online training courses to help develop specific skills available.

Interested?

If this sounds like you, and you are interested in the next steps, have a look at https://cieem.net/ /how-to-become-a-stem-ambassador/. If you are an employer, you too could take part and benefit from being part of the STEM Ambassador Programme. Find out more at https://cieem.net/stem-benefits-for-employers/.

Membership Update

A Record-Breaking Subscription Year – But With It Comes Challenges

Eurasian tree sparrows (*Passer montanus*).

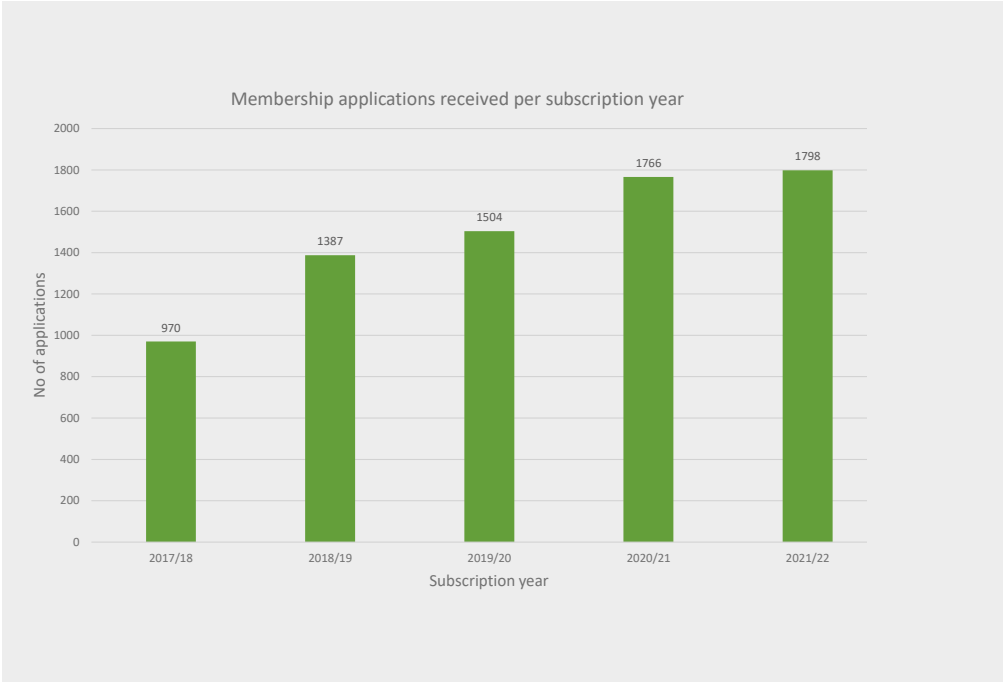
Stuart Parks
Head of Membership and Marketing, CIEEM

Thanks to the necessary lead times and copy deadlines I am writing this on a crisp October day, just as we have come to the end of the 2021/22 membership subscription year. This means that I am also busily collating data about how that year has gone to report to the Governing Board and, of no less importance, to you. And what a year it has turned out to be.

For the second consecutive year we have received a record number of applications to be processed – from aspiring new members and from upgrading current members. The chart below shows the growth in applications processed over each of the last five subscription years, with an average of 150 applications coming in per month in the last year.

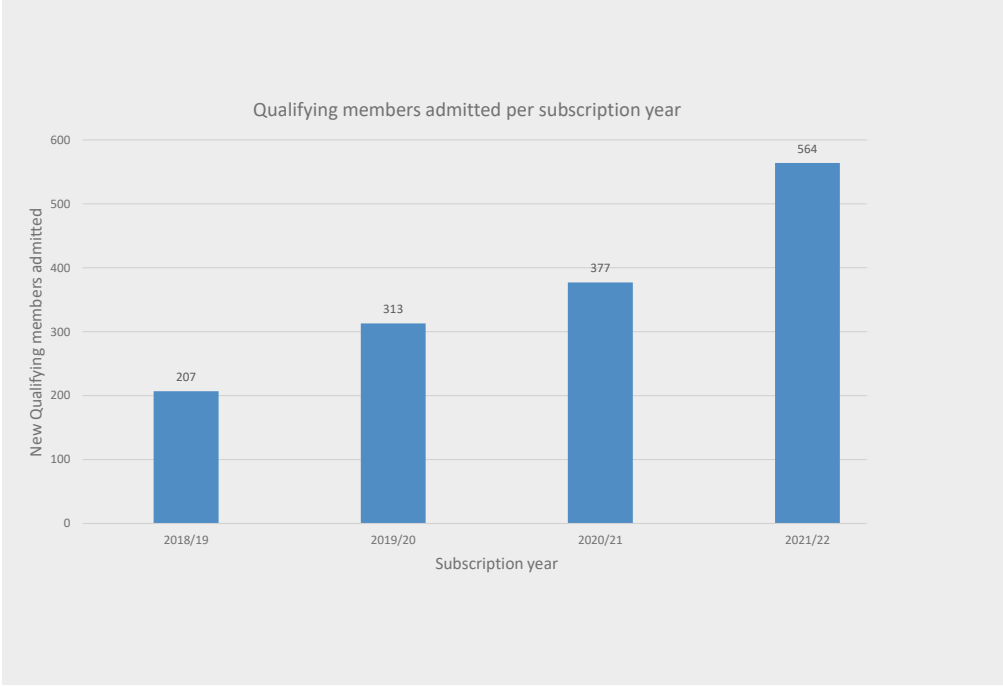
It's also very pleasing to report that yearly applications to the Qualifying membership grade have more than doubled since it was introduced in 2018. The aim of this grade is very much to allow more straightforward access to the benefits of membership and the support of other members for new professionals at the earliest stages of their career.

For me, and I hope for many of you, these figures are a real source of pride in CIEEM and what we as a membership body are achieving together in welcoming, supporting, developing and rewarding professional ecologists and environmental managers – both those new to the sector and those whose careers are better established. I am also very proud of the continuing work of the small but dedicated membership team and the amazing group of volunteer assessors without whom membership applications (perhaps even yours) could not have been processed.



But with all this success comes pressure and, inevitably, some challenges. The sheer volume of applications we have received has really tested the systems and processes we currently have in place. In some cases this will have led to the timeframe for processing applications to become a member or to upgrade an existing membership to have been longer than we would like. We totally understand the frustration this causes and, believe me, we feel that frustration too! So in response we have been developing smoother and much less administratively burdensome processes for some of our early membership grades. In addition, we have already started working with colleagues in the Secretariat and also our governance committees to explore other ways in which professional competence can be evidenced. We have also taken steps to increase the all-important volunteer pool needed to process higher grade applications. We hope that these actions will help us to reduce the timeframe taken to process applications going forward.

So what next? Two consecutive years of record numbers of applications has been a very welcome challenge to rise to. However, the risk of being so busy just processing is that we lose the important time needed to get to know you better. Over the coming months, the membership team will be focusing more attention on revisiting how we communicate with you, reviewing what we know about you now, identifying what we need to know about you in the future, and asking what you need from your membership. The Membership Operations Manager, Sarah



Cox, will be returning from a period of maternity leave to a new role within CIEEM, so we'll also be welcoming new team members to help us look at what we do with some fresh eyes and take this development work forward.

It does feel like an exciting year ahead. And what about you? How can you help to make your membership experience, and that of your peers, a better one?

- Let's start easy – respond. We'll be asking you to tell us more about you. We promise not to do it too often and we'll aim to do it at a sensible time. But when we do, please take the time to respond as it really does help to shape our work.
- Also not too challenging – advocate. Talk to non-members about joining. Offer to be a sponsor or a mentor. Find out more about inspiring the next generation and maybe become a STEM Ambassador or submit a role profile for our website.
- Finally, and maybe needs a bit more thought – muck in! Think about whether you could find some time to be a volunteer assessor and share the load. If not, consider being more active in your local Member Network to make your membership experience, and that of members in your area, a better one.

For more information, contact the team at Membership@cieem.net.

International Focus

Human Wildlife Conflict and Co-Existence

Zebras in Nairobi National Park, with Nairobi city in the background.

Corin Simmonds
CEcol MCIEEM
SLR Consulting

With the ever-increasing need for land to provide housing, infrastructure and agriculture and the shrinking of natural areas, people and animals are increasingly coming into conflict over space and food. Human–wildlife conflict (HWC) occurs when the needs and behaviour of wildlife impact negatively on humans or when humans negatively affect the needs of wildlife. Some of these conflicts are real and can result in loss of life and livelihoods but there is also often a perceived threat that is actually greater than the real threat.

When engaged in a development project it is important that consultants are aware of any existing conflicts and the potential for the project to create or exacerbate HWC. New developments may restrict species movement or fragment habitats forcing fauna into new areas, or food resources may become scarcer and competition higher leading to expansion of territories. Collaboration with social advisors helps with early identification of conflict and the communities or groups that are more likely to be affected.

Common types of conflict are crop damage or damage to land, livestock predation, disease transmission and killing or injury of people and/or wildlife. Responses to these issues is often persecution of the fauna causing the damage but other techniques can be employed including fencing, live guarding and scaring.

As these interactions become more and more common it is important that the narrative changes from one of conflict between people and wildlife to that of co-existence. There needs to be less reliance on out-dated methods of capture and removal and a more holistic approach and use of evidence-based practice to provide solutions. Education and awareness raising are key but can only be successful if communities feel that have a voice and can see that their concerns are being addressed.

It can often be the case that communities located near wildlife

hotspots do not receive the benefits but are at the forefront of HWC. For example, farming communities around national parks may not benefit from the tourism generated. Involving these communities in management decisions, land use planning and linking them with the economic benefits can be beneficial. There are good examples of local communities being involved in camera trapping studies to gather baseline data. The studies were set up in a way that incentivised engagement through a rewards-based programme, which not only delivered good data but developed a greater appreciation of the wildlife encountered.

Approaches need to be tailored to the situation and there is not a one size fits all solution but there are universal principles of inclusion, engagement and education which should form the basis of all examples of human wildlife conflict resolution.

Case study

An energy producer based in West Africa has an ongoing HWC issue between forest elephants (*Loxodonta cyclotis*) and both local farming communities and project staff. The project has been in place and expanding since the 1970s and therefore some of the infrastructure is outdated. This has resulted in inadequate food and waste management systems which entices elephants into the camps and additional crop raiding at neighbouring communities. As biodiversity advisors for the project, we were tasked with updating the operational biodiversity actions of which HWC was a major part. We engaged with local communities and conservation organisations to identify the main issues, locations and agree on priority actions. The first action was to upgrade and modernise the waste management facilities, including fenced and lockable waste stores and to produce waste management and food storage procedures for all staff to follow. The second stage was to engage communities in land use planning to understand those areas that should be developed for agriculture and those areas where agricultural is discouraged and movement of elephants allowed, based on an understanding of elephant movement corridors. As part of this operation, discussions were in place regarding the supply of certified agricultural products to the project to encourage sustainable farming and discourage conversion of natural habitat to agriculture in higher risk areas. Monitoring of forest elephants in this area is ongoing and results will help develop further plans to manage HWC in this sensitive ecosystem.

Elephant tracks

Brown bear

British Ecological Society

Opening School Doors to Nature

Davy Falkner, Charlotte Harrison – Littlefield, Sammy Mason, Alexa Roditi

Over the past 12 months, the British Ecological Society (BES) has been delivering a green transformation to primary schools in North-East England, planting wildflowers, creating hedgehog highways and setting up camera traps to connect school children to nature.

Our understanding of the importance of being connected to nature is ever-growing, with children in particular benefiting from improved health and well-being, alongside positive changes in attitudes and behaviour towards the environment.

Yet the opportunities for children to connect to nature are decreasing.

Across the UK, four out of five children grow up disconnected from nature. A 2019 Natural England study found that children in North-East England spend less time outdoors than anywhere else in the country – an issue largely attributed to the low socio-economic profile of the region.

Delivering a green transformation

The 'Connecting schools to nature in North-East England' project aims to improve 10,000 school children's connection to nature across 47 primary schools in disadvantaged and isolated areas of the North-East of England, covering County Durham, North Yorkshire, the Scottish borders and into the Pennines.

Delivered by the BES – in partnership with citizen science organisation MammalWeb and engagement charity SMASH-UK – this project is one of 90 nature projects across England to have been awarded funding from the Government's multi-million pound Green Recovery Challenge Fund aiming to boost green jobs and nature recovery.

The project has been opening the doors to nature in school grounds through wildlife-friendly activities such as planting wildflowers, building hedgehog-highways, and installing insect hotels and camera traps to allow children to discover and monitor the wildlife in their schools. An online learning portal developed for the project has given school children and teachers the opportunity to track their achievements and aid learning.

Recently, nest boxes and feeding stations have been installed in schools. Children have been given the opportunity to use binoculars and field guides to conduct bird watches in their schools, identifying and learning about different species while contributing to future scientific research.

By providing a green transformation to school grounds in disadvantaged areas, these activities and workshops have been revealing the benefits of nature to those currently least able to access them.

Speaking to the BES outreach team, Michelle Trotter, a teacher at Dunn Street Primary said: *"This has changed the way our children look after our environment. Children regularly ask for the litter pickers and to look after our hedgehogs daily. They are excited to learn and to know more about the natural world. I have shown camera trap images to the whole school and staff who were blown away with what we found."*

A lasting difference

The BES has also provided ecology training to teachers across the region through delivering workshops across the partner schools. As well as upskilling >70 volunteers who have been assisting teachers to deliver biodiversity enhancements to school grounds.

Sammy Mason, Outreach Project Officer at the BES, remarked on the lasting legacy this project will have not only on school grounds but on the careers and futures of those involved: *"Helping to develop the environmental educators of tomorrow is such an exciting prospect, and vital as we emerge from a pandemic. This project is helping scores of ecologists and educators bridge the COVID skills gap, supporting young individuals as they enter the job market and pursue diverse career paths within the environmental sciences."*

Figure 1. The British Ecological Society's connecting schools to nature project gave children and teachers the opportunity to get out and explore nature.

Figure 2. The British Ecological Society outreach team helped children at a local primary school in County Durham investigate nature.

If you would like to take part or support the project in any way, please get in touch with Outreach@britishecologicalsociety.org

From the CIEEM Patrons

Dampening the Swings

Roger Crofts FCIEEM

Whenever there is a crisis which affects government finances and the money in people's pockets, we hear the siren calls to stop spending money on the environment. Unfortunately, this has been a constant call over the decades since the seminal global agreements collectively known as the Rio Accords. Yet, stop/start mentality is not what nature and indeed human society needs to survive as it ignores the fact that caring for the environment is a long-term matter.

Let's face the fact that even when working with nature seems to be the order of the day, it is based on fundamental misunderstandings of the environment and the way that the processes of nature work.

There are many examples. In his recent book – *A Trillion Trees* – Fred Pearce provides a forensic analysis of forestry around the world. Take for example the mad dash to plant more trees with government incentives on the grounds that they will have a beneficial effect on climate change by sequestering carbon. When I travel around Scotland or read about what is happening in other parts of the world, I see a disconnect between action and nature. What species are we using? Non-native of course, whether it is Eucalyptus in Portugal or Sitka spruce in Scotland, when there are plenty of native species which scientists tell us would do a better job. And incentives, favourable to commercial growers, are readily provided from government funds. Why is this? One view is that the commercial timber industry has most of the power as it creates jobs and provides useful products for the construction industry in order to achieve house building targets and reduce timber imports. But the industrial techniques result in loss of carbon, soil and nutrients. More significantly the producers have no notion of natural capital and how they are squandering a priceless, long-term asset.

The same can be said about demands to increase local food supply through intensification and land reclamation, and to produce more energy from non-renewable sources by fracking and re-opening more fields in the North Sea. International markets and short-term shifts in approach by governments seem to rule the day.

I have a simple adage: *"Stop the wild oscillation of the pendulum of allocating public money."* What do I mean? And what should ecologists and environmental managers be doing about it?

We should be arguing for long-term thinking and its application to strategies and policies and their supporting financial instruments. It is therefore about us influencing resource using sectors and the government departments that sponsor them.

We need to take a forward-looking view of our world from the other end of our telescope. We should think about how we are to provide the energy we need in the most environmentally sensitive manner possible, how we should be planning the future of transportation and how we envisage feeding our ever-increasing population.

You might say we are powerless to influence these major decisions. We should extend our influence further in who we work with. Our power base has increased enormously as we have expanded as a professional membership organisation and as we have worked with those with similar objectives. We have increasingly recognised the need to have meaningful dialogues with those of opposing values and approaches. The more we work at a professional level with economists and business analysts, with development planners, and with transport engineers, for example, hopefully the more they will understand our approach and we will increase our influence professionally.

We need to take our message into government even more effectively. It is about engaging with those in the seats of real power, such as the Cabinet Office and the Treasury, political advisers and think tanks, as well as the environmental advisors.

Put simply, our role is to help to dampen the wild swings of the pendulum on environmental policy and resourcing. As a professional chartered institute, we have more power than we might imagine. Let's learn even more how to lever greater influence by assessing how other chartered institutes operate to promote their profession and influence the agenda. In the process we can begin to educate others on better practices favouring nature.

About the Author

Professor Roger Crofts CBE FRSE FCIEEM spent his career within the public sector as a research worker, as a Government adviser and administrator, and as the leader of a major public body. He is now an environmental strategy and policy adviser, charity volunteer, writer and speaker working in Scotland, Iceland and around Europe.

By Members For Members

Welcoming New Committee Members

It's a very warm CIEEM welcome to our new Committee Members. And there's still time to join a Member Network or Special Interest Group (SIG) as a volunteer.

At the time of writing, our 2022 election season is about to kick off, and CIEEM would like to thank all nominees who applied to join a Geographic Member Network Section. You are amazing, and a much needed glimmer of hope at a time when the UK Government appears to be undermining nature protections!

Full disclosure, I'm a touch emotional while writing this, regarding the dire situation we find ourselves in as the UK Government announces policies and plans that would undermine protections for nature and the environment. However, I can honestly say that it is always a real pleasure to be welcoming new volunteers on our Member Network committees, and it is fantastic to see that there is so much support out there for engaging with CIEEM members and supporters on a local level. Right now, it would seem that encouraging networking, problem sharing and reminding the sector of some of the conservation and environmental management success stories is going to be vital going forward. It is a stressful and worrying time to be part of this sector, as well as for those who are thinking about joining it. Together though, we can help to navigate through it. We are all one team working for a cleaner, greener world, richer in nature. With our collective knowledge, skills and expertise, as well as a hard-wired passion for nature, we will continue to fight for nature.

It is not too late to join as a volunteer on a Member Network committee either, as you can be co-opted onto a committee for up to a year before needing to be formally elected. All of our current volunteer opportunities, along with what they would involve, can be found in the MyCIEEM area of our website. Don't forget, you can also be co-opted onto a SIG committee at any time, and formally elected by the existing committee. Please get involved if you can. Below is just a small slice of what our member groups have been up to recently.

Drew Lyness
Volunteer Engagement Officer, CIEEM

West Midlands Geographic Section

Led by Andrew Nixon, Head of Conservation, Herefordshire Wildlife Trust, the West Midlands Member Network visited Bodenham Lake. A site where over 170 bird species have been recorded (including kingfisher, hobby and the nationally scarce lesser spotted woodpecker), and otters are regularly spotted too. They then headed to a bustling Oak Tree Farm, where much was underway at present and the machines were in operation. The wetland designs at the Oak Tree Farm site included the creation of a series of scrapes, which will hold rain and flood water seasonally and support a wide variety of insects. This habitat creation will form an important area for breeding wetland birds and their chicks. The wetland will also have a permanent pool perfect for toads and dragonflies. After a relaxing lunch at Queenswood Country Park (a site featuring a 47-acre tree collection with over 1,200 rare and exotic trees from all over the world), the group moved on to Derndale ponds, a fascinating habitat restoration project.

Photos by Stephen West.

Scotland Geographic Section

Urban Green Infrastructure in Action

CIEEM's Scottish Member Network arranged a joint site visit with NatureScot to two of the sites funded by the European Regional Development Fund (ERDF) Green Infrastructure Fund (GIF), which NatureScot leads on behalf of the Scottish Government. GIF funds multifunctional green infrastructure in some of Scotland's most deprived urban areas and the two sites we visited are excellent examples. Both are Local Nature Reserves which, in addition to the contribution they're making to nature conservation are improving health and wellbeing, providing space for outdoor learning and opportunities for people to get involved in multiple ways.

Karen Smith, Countryside Ranger with South Lanarkshire Council, showed us around Fernbrae Meadows and how the site has been transformed from a fenced off and disused former golf course to an amazing multifunctional greenspace at the heart of the community. We were fascinated to see at first-hand what a difference the site is making to the local area, from reducing flood risk and providing habitat for biodiversity, to providing a safe space for people to experience nature, and wider connections for people and wildlife to adjacent greenspaces including nearby Cathkin Braes and the 'Magnificent 11' walking route.

After enjoying an outdoor lunchbreak in one of Fernbrae's outdoor learning areas, we moved on to the Claypits Local Nature Reserve (LNR) to meet Julieanne Levett, Community Development Manager with Scottish Canals. Julianne showed us the variety of improvements that have been made to the LNR as part of the Canal & North Gateway project which is led by Glasgow City Council and part-funded by GIF. Like Fernbrae, the site used to be a 'no go' area, but now is accessible, welcoming and widely used by the local community. We heard about the innovative Smart Canal at Sighthill which is a revolutionary new way of managing flood risk in response to predicted rainfall.

For more information about these sites, or GIF please go to www.greeninfrastructure.scot or contact greeninfrastructure@nature.scot.

Fiona Strachan
Green Infrastructure Project Manager, NatureScot

Q&A

Ben Kite CEcol MCIEEM
Managing Director, Ecological Planning & Research Ltd (EPR) and Chair of CIEEM's Strategic Policy Panel

How did you get into the sector?

After finishing my biology degree I worked as an Environmental Planner for a firm of planning consultants. They funded my Master's degree in Environmental Assessment and Management, that ultimately enabled me to move into ecological consulting.

What does your current role involve?

It's a dual role. As MD I have one foot permanently in 'business management' – doing everything from chairing management meetings to reviewing financial reports, resourcing strategies, HR, marketing, health and safety, recruitment and more. Wearing my other hat as an ecologist, I oversee our work on large complex projects, handle client and consultee relationships, do surveys, write assessments and ultimately take responsibility for making sure we deliver for both people and planet.

What is your favourite part of your current role?

Seeing large projects decades in the planning finally delivered – particularly when these yield significant biodiversity gains that might inspire others. This year we totted up the biodiversity outcomes of our past projects and were surprised to see that our projects have delivered over four square miles of land for nature conservation!

What is your least favourite part of your current role?

Being forced to spend time and money on bureaucracy that would be better spent directly on people or wildlife.

Why did you get involved with CIEEM?

As a relatively 'young' profession we ecologists need to 'up our game' if we are to be seen on a level with Chartered Town Planners, surveyors and engineers. This is essential if we are to persuade others to implement our advice and deliver better outcomes for the natural environment, and means setting high standards and holding each other to them. I think this is best done via mutual consensus through an organisation like CIEEM.

What do you think is the biggest issue facing the sector?

Ultimately a philosophical one – despite all the burgeoning evidence to the contrary, environmental priorities are still seen by policy-makers as the antithesis to economic prosperity. As a sector, we can (and must!) show people that these two things go hand-in-hand.

Who is your hero and why?

Aldo Leopold. He was one of the first ecologists to satisfactorily describe the link between a healthy natural environment and ethical human behaviour – I highly recommend his book *A Sand County Almanac*.

Who do you see as a great leader in the sector?

His Majesty King Charles III, who championed positive change on issues such as climate change, plastic pollution, biodiversity and natural capital before they became political priorities. It has been my privilege to support some of these by providing ecological advice to the Duchy of Cornwall.

If you could change one thing to make the world better for nature and biodiversity, what would it be?

Expanding the legal duty of Company Directors to act in the interests of their company, so that it is not limited to achieving profit (financial capital) but explicitly includes a responsibility to increase the natural and social capital required for humanity (and by extension the company!) to continue to exist.

If you could magically change one thing we do as a sector, what would it be?

Allowing ourselves to be defeatist and gloomy about the possibility of doing things better. I don't think it helps, and if we want to convince others to change, we must first convince them that this is for a purpose – *"an ounce of hope is worth a ton of despair"*.

What advice would you give to those just starting out in the sector?

Be kind to yourself as you'll achieve more when you are rested enough to think clearly. That said, be open minded about new opportunities, as sometimes saying 'yes' can take you in some wonderful new direction that you hadn't imagined.

What is your favourite animal, plant, fungi, bacteria or archaea?

The common prawn *Palaemon serratus*. I think perhaps rock pooling as a child set me on a trajectory to becoming an ecologist.

What is your favourite thing to do outside of work?

When I'm not out exploring nature, my wife and I train together in Korean Kickboxing and Tae Kwon Do. I've found it to be a very effective antidote to the stresses of work!

Can you tell readers something random about yourself?

I keep bees.

BOOKS, JOURNALS AND RESOURCES

Compiled by the Academia Special Interest Group

Paper Review OPEN ACCESS

The botanical education extinction and the fall of plant awareness

Stroud, S., Fennell, M., Mitchley, J., Lydon, S., Peacock, J. and Bacon, K.L.

Ecology and Evolution, 2002, 12(7), p.e9019. https://doi.org/10.1002/ece3.9019

These authors present a review of the importance of plants to all aspects of life on Earth and the potential consequences of failing to recognise this at all levels, from the political to the personal. They argue that botanists have a range of skills that are fundamental to achieving many of the Sustainable Development Goals (SDGs), particularly in this, the UN Decade for Restoration, when plant knowledge is required to address the climate emergency and biodiversity crisis. They develop this theme by highlighting the decline of botanical teaching in higher education and replacement with broader plant science/biology programmes with the risk of 'reducing plants to processes' and the potential problem for the success of the recently announced GCSE in Natural History to be compromised by the lack of appropriately skilled teachers for plant identification. Detailed research was undertaken to back up these points, with a module-level review of plant-based content across Russell Group universities and further literature-based investigation into 'plant blindness' globally. An overhaul of education, from primary, through secondary and on into Higher Education is suggested to address this trend. While some may flinch at the term 'zoochauvinist' most would agree that 'plant blindness' and lack of plant identification skills is a problem. An interesting read and for those without time for the whole paper a short summary is available at https://theconversation.com/botanists-are-disappearing-just-when-the-world-needs-them-most-186849.

Paper Review

Sphagnum mosses: field key to the mosses of Britain and Ireland

Martin, G. and Karen, R.

FSC Publications. 2021. ISBN: 9781908819604

I like to examine my *Sphagnum* specimens under the microscope (coffee, internet, and psychiatric nurse to hand), cross-referencing different texts and swearing. I also prefer to look at air dried samples alongside fresh, so field identification is challenging. This 56-page field guide provides a range of keys using field characters (hand lens needed) with additional options requiring microscopy (guidance on hand sectioning included). Line drawings of stem leaves and leaf sections, augmented by short species descriptions, notes on rarity, and tables of habitat, make this a practical resource for those like me (nurse not included).

Paper Review OPEN ACCESS

Badger *Meles meles* as ecosystem engineer and its legal status in Europe

P. Kurek , Ł. Piechnik 2, B. Wiatrowska 3, A. Wazna, K. Nowakowski , X. Pardavila, J. Cichocki and B. Seget

Animals **2022**, 12(7), 898 https://doi.org/10.3390/ani12070898

This paper looks both at the importance of European badgers as ecosystem engineers, and their status across the European continent. With badgers so heavily protected in the UK, it may come as a surprise that 24 of 41 European nations permit some form of badger hunting and hunting bags have increased in most countries where such data are available. The paper contains a fascinating literature review of the badger as an ecosystem engineer and its interactions with soil, flora and fauna. The authors cite studies showing that the spoil mounds of setts are chemically and structurally different to the surrounding soil (including lower pH, N and C, but higher Ca, Mg and P), changes that have been associated with higher species richness of plants and soil invertebrates. Their habit of placing latrines on territorial boundaries is also considered important for seed dispersal of several plant species, especially those with large fruit that are less commonly dispersed by birds. Many other vertebrates also share badger burrows (with several examples given, including tortoises escaping forest fires in Greece and salamanders in Poland). Badger bedding can also provide a unique underground microhabit for a range of saprotrophic invertebrates. Interestingly, the paper reports that badger setts are only legally protected in the UK and four other European countries.

Paper Review OPEN ACCESS

Developing a nature recovery network using systematic conservation planning

Smith, R.J., Cartwright, S.J., Fairbairn, A.C., Lewis, D.C., Gibbon, G.E., Stewart, C.L., Sykes, R.E. and Addison, P.F.

Conservation Science and Practice 2022;4:e578

https://doi.org/10.1111/csp2.578

The issue of existing protected areas failing to achieve their conservation goals due to their small size, fragmentation, low biodiversity and economic value has led to global calls to expand and improve conservation areas. This paper presents results from a systematic conservation planning approach used to develop a nature recovery network for three counties in England. The approach produced a list of important conservation features and targets for what should be included in the ecological network. It then identified and mapped areas to direct resources and focus on conservation and restoration. The approach identified core zones in line with increasing areas and targets for priority habitat, landscape, landcover, and ecosystem service types, reflecting the UK Government's target for 30% of England to be conserved and connected by 2030. The process created a repeatable study, that highlights and encourages the need for strong guidance and data from the Government to help stakeholders set targets in line with their policies.

Paper Review

Age and spatial distribution of the world's oldest trees

Liu, J., Xia, S., Zeng, D., Liu, C., Li, Y., Yang, W., Yang, B., Zhang, J., Slik, F. and Lindenmayer, D.A.

Conservation Biology, **36**, 2022, 13907

https://doi.org/10.1111/cobi.13907

This paper extracted tree age data from multiple sources to determine the age of the world's oldest trees and evaluate the factors influencing their global distribution. By virtue of their living archaeology status, ancient trees define human societal and cultural values, maintain ecosystem services and can provide valuable insights about historical climatic events. Climate change, habitat loss, and fragmentation are recognised to impact on their global distribution and conservation.

Detailed information on scientifically dated trees from around the world was compiled from databases including 197,855 tree cores obtained from >230 species at 4,854 sites from the International Tree-Ring Data Bank (ITRDB) and OLDLIST, a database of the oldest scientifically dated trees in the world. Nearly two thirds of trees over 2,000 years old are present in the United States, including a staggeringly ancient 4,900 year old bristlecone pine (*Pinus longaeva*) found at Wheeler Peak, Nevada at 3,277m elevation. In the UK, the oldest tree is hotly contested but is believed to be the Ankerwycke Yew in Berkshire, with an estimated age of 2,500 years. The authors found that extremely old trees (over 1,000 years) were rare and Gymnosperm species (especially pines and cypress) tend to live longer than angiosperm species.

By modelling tree age with climatic, soil topographic, and anthropogenic variables it was found that many of the oldest trees will occur in high-elevation, cold, and arid mountains with limited human disturbance. The oldest trees in high mountains are at risk from climate change and increasing human disturbance, yet many of them are outside protected areas. In order to protect these assets, the authors recommend targeting the establishment of conservation reserves in remote regions, in particular in western parts of China and the United States.

Paper Review

Riverine large woody debris introduced for natural flood management leads to rapid improvement in aquatic macroinvertebrate diversity

Deane, A., Norrey, J., Coulthard, E., McKendry, D.C. and Dean, A.P.

Ecological Engineering, **163**, 2021, 106197

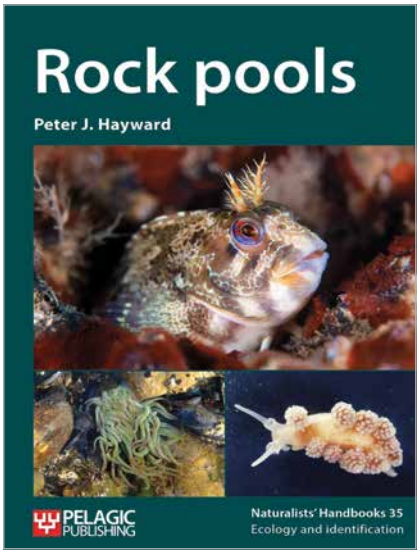
https://doi.org/10.1016/j.ecoleng.2021.106197

This paper advocates the construction of engineered log jams or Large Wood Debris (LWD) barriers as naturalised methods for flood management intervention. The authors sampled macroinvertebrate communities, water quality parameters, and sediment size distribution along 6no. headwater streams following LWD installations at Black Brook in the Peak District National Park. Log jams were engineered from selective felling of 2-4 mature bankside trees directly into the stream channel.

Following 3 and 10 month sampling intervals upstream and downstream from these 'leaky dams', macroinvertebrate abundance and richness increased alongside positive benefits to overall water quality biometrics compared to control sites. Moreover, 'leaky dams' resulted in the colonisation by aquatic beetles (Hydraenidae and Scirtidae), riffle beetles (Elmidae) and caddisflies (Rhyacophilidae) which were largely absent in control sites. After 10 months, areas of enhanced biodiversity were apparent in stream channels downstream from the intervention zone with changes attributed to changes in hydrological flow regimes and habitat heterogeneity.

Finally, the application of LWD as an intervention for flood management is supported with benefits for ecosystem health through the enhancement of biodiversity in riverine systems and may be broadly comparable to catchments of similar land use, hydrology and geology. Although hydrological modelling is not featured, the findings may augment practical techniques for instream channel rewilding to provide biodiversity net gain.

BOOK REVIEW



Rock Pools

Author: Peter J. Hayward
ISBN: 9781784273590
Publisher: Pelagic Publishing 2022
Price: £22.00

The 35th, and latest, volume in the New Naturalist series is the third one penned by Peter Hayward. If you have a little more than a passing interest in the British marine fauna and flora then you are undoubtedly familiar with numbers 9 and 21, and so you will simply know this latest volume will simply 'do its job'.

A Naturalist Guide is not just an identification guide to a target group or habitat, but a stand-alone 'one-stop-shop' on the subject. Yes, you have the all-important keys to guide you, from scratch, on how to identify the plants and animals you may find in a rock pool. But not all of them. Just enough of the major groups to allow you, if unfamiliar with the fauna and flora, to feel satisfied that you have found out what lives in this habitat. And if your deliberations reveal you have found something that is 'not in the book' then you will feel sufficiently armed to have a go at a 'Linn. Soc. Synopsis' or Hayward (him again) and Ryland's two tome monograph on the marine fauna of northern Europe.

The keys cover the familiar groups of larger anemones and molluscs, the myriad of smaller crustaceans and the minute colonial ascidians, bryozoans and hydroids. Here, these small and perplexing creatures are grouped together as 'sessile or modular animals'. This is a refreshing alternative to a traditional 'taxonomic key' because it separates 'giving it a name' from 'understanding its evolution'. But completing the first task often inspires the search for a deeper understanding required for the second. As a teacher I wholeheartedly approve of this approach.

But this is not a collection of cut down synopses. The introduction and 'Pool environment' sections that precedes the keys and 'Investigating rockpools' that follows them do the really important stuff. These explain why this habitat deserves a bespoke book that sits between a pocket shore guide and a specialist synopsis. It does so using some of the classic papers on the rockpool environment, but not in overwhelming detail. This means that the student or merely interested observer can read each section in under an hour and walk away knowing that a rock pool is neither a seawater 'pond' nor a small part of the deep sea you can actually get at. It is a unique habitat with its own resources and challenges which have been overcome by highly specialised species. It also harbours a few offshore or even ocean visitors trapped here, albeit briefly, by storm or tide.

But why identify the plants with photographs and the animals with more complex keys and line drawings? The answer is simple. The relatively few plants photograph rather well, while the critical details of segmentation or appendages needed to diagnose an animal rarely do and require a simple sketch or, as here, a rather nicely executed and annotated one. Both approaches are entirely fit for purpose and quite simply 'work'.

I was initially vexed at the obvious suggestion of: If this is 'the book' on rock pools why list the study projects that can be done with them? But I missed the point. That is 'my job' as a teacher. Peter has set the scene of what rock pools are, what lives in them and how to identify them on the shore or back in the lab. What can be done with this knowledge will differ at my Devon, Norfolk and Millport teaching sites. Including such resources would make the volume unwieldy and appear daunting. And it is neither. Finding what you need is relatively straightforward following a tried and tested formula. Like its forebears and all other Naturalist handbooks it fits as comfortably in the head as it does in the hand.

About the Reviewer

Dr Philip Pugh, Senior Lecturer, Anglia Ruskin University, joined ARU in 2000 to teach conservation biology and develop new marine biology modules. He currently teaches on the BSc (Hons) Ecology and Conservation, and BSc Zoology courses. His recent research has centred on Antarctic biogeography, cladistics and multivariate analysis.

Contact Philip at: philip.pugh@aru.ac.uk

ECOLOGY
RESOURCES

Our team voted for us. Three times.

Best Workplaces™ Small Organisations Great Place To Work. UK 2022

Best Workplaces™ For Wellbeing Small Organisations Great Place To Work. UK 2022

Best Workplaces™ for Women Small Organisations Great Place To Work. UK 2022

100% People here are treated fairly regardless of their race or ethnic origin.

100% Taking everything into account, I would say this is a great place to work.

100% People here are treated fairly regardless of their sexual orientation.

100% When you join the organisation, you are made to feel welcome.

100% People here are paid fairly for the work they do.

100% Management is approachable, easy to talk with.

"Ecology Resources took me on as a graduate and have shaped me into the Ecologist that I am today. Each new team member feels like a new member of the family, instead of just another colleague. The company culture is one of respect and trust."

BETHANY HUNT
Ecologist, BSc (Hons) ACIEEM

"ER show genuine altruism towards their staff and a willingness to develop people at the start of their career. You feel empowered to try new things, push beyond your comfort zone or say when you are not capable because there's no negative judgement or fear of failure."

DOM BOWYER
Senior Ecologist, BSc (Hons) ACIEEM

Want to join them? Send us your CV and let's talk.
www.ecologyresources.co.uk

Is it time to upgrade your membership?

Take a moment to reflect on everything you've learned and all the professional development you've undertaken in the past year. Are you in the same place professionally as you were this time last year?

Perhaps it's time to consider taking the next step on your journey to Chartered status by upgrading your membership.

It's important that your membership grade indicates your competence and experience to provide you with the professional recognition you deserve.

Visit the '**Upgrade your membership**' section of the MYCIEEM area of our website to find out more and download an upgrade application form.

It's okay not to feel okay

It's been a difficult few years. Not only have we lived through a global pandemic and somewhat come out the other side, but we're now experiencing the cost of living and energy crises.

We know that many of our members are feeling the strain.

But you're not alone.

If you feel like you're struggling to stay afloat, or perhaps you'd just benefit from speaking to someone who is trained to listen, then the **Member Assistance Programme** can help.

All CIEEM members, their partners and dependents can access this free counselling service, consisting of up to six sessions of counselling per year. Explore your worries and concerns with a trained counsellor and strive to find positive solutions that work for you.

Unfortunately, the cost of living crisis may not be going away anytime soon, but support is available for you if you need it.

For more information on our Member Assistance Programme, please visit the Member Benefits section in the MYCIEEM area of our website.

CIEEM

Forthcoming Events

For information on these events and more please see http://cieem.net/training-events.

Conferences
Training Courses
Webinars

05, 08 and 12 December **Biodiversity Metric V3.1 Training (multiple sessions)** Online 14:00-17:00	05-06 December **Plant Identification and Botanical Keys** Online 10:00-13:00	07 December **Winter Tree ID: extending the season in ecological surveys** Shrewsbury 10:00-17:00	07-08 December **Ecological Report Writing** Online 09:30-13:00
08-09 December **Otter Survey and Ecology** Birnam, Scotland 10:00-17:00	08, 09 and 15 December **Biodiversity Metric V3.1 Training (multiple sessions)** Online 14:00-17:00; 09:30-1230 & 14:00-17:00	10 & 11 January **Preliminary Ecological Appraisal** Online 0930-1300	16, 17 & 18 January **Intermediate QGIS for Ecologists and Environmental Practitioners** 14:00-16:30; 10:00-16:30; 10:00-13:00
17 January **Could you be our next Mentor?** Online 12:00-13:00	17 & 18 January **Developing Skills in Ecological Impact Assessment (EcIA) (England & Wales)** Reading 10:00-17:00	17 & 24 January **Introduction to Nature Conservation Legislation in the UK (Wales)** Online 10am-1pm	18 & 25 January **Introduction to Nature Conservation Legislation in the UK (England)** Online 10am-1pm
24-25 January **Ecological Report Writing (multiple sessions)** Online 09:30-13:00	24 and 31 January **Positive Planning for Biodiversity (multiple sessions)** Online 10:00-13:00	30-31 January **Train the Trainer for Ecologists** London 10:00-17:00	1 & 2 February **Identifying and Managing Non-native Invasive Plant Species** Online 10:00-13:00
9-10 February **Beginners QGIS for Ecologists and Conservation Practitioners** Ireland 10:00 -17:00	23 & 24 February **Intermediate QGIS for Ecologists and Conservation Practitioners** Ireland 10:00-17:00	1 & 2 March **Environmental Management on Construction Sites** Scotland 10:00-17:00	08 & 09 March **Red Squirrel Ecology and Surveys** Birnam, Scotland

WILDLIFE ACOUSTICS

LEARN MORE AT
wildlifeacoustics.com/minibat

SONG METER MINI BAT

Simple to use, but far from simple

With an ultra-weatherproof design and Bluetooth compatibility, the Song Meter Mini Bat simplifies ultrasonic recording without compromising on sound quality.

- Manage multiple recorders from our innovative Bluetooth mobile app.
- Record up to 125 ten-hour nights (with optional lithium-ion lid & batteries).
- Record birds, frogs, and other vocal wildlife with optional acoustic mic attachment.

@WildlifeAcoustics @wildlifeacoustics @WildlifeAcoust
3 Mill and Main Place, Suite 210 | Maynard, MA 01754, USA | +1-978-369-5225

Available from our local resellers:
WILDCARE Nationwide Ecology Supplies
Wildlife Services
nhbs