



Issue 123 | March 2024

inpractice

Bulletin of the Chartered Institute of Ecology and Environmental Management



Integrated Water Management
in the National Trust

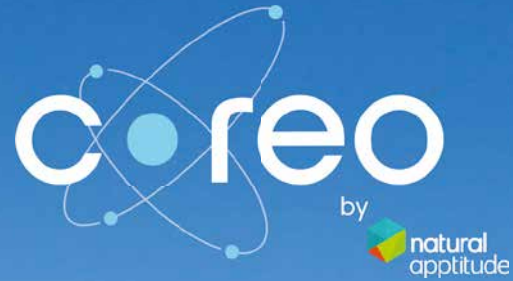
Biodiversity Gains from
Compensation Wetland
in Hong Kong

Sustainable Restoration of
Freshwater Ecosystems:
The Eddleston Water Project

Do UK Survey Licences for
Otter Support Best Practice?

Water and Ecology

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- UKHab **Surveys**
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Survey have increased
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survey efficiency by
around 65%.”**

SHANNON BRADY, SENIOR BIODIVERSITY
NET GAIN CONSULTANT, URBAN GREEN



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Editorial

The water issue

In June 2018, I wrote about the 'Hidden tragedy of the Earth's freshwater ecosystems' to help mark the 100th edition of *In Practice*. I described the alarming global decline of freshwater biodiversity, outlining also the fortunes of the UK's rivers, lakes and wetlands. There had been some successes, for example in improvements in the quality of what were once our grossly polluted urban rivers. But there were growing problems from changing land management, combined sewer overflows that were sometimes spilling too often, and emerging pollutants such as pharmaceuticals and plastics. Accelerating evidence showed the impacts of climate change both directly on cool-water organisms such as salmonids, and through effects on water quality or quantity.

Some of these problems have since worsened everywhere from the local to the global. Multiple lines of evidence continue to show the Earth's freshwater ecosystems hemorrhaging biodiversity faster than on land or at sea: these include the results of the updated WWF Living Planet Index, the decline of the freshwater 'megafauna', losses among groups such as amphibians and ecosystem degradation in global biodiversity hotspots such as the Amazon Basin.

In the UK and across Europe, the recovery of urban rivers boosted by 1990s EU legislation has slowed or stalled (Haase *et al.* 2023). The causes are debated but likely reflect the shift from insanitary wastewater to emerging and diffuse pollutants, to intensifying agriculture or to our failure to contain climate change. This slowdown also reflects the cumulative effects of local pressures that vary across catchments: poorly planned poultry units, intensive dairy, contaminated minewater, drainage systems that inadequately separate foul sewage from surface run-off, continuing under-performance in some wastewater treatment plants and complex organic chemicals persisting despite long-standing controls. We know also that invasive non-native

species are problematic in highly invaded systems like the River Thames while physical habitat impairment is widespread, including barriers to some of the world's most highly evolved migratory species such as European eels or Atlantic salmon. Some issues are still characterised by knowledge gaps – as in our incomplete understanding of the ecological effects of pharmaceutical compounds – while solving others presents practical or economic challenges. Some problems are probably overlooked, for example at least 5% of our household sewers are misconnected to surface drains thus providing a direct pollution route to rivers.

Yet there is hope at all scales, from global to local. As a result of lobbying from the freshwater conservation sector, inland freshwater ecosystems are now recognised explicitly alongside marine and terrestrial in the UN Global Biodiversity Framework. This has precipitated a global lobby to 'bend the curve' of freshwater biodiversity loss through priority actions revolving around environmental flows, water quality, habitat protection, reducing exploitation, tackling invasive species and restoring river connectivity (Tickner *et al.* 2020). Here in the UK, public interest in the state of freshwater ecosystems has become so acute that water could be a significant election issue. Aspirations and opportunities in sectors ranging from government to non-governmental organisations, public to private, range across more effective regulation, closer scrutiny from the offices of environmental protection, water company investment, improved climate change adaptation, innovative investment in nature-based solutions, support for more sustainable agriculture, expanded freshwater designation through the 30x30 agenda or as bathing waters, more responsible cost-sharing of pharmaceutical or plastic disposal from manufacturers ... the list goes on.

In other words, we have multiple options but we have to turn them into action. And CIEEM has a significant



role. The contributions in this issue illustrate where our members are acting or leading on a range of fronts such as climate change, source-to-sea management, species protection, Biodiversity Net Gain, habitat restoration, organisational involvement and demonstration projects.

Is it enough? Our own future is tied to the future of the world's water.

Steve Ormerod FCIEEM

Professor of Ecology, Cardiff University School of Biosciences; Deputy Chair, Natural Resources Wales; and CIEEM President 2008-2010

References

- Haase, P., Bowler, D.E., Baker, N.J. *et al.* (2023) The recovery of European freshwater biodiversity has come to a halt. *Nature*, **620**: 582–588.
- Tickner, D., Opperman, J.J., Abell, R. *et al.* (2020) Bending the curve of global freshwater biodiversity loss: an emergency recovery plan. *BioScience*, **70**: 330–342.

Cover photo: Pheasant-tailed jacana (*Hydrophasianus chirurgus*) on waterlily (*Nymphaea lotus*) at the Lok Ma Chau Ecological Enhancement Area, Hong Kong. Photo credit: Paul J. Leader.

Conferences For Your Calendar!



Biodiversity Net Gain In Practice

Spring Conference 📍 19 March, Online

Hear about some of the lessons learned from early implementation of BNG with emphasis on delivery post-planning approval, habitat creation, management and monitoring.

LAST
CHANCE TO
BOOK

Examining the Practical Impacts of Environmental Policy and Legislation on Ireland's Ecology

Ireland Conference 📍 April, Dublin

Learn about new and emerging environmental policy and legislation and how it might impact people, nature and your work.

BOOK
NOW

Financing the Future: Using Green Finance to Drive Nature's Recovery

Summer Conference 📍 16 July, Online

Find out how to access funding to support nature's recovery by hearing examples of green finance initiatives in the UK and Ireland and the success of nature-related financial mechanisms.

REGISTER
YOUR
INTEREST

Visit www.cieem.net/events to browse our 2024 conference lineup and secure your place

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Good practice guidance for ecological restoration published

The CIEEM Working Group on Good Practice Guidance for Ecological Restoration has published *Rebuilding Nature*, setting out 10 good practice principles for ecological restoration projects in the terrestrial, freshwater and marine environments of the UK and Ireland. The guidance for restoration practitioners provides an introduction to ecological restoration with a glossary of key terms and a set of key references, and is being published in advance of more detailed material relating to habitat types to stimulate discussion and comments. Read more here: <https://cieem.net/resource/good-practice-guidance-for-ecological-restoration/>

Recent webinars

We continue to run a full and varied series of webinars for members and the sector. Readers may be interested in the following recent webinars that are available on the CIEEM Resource Hub (<https://cieem.net/i-am/resources-hub/>).

- How to Get Involved in CIEEM Policy Activities
- Mandatory Biodiversity Net Gain: The Policy
- The Statutory Biodiversity Metric for Mandatory Biodiversity Net Gain in England
- Growing our Sector: Redefining Entry Routes Into Ecology and Environmental Management Careers
- The Ecology Skills Gap: Are Vocational Routes the Answer?
- The Amplification of Plant Disease Risk Through Ecological Restoration
- Can You Hear Me? Oh, I'm Muted!
- Project Seagrass with Dr Richard Lilley
- Tree Health in Scotland
- Addressing the Capacity Crisis in the Ecology Profession
- From Red to Green: Using the IUCN Status of Species to Evaluate Conservation

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

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 update your Preferences in the members' area of the website.

Recent blog posts

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

- Charting the Course: Mastering Ecology Through CIEEM's Early Careers Training Programme – by Jen Jones
- International Mentoring Day
- Motherhood and an Ecology Career: Can the Two Go Hand in Hand? – by Laura Sanderson
- Year in Review: 2023 Environmental and Policy News

- Empowering Environmental Professionals: Become a STEM Ambassador – by Ashleigh Kitchiner MCIEEM
- Housing or Habitats – Should We Have To Choose? – by Stuart Ireland CEnv MCIEEM
- Leading the Way: Positive Actions for Ecologists and Environmental Managers – by John Box and Morgan Taylor

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

Staff changes

Last November, **Dr Ashley Buchan** joined the CIEEM team as Policy Officer. And in February we were joined by **Alice Walker** as Volunteer Engagement Officer.

CIEEM Conferences

Date	Title	Location
19 March	CIEEM Spring Conference: Biodiversity Net Gain in Practice	Online
17 April	CIEEM Ireland Conference: Examining the Practical Impacts of Environmental Policy and Legislation on Ireland's Ecology	Dublin
16 July	CIEEM Summer Conference: Financing the Future: Using Green Finance to Drive Nature's Recovery	Online
October TBC	CIEEM 2024 Scotland Conference: Restoration Ecology. In person.	location TBC
27–28 November	CIEEM 2024 Autumn Conference: Good Practice in Habitat Restoration	Cardiff

Find out more: <https://cieem.net/events>

In Practice Themes and Deadlines

Edition	Theme	Article submission deadline
June 24	Afforestation and Tree-Planting	n/a
September 24	Financing Nature's Recovery	17 May 24
December 24	Non-themed (submissions welcome on any topic)	16 Aug 24

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/>

UK

New climate finance initiative launched alongside World Bank

The UK Government and World Bank have revealed plans to launch the Climate Investment Funds (CIF) Capital Market Mechanisms this year to unlock more private sector investment for innovative projects to tackle climate change. The Mechanism will see bonds generate up to \$750 million per year in climate finance, with the potential to attract over \$50 billion in co-financing for climate projects in emerging and developing economies. This announcement comes as part of the widescale push at COP28 to utilise private finance for climate change mitigation.

Northern Ireland

DAERA to stop using the Operational Protocol (ammonia advice) in Northern Ireland

The Department for Agriculture, Environment and Rural Affairs (DAERA) has decided that the Northern Ireland Environment Agency will no longer rely on ammonia guidance, commonly known as the 'Operational Protocol', when giving statutory advice on planning applications. Instead, it will provide planning authorities with site-specific advice on a case-by-case basis. A new draft strategy for ammonia is being informed by responses received in the Call for Evidence from October last year.

Republic of Ireland

Seas off Wexford announced as Ireland's largest Special Protection Area

The Irish Government has announced a new Special Protection Area (SPA): the seas off Wexford, covering more than 305,000 ha of marine waters, to improve the protection of 20 different species of birds. This new SPA will be designated under the EU Birds Directive and will be the Republic's largest SPA. Its designation increases the percentage of Ireland's protected marine waters to just under the 10% for nature designations required by the EU Biodiversity Strategy, a target which is aimed to be achieved this year.

Wales

Report on resilience of buildings to climate change

A new report published by Natural Resources Wales (NRW) has found that keeping pace with climate change and reducing flood risk to communities across Wales will require significant and sustained investment in flood defences to manage future flood risk from the sea and rivers. The report considers four different investment scenarios for flood defences over a 100-year period. The scenarios include keeping investments at their current level, investing only in high-risk locations and keeping pace with climate change by investing in all existing defences. The report highlights that Welsh Government must be ambitious with its defences against climate change and look further than pure flood defences since, regardless of the scenario, residual damages will remain.

England

BNG implementation date

The UK Government has confirmed that Biodiversity Net Gain (BNG) will become mandatory for new major developments from 12 February 2024, and for small developments from 2 April 2024. BNG will only apply where the planning application was made on or after 12 February, and Defra has put in place transitional arrangements to ensure that BNG will not apply to a planning permission if the application was made before this date. Defra has published the package of secondary legislation in draft to aid stakeholders and has made a series of minor changes to the drafting of this legislation. The finalised regulations will be published on the Defra BNG page (<https://defra.landuse.blog.gov.uk/category/bng/>) when ready.

Scotland

Planning biodiversity guidance published

The Scottish Government has published draft planning guidance setting out the Scottish Ministers' expectations for implementing NPF4 policies which support the cross-cutting NPF4 outcome 'improving biodiversity'. Publication of this guidance goes alongside Developing with Nature Guidance to support NPF4 Policy 3c. The Scottish Government also recently published independent research undertaken by SRUC into 'Approaches to Measuring Biodiversity in Scotland'. With regards to the planning sector specifically, NatureScot will shortly commence work to develop an adapted biodiversity metric suitable for use in supporting delivery of NPF4 policy 3b, engaging closely with all relevant stakeholders.



Figure 1. Telford and Wrekin Council *Becoming Carbon Neutral: Action Plan*. Credit: Telford and Wrekin Council.

My Actions to Persuade Organisations to Tackle the Climate Crisis



John Box CEcol
CEnv FCIEEM

Challenged by CIEEM in early 2019 to write a blog on the climate crisis, I sought information from other professional institutes and leading environmental organisations, online sources and books. In 2019, many organisations were declaring a climate emergency and biodiversity crisis. These declarations can only be symbolic until there is an action plan, staff and financial resources to make a difference. Simply, the blanket of pollution trapping heat on Earth is made worse by burning coal, oil and gas. This article describes my actions to persuade the national and local organisations that I am a member of, as well as my local council, to tackle the climate crisis together with the actions taken by these organisations. I hope that this article will encourage others to stimulate and support actions to tackle the climate crisis locally and through their organisations and networks.

Keywords: climate emergency,
global heating

CIEEM

I have been a member of CIEEM since 1991 and I have had various voluntary roles including being President. The outcome of my challenge to write a blog was the CIEEM declaration of a climate emergency and biodiversity crisis in September 2019 supported by a commitment to net zero carbon emissions by 2030 and the creation of the Action 2030 project.

Action 2030 will ensure that CIEEM achieves net zero by 2030 and leads the way for our profession in taking action to address the interlinked climate emergency and biodiversity crisis.

Nature-based solutions must play a key role in mitigating against and adapting to climate change and reversing ongoing declines in biodiversity (CIEEM 2020).

The Action 2030 working group provides challenge and advice to CIEEM on these issues and real progress is being made (Box and Connett 2019, 2021, Connett and Box 2020, Box 2023).

CIEEM has committed to the Pledge to Net Zero (www.pledgetonetzero.org). This global initiative recognises the need for those in the environmental sector to demonstrate leadership and take strong actions to mitigate the most significant impacts of climate change. The pledge requires science-based targets from its signatories to tackle greenhouse gas emissions in their organisations. CIEEM's Pledge to Net Zero was submitted in April 2022: a 90% absolute reduction of scope 1, 2 and 3 greenhouse gas emissions by 2030 from a 2019 base year. This means a reduction from 77.52 tonnes of CO₂ equivalent (tCO₂e) in the 2019/20 base year to no more than 7.75 tCO₂e by 2030. The calculation of the CIEEM emissions uses the standard scope 1, scope 2 and scope 3 categories and includes staff travel and commuting, staff energy consumption when working at home, the production of *In Practice* and energy use and catering at venues used for CIEEM events. The staff includes those based at the main office and home-based staff.

The reduction in CIEEM's emissions of greenhouse gases to 69.90 tCO₂e in 2022/23 was helped by the move to a more energy efficient main office which had solar panels on its roof. The *Carbon Reduction Plan 2021–2030* that is updated annually (CIEEM 2022) sets out

the baseline carbon emissions, how they are recorded, the projects for reducing emissions and how residual emissions will be compensated.

I devised seven principles to guide the choice of compensation schemes for residual carbon emissions, adopted by CIEEM in 2021 (Box and Connett 2021). CIEEM has donated annually since 2017 to habitat restoration or creation projects throughout Britain and the island of Ireland based on the carbon costs for similar projects on online offsetting websites of around £5–10/tCO₂e (2017–21) and around £15/tCO₂e (2022 and 2023). The valuation of carbon is likely to increase and there are discussions going on about the carbon price that should be used by CIEEM to compensate for future emissions.

The Linnean Society

The Linnean Society of London encourages the debate and discussion of natural history including taxonomy, evolutionary biology and ecology. The Society operates from two properties in London: a public headquarters at Burlington House near Piccadilly and a collections facility at Toynbee House in Wimbledon. I have been a Fellow since 1997.

I contacted the Society about the climate emergency and net zero in autumn 2019. I proposed a motion seconded by 11 Fellows for the online AGM in May 2020. Discussions generated a revised AGM motion that was agreed by Council and endorsed by the Fellowship. An outcome was the establishment of the Linnean Future Committee in August 2020 to cover the climate emergency and biodiversity crisis and I was a member of this committee. The Linnean Future Committee's activities were taken on by the new Finance and Risk Committee in May 2022.

A carbon calculator was created in 2021 to calculate the CO₂ emissions of the operations and activities of the Society from 2018 to 2023. A carbon action plan was produced in May 2021 that is reviewed regularly, and an updated action plan will be available in 2024. The Society will seek to reduce its annual CO₂ emissions from 67 tCO₂e in 2018 to 25 tCO₂e by 2030. The emissions were substantially reduced to

35 tCO₂e in 2022. The key actions have been switching suppliers in general with the intention to change to renewable electricity suppliers where possible, reducing printed materials, scrutinising recycling and waste reduction, and replacing the bottled water fountains with filtered tap water. Reducing carbon emissions is now raised at all staff meetings for the whole team to be aware of carbon reduction, feed in ideas and actively participate (for example, methods of recycling, replacing the water fountains).

The expectation is that any unavoidable carbon emissions will be compensated using the six principles agreed by Council to guide the choice of effective compensation schemes, but a compensation scheme has not yet been agreed.

Telford and Wrekin Council

My motion for my local council to declare a climate emergency and be carbon neutral by 2030 was agreed by the committees of the local Labour party in June 2019, revised and then agreed by the full Council in July 2019. The council established a climate change coordinator and team and produced a climate action plan (Telford and Wrekin Council 2021) (Figure 1). The outcome has been a 60% reduction in CO₂ emissions from operations and processes involving the corporate estate, street lighting, transport and travel (excluding staff commuting) from the baseline of 5882 tCO₂e in 2018/19 to 2344 tonnes in 2022/23.

The wide range of actions being undertaken by the council are set out in the corporate climate change plan and reported annually to the Cabinet. Highlights include switching to 100% green tariff for council buildings and

I contacted the Linnean Society about the climate emergency and net zero in autumn 2019. One outcome was the establishment of the Linnean Future Committee in August 2020 to cover the climate emergency and biodiversity crisis.



Figure 2. Signposting the future: solar farm owned by Telford and Wrekin Council. Photo credit: Telford and Wrekin Council.

street lighting, converting over 20,000 streetlights to LEDs, delivering LED lighting and solar photovoltaic panels across a range of corporate buildings, procuring six fully electric commercial vehicles to replace diesel vehicles as part of an overall vehicle replacement strategy and committing to enhancing and restoring over 70 ha of heathlands, wetlands and species-rich grasslands.

The Telford and Wrekin Climate Action investment scheme launched by the council in 2022 allowed the public and organisations to invest in a 5-year municipal investment loan which raised £339,000 that funded two electric minibuses and community grants for climate action projects.

There is an aspiration for the council to create another renewable energy project to follow on from their very successful 4 MW solar farm (Figure 2) that was constructed in 2014. This solar farm was a pioneering renewable energy project for a local authority (Local Government Association 2021).

Ironbridge Gorge Museum Trust (IGMT)

For over 40 years I have lived in Ironbridge where the landscape and ecology has been greatly influenced by past industrial activities. The IGMT

operates and manages multiple historic sites in the Ironbridge Gorge World Heritage Site. This designation recognises the unique contribution of this area to the birth of the Industrial Revolution in the 18th century. Emissions of CO₂ associated with industrialisation began with the large-scale smelting of iron ores using coke as fuel and limestone as the flux to absorb impurities (Figure 3).

The crucial relationship between the Industrial Revolution and climate change and the responsibility of the IGMT to take action has been set out for the public by their Chief Executive: "So climate change, to an extent, started with industrialisation and it started here. Ironbridge was an amazing and innovative place, but while you could see the furnaces burning brightly at night, there was also a pall of smoke that hung over the gorge because of this process. It is important that we get these stories across to our visitors, because climate change and environmental issues are so important and topical" (*Shropshire Star* 2021).

I had a very positive meeting with the Chief Executive in early 2020, but further progress was curtailed by COVID-19, which caused extreme financial pressures as IGMT museums

closed during lockdown. The IGMT expects to have established an accurate carbon footprint in 2024 for building and travel emissions, but establishing the operational footprint including logistics, exhibitions and maintenance works will take longer.

The three most significant actions taken to reduce carbon emissions are (1) establishing the Environment and Sustainability Committee to support operations and monitor actions to reduce environmental impacts including carbon emissions and biodiversity, (2) installing voltage optimisers on the main electricity supply to two of the main museum sites and (3) the annual action plan to reduce operational energy use across all departments.

Shropshire Wildlife Trust (SWT)

I have been a member of SWT for over 40 years and undertaken various roles and lots of activities on a voluntary basis. In 2019, I proposed a motion for the AGM that SWT declare a climate emergency and biodiversity crisis and commit to net zero by 2030. This motion was passed overwhelmingly. The outcome was a climate action plan that is updated annually and a carbon and climate working group attended by the Chief Executive.



Figure 3. *Iron Works, Colebrook Dale*, Philip de Loutherbourg, 1805. Copyright of and courtesy of the Ironbridge Gorge Museum Trust – The Sir Arthur Elton Collection.

Emissions of greenhouse gases have been reduced from 372 tCO₂e in 2019/20 (baseline year) to 270 tCO₂e in 2022/23. The largest reductions have been in electricity use, in part due to the switch to LED bulbs in the buildings; transport fuels, with petrol/diesel vehicles reduced from eight to three and two electric vehicles purchased; and staff commuting, initially due to COVID-19 restrictions but now due to established 50/50 home/office working.

The methane generated by the animals that graze some of the SWT nature reserves is the largest component (70%) of the annual carbon emissions. Six Nofence solar-powered GPS collars are being trialled with cattle owned by tenant graziers on certain SWT nature reserves (Figure 4). Virtual boundaries can be set and adjusted to focus the grazing on particular areas. The animals learn to recognise the audio warning from the collars and turn around to avoid the electric pulse equivalent to that from electric fences used in



Figure 4. Pedigree Dexter cattle with Nofence collars being trialled to graze specific areas at Cramer Gutter nature reserve. Photo credit: Clive Dean and Shropshire Wildlife Trust.

“ The requirement for SGCT to create new habitat resulted in a rewilding strategy. The natural succession from grassland in the Ironbridge Gorge is led by brambles that protect colonising shrub and tree species from deer browsing. This woodland creation will remove CO₂ from the atmosphere. ”

agriculture. If successful, SWT should be able to avoid grazing specific locations that do not need to be grazed and hence reduce the numbers of stock.

Currently, the purchase of land is being considered and costed to compensate for these emissions by sequestration of CO₂ through changes in habitat from arable/grassland to woodland and through avoidance of carbon emissions by restoration of peatlands currently in agricultural use.

Severn Gorge Countryside Trust (SGCT)

The SGCT manages the woodlands, meadows and heathlands (270 ha) in the Ironbridge Gorge World Heritage Site. I am a Trustee and my proposals for action on climate change resulted in agreement in November 2019 that SGCT would declare a climate emergency, become carbon neutral by 2030 and set up a climate change working group. I am a member of this working group, which has created the Tackling Climate Change section of the SGCT website and also includes a climate strategy that I helped to draft (Rowley and Box 2022). A carbon calculator has been generated to assess annual SGCT greenhouse gas emissions from their operations and activities. These emissions include the methane from their flock of 60–70 Soay sheep that are used to graze the meadows and grasslands in combination with hay cutting.

Current discussions are focusing on how to compensate for the greenhouse gas emissions of around 18 tCO₂e annually. The SGCT cannot rely on existing habitats on their land to remove their CO₂ emissions from the atmosphere. New habitats are needed



Figure 5. Bramble scrub leading a natural succession from grassland with colonisation by tree and shrub species protected from deer browsing. Photo credit: John Box.

that will absorb these greenhouse gases as well as to help address the biodiversity crisis.

The requirement to create new habitat resulted in a SGCT rewilding strategy (Box and Morris 2022) and its implementation on Trust-managed land. Operational difficulties in managing two small meadows (2 ha in total) have resulted in no grazing or hay cutting since 2020 and these are being allowed to undergo natural succession, initially to brambles and scrub and ultimately to woodland. The natural succession from grassland in the Ironbridge Gorge is led by brambles that protect colonising shrub and tree species from deer browsing (Figure 5). This change from grassland to woodland creates a complex vertical dimension that is rich in biodiversity. This woodland creation will remove CO₂ from the atmosphere: a mixed native broadleaved woodland

that is 30 years old will absorb 14.5 tCO₂e/ha/year averaged over the time period whereas undisturbed semi-natural grassland in long term management has negligible CO₂ sequestration (Gregg *et al.* 2021).

Conclusions

I have learned that promoting hope and using storytelling about my own experiences are a much better way of getting others to take action than making people fearful of the future (De Meyer *et al.* 2021). Individuals are making a real difference to how organisations tackle climate change, global heating and biodiversity loss.

It helped that I was already a member of most of these organisations, was involved in various roles over the years on a professional and voluntary basis and had useful contacts. Working with



“ Don't be discouraged by people saying your actions are just a drop in the ocean. What's an ocean except millions and millions of drops? If you've ever seen a stalactite or a stalagmite, you'll know small drops can produce spectacular results. (Losada 2020). ”

Objectivity and an evidence-based approach are fundamental. In a world of alternative facts, fake news and social media, we need to demonstrate professionalism, integrity and reputation. Of these, integrity is absolutely fundamental and must underpin everything that we do.

Organisations of all types must tackle the climate crisis now. The message needs to be simple: the blanket of pollution trapping heat on Earth is made worse by burning coal, oil and gas. Another 10 years of incremental changes will not be enough. We can all play a part. Hope is created by actions. One action leads to another.

these local and national organisations at the same time meant that I could learn from each and use their actions to influence the other organisations.

So often there is a will to deal with these issues in an organisation and what is needed is a challenge to act. It is vital to establish good relationships with organisations and always try to offer creative solutions, particularly where financial resources are involved and when good intentions have to become real actions. Being part of a new working group dealing with ways of tackling these global issues gave me confidence, created allies and encouraged me to take more actions.

As ecologists and environmental managers, we must grasp the role of explaining the implications of the interlinked climate emergency and biodiversity crisis to those around us.

About the Author

John Box CEcol, CEnv, FCIEEM is an experienced ecologist and environmental manager who has worked in both public and private sectors. He chairs the Action 2030 working group that provides challenge and advice to CIEEM on the climate emergency and biodiversity crisis.

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Mimi Stanwood, at that time the CIEEM Marketing Officer, and Jason Reeves, CIEEM Head of Policy, started me on this journey. My grateful thanks to everyone in the six organisations who helped me, to Diana Pound for introducing me to new ways of telling stories and involving people in global issues, and to those who provided the photographs. Richard White and Penny Anderson provided very useful comments on a draft text.

References

- Box, J. (2023). How CIEEM is tackling its own greenhouse gas pollution. *In Practice*, **122**: 8–12.
- Box, J. and Connett, A. (2019). Action 2030: CIEEM response to the climate emergency and biodiversity crisis. *In Practice*, **106**: 58–59.
- Box, J. and Connett, A. (2021). Carbon offsetting to achieve net zero by 2030. *In Practice*, **113**: 29–33.
- Box, J. and Morris, N. (2022). *Rewilding Strategy*. Severn Gorge Countryside Trust, Ironbridge. Available at www.severngorge.org.uk/wp-content/uploads/Rewilding-Strategy-approved-June2022.pdf (accessed 7 January 2024).
- CIEEM (2020). *Using Nature-based Solutions to Tackle the Climate Emergency and Biodiversity Crisis*. Available at <https://cieem.net/wp-content/uploads/2020/07/Nature-Based-Solutions-designed.pdf> (accessed 7 January 2024).
- CIEEM (2022). *CIEEM Carbon Reduction Plan 2021–2030. 2022 Update*. Available at <https://cieem.net/resource/cieem-carbon-reduction-plan/> (accessed 7 January 2024).
- Connett, A. and Box, J. (2020). Steps to net-zero: how we are tackling the climate emergency and biodiversity crisis. *In Practice*, **108**: 66–68.
- De Meyer, K., Coren, C., McCaffrey, M. and Slean, C. (2021). Transforming the stories we tell about climate change: from 'issue' to 'action'. *Environmental Research Letters*, **16**: 015002.
- Gregg, R., Elias, J.L., Alonso, I. et al. (2021). *Carbon Storage and Sequestration by Habitat: A Review of the Evidence*, 2nd edn. Natural England Research Report NERR094. Available at <https://publications.naturalengland.org.uk/publication/5419124441481216> (accessed 7 January 2024).
- Local Government Association (2021). *Telford & Wrekin Council: Publicly Owned Solar Farm*. Available at www.local.gov.uk/case-studies/telford-wrekin-council-publicly-owned-solar-farm (accessed 7 January 2024).
- Losada, I. (2020). *The Joyful Environmentalist*. Watkins, London; p 3.
- Rowley, R. and Box, J. (2022) *Severn Gorge Countryside Trust and Climate Change*. Severn Gorge Countryside Trust, Ironbridge. Available at www.severngorge.org.uk/wp-content/uploads/Final-Text-for-Website-SGCT-Climate-Change.pdf (accessed 7 January 2024).
- Shropshire Star (2021). Ironbridge must accept 'unflattering' climate change role. *Shropshire Star*. Available at www.shropshirestar.com/news/environment/2021/10/23/ironbridge-must-accept-unflattering-climate-change-role/ (accessed 7 January 2024).
- Telford and Wrekin Council (2021). *Becoming Carbon Neutral: Action Plan. Annual Update 2021*. Available at www.sustainabletelfordandwrekin.com/what-the-council-is-doing/carbon-neutral-action-plan (accessed 7 January 2024).

Source to Sea: Towards Integrated Water Management in the National Trust

Figure 1. Intertidal habitat creation at Cotehele in the Tamar Estuary, south west England. Low-grade farmland has been restored to coastal wetland by breaching an embankment. As well as improving habitat this will help alleviate impacts of rising sea levels and coastal squeeze across the Tamar Valley. Photo credit: National Trust.



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The National Trust is a major land manager with ambitious targets for nature recovery and addressing climate change. Water management and restoration of freshwater and wetland habitats have a critical role to play, and we have a growing portfolio of demonstration projects. The National Trust is striving to take an integrated 'source to sea' approach to our water and land management as well as our visitor operations.

“ We estimate over 40% of the land in England and Wales drains to a National Trust boundary. We have a critical role in looking after water flowing through our land and reducing the impact from our own commercial activities. ”

Context

The National Trust looks after 250,000 ha of land in England, Wales and Northern Ireland, much of which is significant for nature (over 40% protected as Areas/Sites of Special Scientific Interest). This land ownership provides a wide range of benefits, from public access to important ecosystem services such as carbon storage and flood and drought resilience. Since 2015 the National Trust's strategy has focused on the interconnected challenges of nature recovery, climate mitigation and adaptation, and people's connection with the natural world. Understandably, water is an important natural asset across the National Trust estate, and we look after some of the UK's most important and iconic freshwater, wetland and coastal sites. We estimate that over 40% of the land in England and Wales drains to a National Trust boundary. As such we have a critical role in looking after water flowing through our land and reducing the impact from our own commercial activities.

It is increasingly recognised that globally freshwater biodiversity is declining faster than in other biomes (Almond *et al.* 2022) and at a UK level our freshwaters continue to be affected by a range of pressures despite improvements to some aspects of water quality in recent decades (Whelan *et al.* 2022). Protecting our water environment is becoming ever more critical; this is where the impacts of climate change are already being felt, through increased flooding and drought effects, and will continue to escalate.

An integrated approach to water

The National Trust approach to water management is guided by a set of principles (Box 1). These link the ambition and opportunity to work with natural processes at catchment scale with the need to demonstrate best practice management of our own estate and operations. Whereas these principles are focused on the freshwater and wetland environment, they are complemented by our framework for managing 1250 km of coast, which promotes working with nature in developing sustainable, long-term adaptation responses (National Trust 2015).

Box 1. National Trust guiding principles for our water and catchment work.

1. We will protect and restore all our freshwaters, wetlands and transitional waters.
2. We will work with natural processes whilst respecting cultural heritage.
3. We will take a sustainable, integrated and long-term approach to the protection of water, working at a catchment scale and in partnership.
4. We will reduce our use of water both treated and untreated to limit our impact on the water environment.
5. We will ensure our operations have no detrimental impact on freshwater and coastal ecosystems.
6. We will take an evidence-based approach to our water management decisions and gather evidence where our work can contribute to scientific understanding.
7. We will use our acquisitions to protect fresh and coastal waters.
8. We will ensure our decisions and actions about water management always take account of climate change projections.

In some places we manage rivers from their source to the coast. We are also collaborating with other landowners and organisations to place our work within a catchment context and address issues at source, in an integrated, holistic way. For example, the health of our beaches and coasts is affected by the release of pollutants from the land, via a range of sources including storm overflows, wastewater treatment works and agricultural activity. Therefore, it is only through working with others across a range of different sectors and at catchment scale that we can ensure the health of our beaches and bathing waters.

Visitor business and operations

There are many ways in which our activities as a custodian of land and a

major visitor business can impact the water environment. An important part of looking after the water environment is managing these impacts across our day-to-day operations.

The quantity and quality of water moving through landscapes is also changing due to climate change. At our properties, observed impacts include trees stressed due to soil moisture deficits during the summer months; damage to structures, such as walls due to shrinkage of clay substrates; property closures due to surface and fluvial flooding; erosion and damage to infrastructure during intense rainfall events; vegetation impacts from rising saline groundwater at the coast (e.g. Mount Stewart, Northern Ireland); and gardeners having to change planting plans to adapt to the changing availability of water.

As a response to changing water availability we are encouraging investment in rainwater collection and storage to limit our use of mains water. For example, at Ham House, London, where models now predict a 10–25% chance of a heatwave each year (up from 10% a decade ago; National Trust 2023) we have restored a Victorian water harvesting and irrigation system to use rainfall from the house guttering in the gardens. We are also investing in better composting facilities to provide mulches to reduce moisture loss and improve garden soils. Our guidance states that we only irrigate plants that are newly planted or highly significant and, at Sissinghurst, the garden planting has been redesigned to be both closer to the 1930s vision for the garden and more resilient, requiring almost no watering, even during drought. At our visitor hubs we aim to monitor and reduce water consumption and move away from mains water for activities like garden irrigation and toilet flushing (Figure 2).

Water management for visitor operations considers both ends of the pipe: water use and wastewater treatment. We manage over 40 surface and subsurface flow reedbeds and have plans to increase them with more nature-based solutions to treat wastewater. There is a growing need to address nutrients, particularly phosphates, from small-scale



Figure 2. A rainwater harvesting tank at Powis Castle, Wales. Photo credit: National Trust.

wastewater discharges. We have recently begun a pioneering trial of reactive media for phosphate removal at one of our most sensitive sites. Developing and testing simple cost-effective nutrient removal solutions means knowledge can be transferred helping to reduce impacts on and off our land.

Working at catchment scale and in partnership

The boundaries of our sites do not relate to movement of water across the landscape, which means working at catchment scale, involving a complex mosaic of landowners, stakeholders and responsible authorities. At the coast, it needs to extend further to consider adjacent shorelines linked by sediment movement.

The National Trust has a significant let estate, 80% of which is farmed (1200 farms). Working in partnership with tenants is critical to achieving our nature recovery and climate ambitions (Box 2). Recognising that land management practices can have a direct impact on the water environment, we are supporting tenants to incorporate nature recovery schemes in farm business plans. The scale of our estate means that we are often able to work at catchment scale. For example, we are working with our tenants in Bransdale, North Yorkshire, to deliver more for

nature throughout a farmed, upland catchment. Similarly, in the Yorkshire Dales we have worked with tenants to test a 'payments for outcomes' approach to delivering a range of ecosystem services across farms, including actions to improve soils, increase pollination and reduce flood risk (Richardson *et al.* 2020).

Our Riverlands programme has trialled integrated catchment management in locations where we have delivered river and other habitat restoration schemes working with statutory agencies (Environment Agency and Natural Resources Wales), community groups and neighbouring landowners. The Riverlands work embraces the whole freshwater landscape, targeting small streams, wetlands and ponds which we know are critically important for biodiversity at the catchment scale (Williams *et al.* 2020). Elsewhere, in the River Skell catchment in Yorkshire, we have worked with Nidderdale National Landscape and others to implement natural flood management (NFM) to protect downstream communities and provide resilience for our Fountains Abbey World Heritage Site. Wherever possible we are monitoring the impacts of our work through partnerships with other research organisations and citizen scientists (Clarke *et al.* 2023).

Box 2. Working with tenants.

At Wallington in Northumberland, the largest intact estate in our ownership at 5432 ha (2% of our total land holding), we have been working with our tenant farmers to improve watercourses flowing through the estate. Providing livestock with alternative drinking sources has enabled us to fence off streams and plant riparian woodland to reduce diffuse pollution, sequester carbon and create wildlife corridors. To date, 3 km of riparian corridor has been protected, with a further 10 km to be fenced this year.

Working with natural processes

The National Trust, along with many others in the UK environment sector, increasingly recognises the value of working with natural processes. This approach can bring benefits for people and nature and should help our rivers to become more dynamic, and therefore resilient, to a changing climate. Our coastal and river management approaches prioritise working with, rather than trying to constrain, natural process such as erosion and sediment transport.

Working with nature recognises that today's landscapes have been radically changed through human interventions (see Box 3). Some of these are clear, such as river embankments, weirs and coastal defences, but others are less obvious, such as land drains, historical removal of sediments and gravels, and loss of trees and vegetation or landscaping. To return our systems to a more naturally functioning and self-sustaining state will, in some cases, require significant changes in management.

There will also be difficult choices to be made in adapting to future change. Changes arising from adaptation will impact both natural and cultural heritage, and inevitably will involve losses, gains or simply something different from what is present today. For example, at Dinas Dinlle in north

Box 3. Wicken Fen: embracing naturalistic grazing with Konik ponies.

The East Anglian Fens were drained for agriculture during the 17th century. Just 0.1% of the former wetland remains with the National Trust's Wicken Fen one of the last surviving fragments; but even here the effects of wider drainage are leading to changes in the soil chemistry and wetland ecology.

As a new approach, the National Trust introduced Konik ponies and Highland cattle to Wicken Fen in 2001. These animals are allowed to roam widely and behave as wild animals displaying complex social interactions. Varied grazing patterns together with changes to water level control are helping to create a more diverse landscape that is more dynamic and hopefully more resilient to future climate change.

Our vision is to create a 52 km² nature reserve stretching from the oldest part of Wicken Fen to Cambridge. This will help with water management and fulfil joint ambitions of biodiversity recovery and connecting more people to nature.

Wales, coastal erosion threatens an Iron Age hill fort; here we are working with others to carefully record the site before it is lost to the sea. Raising awareness of the impacts of both climate change and our work to adapt is vital in building consensus with communities and partners.

River restoration

Some of the most dramatic and visible change on National Trust land has been delivered through river restoration projects. Due to the diversity of our rivers and constraints such as neighbouring land use, infrastructure or housing, there is no single method to restoring rivers. We have pioneered a range of different approaches aiming for the right solution for each location based on understanding geomorphological process and river

'types' expected in each location. In some situations, our work has returned watercourses to their natural course, for example at Goldrill Beck in Cumbria. Elsewhere, such as at Holnicote, Exmoor, we have been testing 'Stage 0' restoration approaches (Cluer and Thorne 2014), in-filling sections of modified over-deep river channel to 're-set' the valley floor and spread the flow (Figure 3). In other locations, we have helped the river do the work by introducing wood and fallen trees (often fixed to avoid movement downstream) to the channel to kick start processes to restore the channel form.

We have also been broadening out from classic 'leaky dams' to include a suite of other NFM measures across properties. These include aerating soil and changing land management techniques

to reduce compaction and increase infiltration; increasing surface roughness through vegetation growth and planting; breaking below surface land drains; using cross-slope features such as willow weaves, tree and scrub planting; and run-off management and offline storage such as terraced ponds. We have also reintroduced beavers to enclosures as a means of slowing flows and restoring habitat as well as returning a native species (Figure 4). Our ambition is to see these ecosystem engineers once again living free in many of our catchments.

Lessons learned

While we continue to learn from these ongoing projects, we already have some insight into challenges and opportunities. First, many of the projects



Figure 3. River Aller, Somerset, Stage 0 restoration, where a 1.2 km straightened and deepened section of the river has been in-filled to reconnect the river and floodplain. (a) Pre-restoration river 'hidden' in the central hedge line; (b) immediately post-restoration (September 2023) the river found new routes across the floodplain and created 7 ha of multi-channel wetland. Woody material (4000 tonnes) was added to increase habitat complexity and surface roughness and over 25,000 trees and wetland plants were planted. The site has continued to develop since, with additional complexity of channels, numerous ponds and pools, an increase in groundwater levels and an abundance of wildlife. Photo credit: National Trust & View It 360.



Figure 4. A beaver dam in the enclosure at Wallington, Northumberland. Photo credit: National Trust.

to date are opportunistic, where we have control of land, sympathetic tenants or a break in tenancy. However, many water management interventions need to be targeted to deliver the best outcomes and hence in future we need to direct activity to where it will deliver most and to do this at scale. Second, we have discovered the challenge of guiding open-ended, natural process-led projects through consenting regimes intended to deal with predictable end points. Early engagement with planners and statutory agencies is critical to secure support and understanding. Finally, although we have managed to undertake some monitoring in most instances, typically this has been harder to fund than practical works. Partnerships with universities have proved invaluable for securing some degree of monitoring and before/after comparisons.

Conclusions

The National Trust has the potential to deliver water management at scale across our estate. We are working towards embedding our work on water into our wider nature, climate and operational activities. Floods and drought are already affecting our places and hence the source-to-sea philosophy is an important foundation for our climate adaptation work. Our teams on

the ground are already doing a lot to make this happen but, given the challenges we face, it is clear we need to work faster, smarter and in more places. As the National Trust develops its next 10-year strategy we anticipate water management playing an increasingly central role in our work on nature recovery and tackling climate change.

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References

- Almond, R.E.A., Grooten, M., Juffe Bignoli, D. and Petersen, T. (eds) (2022). *Living Planet Report 2022 – Building a Nature-positive Society*. WWF, Gland.
- Clarke, S., Long, E., Biggs, J. *et al.* (2023). Co-design of a citizen science study: unlocking the potential of eDNA for volunteer freshwater monitoring. *Ecological Solutions and Evidence*, **4**: e12273.
- Cluer, B. and Thorne, C. (2014). A stream evolution model integrating habitat and ecosystem benefits. *River Research and Applications*, **30**: 135–154.
- National Trust (2015). *Shifting Shores: Playing our Part at the Coast*. National Trust, Swindon.
- National Trust (2023). *A Climate for Change: Adaptation and the National Trust*. National Trust, Swindon. Available at <https://nt.global.ssl.fastly.net/binaries/content/assets/website/national/pdf/a-climate-for-change-adaptation-and-the-national-trust-report-full.pdf> (accessed 24 January 2024).
- Richardson, J.C., Armstrong, J., Sullivan, E. *et al.* (2020). *Integrating Natural Flood Management into Payment for Outcomes Schemes in the Yorkshire Dales*. Available at <https://icasp.org.uk/projects-2-2/payment-for-outcomes/> (accessed 19 January 2024).
- Whelan, M.J., Linstead, C., Worrall, F. *et al.* (2022). Is water quality in British rivers “better than at any time since the end of the Industrial Revolution”? *Science of The Total Environment*, **843**: 157014.
- Williams, P., Biggs, J., Stoate, C. *et al.* (2020). Nature based measures increase freshwater biodiversity in agricultural catchments. *Biological Conservation*, **244**: 108515.

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Rivers are Essential to Life: The Rivers Trusts Look After Them

The River Liza in West Cumbria.



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Keywords: farming, rivers, soil management, tree planting, water quality

“ Only 14% of rivers in England and Wales are considered to have ‘good’ ecological status, based on Environment Agency monitoring. ”

Rivers Trusts are non-governmental organisations dedicated to protecting, restoring and improving our watercourses. They work collaboratively with partners, landowners, government bodies and communities to drive positive change by improving water quality and biodiversity, increasing resilience to flood

and drought events and connecting communities with their blue spaces. I recently started working with the West Cumbria Rivers Trust. This article is about what it is like to work for a Rivers Trust.

Water is the basis of all life, but the quality and quantity of water defines whether we and numerous species can live well. Poor ecological health, droughts and floods are issues that frequently hit the news agenda as

people are becoming more aware of the state of our rivers and the many impacts on them. The Rivers Trusts in the UK and Ireland aim to improve rivers and lakes for the benefit of wildlife and people. Officers in the Rivers Trusts collaborate, influence and take action to – sometimes literally – change the course of rivers.

Historically, we have abused our freshwater systems. Our rivers have been heavily modified and have to cope with a wide range of pressures including run-off from farmland, sewage overflows and abstractions. Only 14% of rivers in

England and Wales are considered to have 'good' ecological status, based on Environment Agency monitoring (see Environment Agency 2023) as per the Water Framework Directive.

In 1994, the first Rivers Trust was formed in the south west of England with the aim of reversing the decline in the condition of freshwater habitats. Over the next 30 years, the Rivers Trust movement has grown into a national movement with an umbrella organisation and 65 member trusts across the UK and Republic of Ireland. The Rivers Trust has 69 members of staff and the other trusts around 550 altogether.

The overarching Rivers Trust organisation protects, promotes and enhances freshwater ecosystems for people and wildlife. It is 75% project-funded with the rest coming from grants, donations and partners. Taking a science-led, solutions-focused approach, it works with the local Rivers Trusts to deliver better rivers through four key priority themes.

1. **Democratising data:** the Rivers Trust is passionate about putting environmental data in the hands of the wider public, so they can fully understand the state of our rivers and feel empowered to demand better for them. The best-known example of this is the sewage map, showing where untreated sewage is discharged annually in England and Wales (<https://theriverstrust.org/sewage-map>).
2. **Collaboration and partnerships:** the Rivers Trust takes a partnership approach to the improvement of rivers, recognising that there are countless stakeholders involved and that engaging with them is the most effective way of achieving positive results. We work with water companies, businesses, fellow non-governmental organisations (NGOs), local authorities and more.
3. **Connecting communities:** rivers are at the heart of communities, and so communities should be at the heart of river restoration. The Rivers Trust umbrella body was initiated to better connect the Rivers Trusts and scale up delivery while staying true to the principle of being a grassroots movement. It can act as a conduit to drive national or international funding

to local groups, or to take local expertise and share it more widely.

4. **Influence and advocacy:** the Rivers Trust engages proactively with politicians, the civil service, businesses, farmers and other NGOs to influence decisions that protect and improve river health, as well as the wider landscape. We call on them to take ambitious, strategic, evidence-based actions. For example, the Rivers Trust is a leading voice in calls to prioritise nature-based solutions, and work to improve rivers at a whole-catchment level.

The Rivers Trusts are slowly but surely making progress towards their vision of healthier rivers and lakes. In 2022–23 they worked with nearly 4500 farmers, planted more than 340,000 trees and installed 900 natural flood measures such as leaky dams.

Figure 1 shows where the Rivers Trusts are located; they follow the water, and therefore often cross administrative boundaries. This allows them to take a catchment-scale approach, thinking of a river and the land that it drains as a single unit, from source to sea. Not the whole of the UK is covered yet, but more Rivers Trusts are being formed in Ireland and in Scotland, where they work closely with Fisheries Management Scotland, which is a similar organisation. In Cumbria, there are four Rivers Trusts: Eden Rivers Trust, Lune Rivers Trust, South Cumbria Rivers Trust and West Cumbria Rivers Trust. These smaller organisations are agile and able to adapt to changing circumstances and draw on local knowledge and connections to deliver their work.

Enacting the sort of change we want to see for our rivers isn't easy and requires collaborative working. Rivers Trusts work in partnership to deliver projects, using resources and expertise of the Environment Agency, Natural England, the Woodland Trust, local councils and the Farmers Network, among others.

On the ground in Cumbria

West Cumbria Rivers Trust (WCRT) looks after the rivers and lakes in north west Cumbria (see Figure 2), which include the northern half of the Lake District and the whole area west of Carlisle.



Figure 1. Rivers Trusts in the UK and Ireland.

In this area there are 10 separate river systems divided over four distinct catchments. The River Derwent and River Ehen are large river systems, both designated as Special Areas of Conservation and salmonid rivers. Other rivers include a series of short rivers cascading from the high fells to the Irish Sea along the west coast. In the north, the Waver and Wampool flow through lowlands to the Solway estuary. Across these catchments, there is a huge variety in land use, topography and culture, from the traditional sheep farming on the Lake District fells to the productive lowlands. There are urban areas, including the towns of Whitehaven, Cockermouth and Keswick, but the majority of west Cumbria is agricultural, so our work is focused around supporting farmers by providing advice and delivering projects that not only make our rivers healthier but also benefit farm businesses.



Figure 2. West Cumbria Rivers Trust map.

Here at WCRT we have 21 members of staff. Most are Project Officers for a specific catchment area, and some specialise in subjects like fisheries, invasive species management and woodland creation. Over the last 5 years, WCRT has worked with 300 farmers to deliver 258 km of re-naturalised river, 26 ha of wetland creation/restoration and 66 ha of woodland creation, among other achievements.

The WCRT also leads the West Cumbria Catchment Partnership, which brings together local people and organisations to achieve *“healthy and sustainable water environments that benefit people, the economy and wildlife and are valued by all”*. We work collaboratively to prioritise, plan and deliver actions, share information and expertise, coordinate funding resources and champion nature-based solutions that provide multiple benefits. Every pound that is delivered through this partnership has added value.

I joined WCRT in May 2023 as the Project Officer for the Waver and Wampool catchment and I would like to take this opportunity to share some reflections on my first 9 months.

Working with farmers in the Waver and Wampool catchment

This is the first time WCRT have had a dedicated Project Officer in the Waver and Wampool catchment, so there is lots of work to be done. Prior to May 2023, only a couple of projects had been completed in the catchment by colleagues, but a walk-over survey of the whole catchment had been done a few years previously, which gave a good insight into the issues in the area. They range from river modification, erosion, run-off, poaching by cattle and weirs blocking fish movement to dredging.

None of the watercourses in this catchment have good status as defined by the national Water Framework Directive classification. The main causes of this are sediment, slurry and fertilisers that are washed off the land and into the water. Such diffuse water pollution has many effects. Sediment can smother the riverbed, meaning that the habitat for insects and fish is of reduced quality. Nutrients from fertiliser or slurry can also be harmful to river ecosystems, causing

blooms of algae and excessive plant growth that reduce the amount of available oxygen. Slurry contains bacteria that are harmful to river wildlife and to humans. The soil and fertiliser in run-off are a lost resource for farmers, so actions that reduce this run-off are good for both farm businesses and rivers.

I have set up some farmers' groups so farmers can learn from each other and industry experts. We have one for the whole catchment in which we discuss watercourse management, detailing how and when to maintain the watercourses and the best handling of slurry and fertilisers, as well as a smaller subgroup, the Crummock Beck farmers group. Farmers came together to talk about healthy soils and how, by better looking after the soil, rain, slurry and fertiliser will be better absorbed. This not only leads to higher yields of silage, but also reduces run-off. One way of improving the soil condition is by using a soil aerator to reduce compaction. WCRT purchased a soil aerator for shared use by this group of farmers. Natural England's Catchment Sensitive Farming team and the Farmers Network are working with us on this project. Together we offer nutrient management clinics that will inform farmers where they do and don't need to put any additional fertiliser, which could save them a lot of money and make the run-off less nutrient-rich. In terms of practical work, my main aim in this first year is to fence off streams and plant trees to improve the water quality by keeping livestock out of the water and creating buffer strips that will filter run-off on the Wiza and Crummock Beck.

The funding for my post and my work comes from three pots of money. My time and the community activities are being paid for by the Garfield Weston Foundation and we have successfully applied for Environment Agency Water Environment Improvement Fund money. The third stream of money comes from United Utilities, which provides funding to organise the farmers' meetings.

Challenges

Overall, working with the farming community is very rewarding but there are challenges. Farmers have a lot of demands on their time and, like all of us, it can be difficult for them to

prioritise long-term projects. The role of WCRT is to make sure that projects deliver for farm businesses as well as the environment and make project delivery as hassle-free for farmers as possible. This work is paid for and managed by WCRT including gaining all necessary consents to carry out the works and managing contractors and volunteers. Some projects take a long time to develop, but funding is often allocated on a year-to-year basis by the Environment Agency, United Utilities and other funders. This can put a lot of pressure on delivery and make budgeting difficult.

We are unable to get contact details of new contacts from partners such as the Environment Agency, Natural England or any other organisation that has members, like the Farmers Network or National Farmers' Union, due to data protection regulations. So, we have to work hard to reach out to landowners and land managers to let them know about our work. This is an essential but time-consuming task, so I have been very busy forging new relationships and building on the contacts my colleagues have previously developed in the area.

Through research of maps and local connections, I've managed to contact the landowners adjacent to my target streams that are in need of fencing. In the first 2 months of my employment, I arranged with four of them to fence off the Wiza or Crummock Beck fields and plant trees, which will reduce silt and chemicals entering the water stream.

The importance of these catchments for food production and the risks to the water environment have now been recognised by the Waste and Resources Action Plan (WRAP), an independent body made up of supermarkets and food producers. Under the Courtauld 2030 initiative, WRAP aims to source 50% of UK's fresh food from areas with sustainable water management by 2030 and will commit significant funding to the Waver and Wampool catchments next financial year to help achieve this. It's an exciting time for the catchment and will enable us to make plans that take more than a year to develop!

Community support

Although farmers are the custodians of the land, the natural environment

belongs to all of us. We want to encourage people to enjoy, value and look after our river environments and get involved in our projects. Therefore, we work with volunteers.

In December, I planted 600 trees adjacent to the Wiza Beck with the help of enthusiastic students from the Nelson Thomlinson School in Wigton and volunteers. These trees will help stabilise the riverbanks, sequester carbon and increase biodiversity along the streams. A wide strip along Wiza Beck was fenced off last year to not only keep cattle out of the river, but also to keep dogs away from the cattle as there is a well-used public right of way. This was useful to the farmer and the area is now transformed into a wonderful recreational area where people can

linger and enjoy the trees. After only 1 year it's amazing how well the riverbank has recovered (see Figure 3) with the help of some willow whips.

Children from St Cuthbert's Catholic School in Wigton helped me to plant 200 trees along a small tributary of the Wiza Beck in November. The first group were 5 and 6 years old, some of them smaller than our children's spades, but they really made the effort to dig a hole for a tree to go in. It pleased me to hear that the children knew that trees provide oxygen and I told them about the other important jobs trees do. Despite the weather being drizzly and cold and the field very muddy, all groups were very eager and with the help of our four apprentices we got it all done in 4 hours. Now there is a

beautiful strip with a variety of trees, which will enhance their playing field in years to come. They promised me that they will look after the trees too.

On the same field, I am in the process of having some scrapes dug by a contractor. These scrapes will hold water when it's wet, but are also a good place for birds to find invertebrates in the muddy edges.

Working for the WCRT is satisfying as it's an organisation that is practical and just gets on with things without too much red tape. I love talking to farmers about things I can do that will help their businesses and improve the environment. My colleagues are great and very helpful and I enjoy working here very much.

Conclusion

The Rivers Trusts work towards cleaner rivers and lakes, increasing biodiversity, reducing flooding and storing more carbon. Together with landowners they make practical projects happen on the ground. The uncertainty of funding streams and allocation of only yearly budgets by certain funders makes forward planning difficult. However, all Rivers Trusts achieve their goals slowly but surely, despite these challenges. Project opportunities like WRAP give us scope to develop long-term collaborations, which will benefit the Waver and Wampool catchment greatly.



Figure 3. Wiza Beck (a) showing willow spiling in place and (b) 1 year later. Photo credits: (a) Ruth Mackay; (b) Monique Speksnyder.

References

Environment Agency (2023). *State of the Water Environment Indicator B3: Supporting Evidence*. Available at www.gov.uk/government/publications/state-of-the-water-environment-indicator-b3-supporting-evidence/state-of-the-water-environment-indicator-b3-supporting-evidence (accessed 23 January 2024).

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West Chisenbury River Restoration and Wetland Project



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“ There were two main drivers and design objectives for the wetland project. 1. Quantifiable phosphorus capture through settlement of sediments with adhered phosphorus in wetland areas. 2 Restoration of natural chalk river geomorphology and floodplain processes. ”

Keywords: chalk stream, nutrient neutrality, phosphorus, river restoration, SAC, SSSI, wetland

Defence Infrastructure Organisation and Wiltshire Wildlife Trust are working in partnership to deliver a pioneering project at West Chisenbury on the Hampshire Avon. The project has been designed not only to restore a degraded stretch of a globally important chalk stream but also capture and remove phosphorus from the river. This is the first such project on a lowland chalk river system, creating a fully naturalised series of wetlands together with realignment of the main river channel through the centre of its floodplain and a network of braided channels.

Background

The Hampshire Avon is one of the finest chalk streams in the UK and the quality of this habitat means that much of the river and associated floodplain wetland is designated as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC). Like many of England's chalk streams the diverse ecosystem is particularly vulnerable to nutrient pollution (Natural England 2019). Excess amounts of nutrients in rivers, such as phosphorus, can cause increased growth of algae and large aquatic plants. This overabundance of vegetation alters the competitive balance of the community and results in decreased levels of dissolved oxygen through eutrophication, which can kill fish and other aquatic life.

As for most lowland UK rivers, the Hampshire Avon has been subject to extensive physical modification over time, resulting in loss of habitat and species diversity. Halcrow and GeoData Institute (2009) found 59% of the River Avon to be partially, significantly or severely modified. This analysis was based on extensive fluvial and

geomorphological audit of the entire designated stretch of the river between 2001 and 2009 with subsequent multi-criteria assessment applied to score and weight the physical habitat quality (naturalness) and degree of modification of river reaches.

The MOD Army Basing Programme (ABP) relocated around 2700 Army personnel and their families to the Salisbury Plain area during 2017–20. It has involved the construction of 1240 additional service family homes as well as accommodation for over 1000 soldiers and extensive new infrastructure. As part of the Masterplan process with Wiltshire Council, the decision was taken to close the MOD's existing sewage treatment works (STW) at Larkhill and make new connections to Wessex Water's Ratfyn STW on the Hampshire Avon, just above Amesbury. This has been estimated to result in an uplift in phosphorus entering the Avon of 567 g P/day (207 kg P/year).

As the Hampshire Avon was already deemed to be in unfavourable condition due to point and diffuse pollution, primarily from agriculture and the water

industry, the additional phosphate loading from ABP would add to the existing negative impacts arising from elevated nutrients. Mitigation was therefore required under the Habitats Regulations (2017) (as amended) to achieve nutrient neutrality and therefore demonstrate no adverse impact on the integrity of the River Avon SAC. It is a planning requirement that MOD offsets the increase in phosphate from ABP developments.

Over the last 5 years, MOD has delivered a series of projects towards the required phosphate offset. This has included delivery of a 5 year long Catchment Sensitive Farming (CSF) initiative (the Rivercare programme) which worked to reduce diffuse inputs in the Upper Avon catchment. Work has also been undertaken to reduce sediment run-off from military roads and tracks on the Salisbury Plain Training Area. However, in recent years, it has become clear that a CSF approach alone would not be adequate to deliver the required offset and a change of focus was required. A number of options are therefore currently under

investigation, including constructed wetlands and land-use change. An opportunity to develop a wetland project was identified at West Chisenbury and initial feasibility reports confirmed potential at this location to offset phosphate.

The wetland project

The project site (Figure 1) is an area of floodplain adjacent to the Hampshire Avon, between the villages of West Chisenbury and Upavon, in the heart of Salisbury Plain. In this location, the river has been previously realigned and heavily modified, over-deepened and widened, and largely disconnected from the floodplain (see for example Figure 2). The slow-moving water through the reach and lack of flow diversity had resulted in loss of water-crowfoot (*Ranunculus* spp.) and siltation of the gravel bed, limiting invertebrate diversity and salmonid spawning.

There were two main drivers and design objectives for the wetland project at West Chisenbury (Wiltshire Wildlife Trust 2022).

1. Requirement for quantifiable phosphorus capture. Phosphorus would be captured and removed from the river system through settlement of sediments with adhered phosphorus in wetland areas. The phosphate is then absorbed by growing vegetation. Plant litter settling to the bottom of the wetland stores continues to bind phosphates in the sediment layer as it builds up.
2. Restoration of natural chalk river geomorphology and floodplain processes in accordance with SAC conservation objectives.

Typically, optimum wetland design for phosphorus removal would be a constructed system with known input and output volumes, retention time and controlled water levels. However, an artificial system in this location would be directly contrary to the conservation objectives of the SAC (Natural England 2019), which dictate the need for a natural floodplain wetland. Conversely, a natural wetland is typically a dynamic system with a wide range of fluctuating variables, which means that

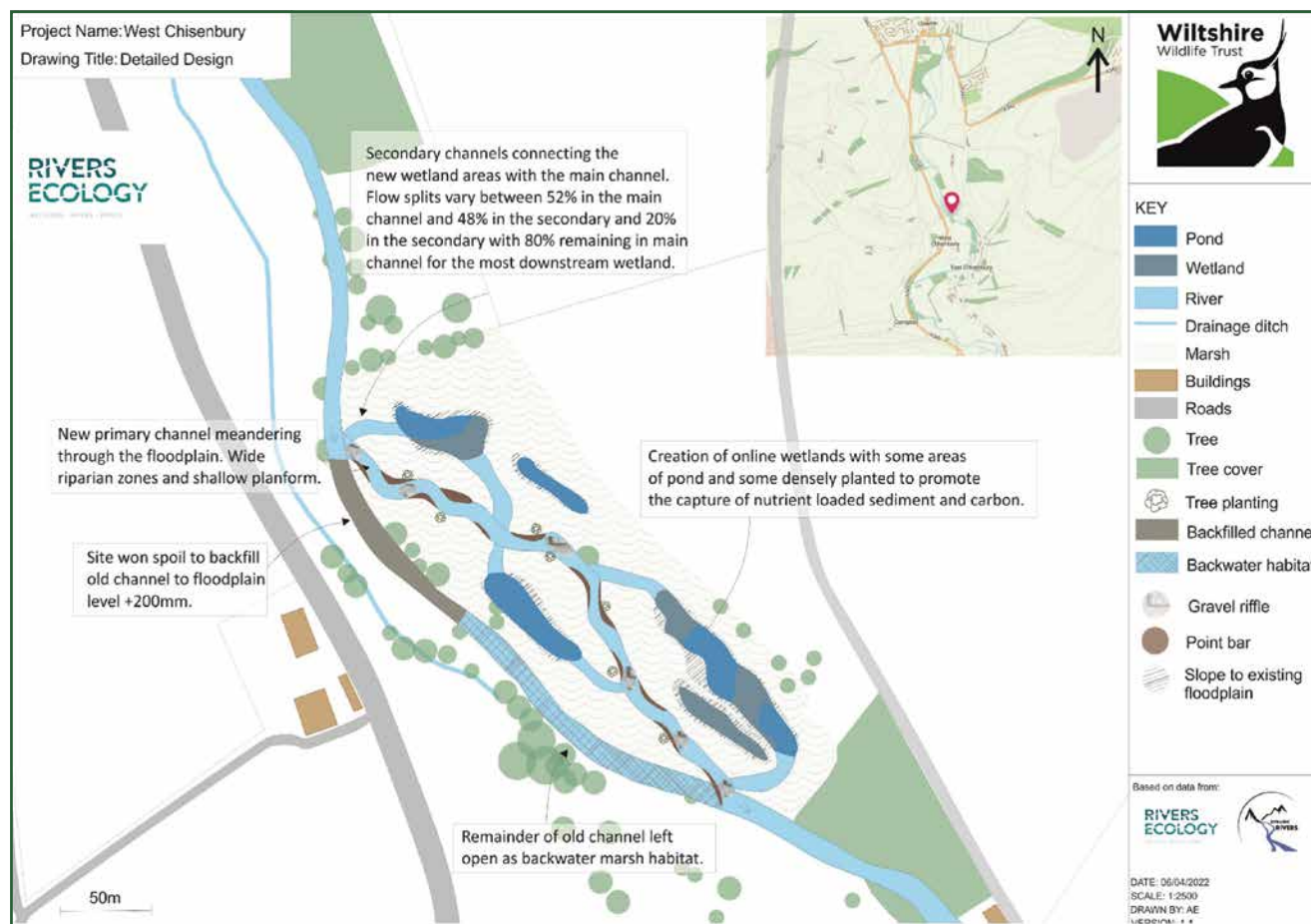


Figure 1. Overview of the West Chisenbury site: location and design.



Figure 2. Aerial view of the site at the beginning of construction. Photo credit: Kev Morris.



Figure 3. Completed new channel and wetland features immediately post construction, 9 November 2023. Photo credit: Kev Morris.

quantification of phosphorus removal is difficult (Land *et al.* 2016, Natural England 2022a). This leads to an inherent conflict between the two core objectives, which posed a challenge for the design team.

The design process therefore needed to balance the restoration of natural processes to a chalk river and floodplain with the conditions necessary for effective phosphorus removal in wetlands. Hydrological and phosphate modelling were used to inform design. It is critical that the wetlands remain wet year-round: if they dry out, the phosphorus bound in organic or inorganic forms could be remobilised when inundated again. Equally, the design sought to maximise the retention time in the wetlands to capture as much phosphate as possible. The design avoids the use of non-natural materials and incorporates gravel riffles at the inflow to the wetlands to deliver the designed flow splits. The gravel riffles also ensure the river is able to move and change through continuing erosion/deposition processes while still allowing flows into the wetlands.

Natural England and the Environment Agency have been involved from the early stages. Consultation was required to agree the methodology adopted for modelling a natural system. Obtaining relevant permissions and licences has been complex and challenging, including planning permission, Habitats Regulations Assessment, Biodiversity Net Gain assessment, Flood Risk

Assessment and a bespoke flood risk activity permit. The project design has also needed to build in access for the local fishing syndicate.

Further complicating the design process was the presence of water voles (*Arvicola amphibius*) in this stretch of the river. The design has incorporated good-quality habitat for water voles including wide riparian margins, diverse floodplain vegetation and varying bank profiles to provide opportunity for foraging and burrows. However, a Natural England water vole mitigation licence was required to displace water voles in advance of construction. Implementation of the project was therefore limited to August to October, constrained by the window in which water vole mitigation could be implemented successfully while avoiding the fish spawning season.

Implementation

Construction commenced on site in late August 2023. Excavation of the new river channel and wetlands progressed downstream, leaving a land bridge in place at the upstream connection. An archaeological watching brief encountered some interesting finds, including an elk antler! Following connection of the new channel to the existing river, approximately 75 m of the original channel was backfilled and plugged to ensure all flows pass through the restored reach. A large stretch of the old channel has been

retained as backwater habitat furthering the biodiversity potential of the site.

The new channel was connected to the main river in October 2023, a significant and symbolic moment for the project team to witness. One month on, it was already clear to see that the restored reach was hydrologically functioning in a more natural way, connecting the river to the floodplain and holding large volumes of water. Figure 3 depicts post-construction aerial imagery of the site, displaying the floodplain connectivity and layout of new features.

Monitoring

The initial modelling estimated that the online wetlands are capable of removing an average of 18 kg of phosphorus a year (Norfolk Rivers Ecology 2021). However, it is challenging to accurately model phosphorus uptake in a natural wetland system and therefore a monitoring programme funded by Natural England has commenced to determine the efficacy of the wetlands at phosphorus capture. Water samples are being taken twice a month at the upstream and downstream connections of each wetland area, and sediment samples are being collected monthly from across each wetland. This, along with flow and water temperature logging, will enable a picture to be built of total phosphorus removal from the system. A bespoke monitoring regime has been built for this wetland due to the unique nature

of the project; however, this is based on lessons learned from monitoring constructed schemes across the country. Restoration of fluvial geomorphology will be monitored using fixed-point and aerial photography, and invertebrate and Modular River (MoRPh) surveys. Colonisation of the new channel and backwater by water voles will be monitored.

Conclusions: a model for future wetland nutrient neutrality schemes?

Reducing phosphate input to our riverine ecosystems is fraught with difficulties and, in practice, requires intervention at the landscape scale and an integrated approach to nutrient and sediment management. This must include agricultural land management as well as treatment of point-source pollution to prevent phosphorus reaching the river in the first place, something that both Wiltshire Wildlife Trust (WWT) and Defence Infrastructure Organisation (DIO; see Note) work with land managers in the catchment to address.

It is hoped that the completed project at West Chisenbury will provide a template for combining large-scale river and floodplain restoration with the capture and removal of nutrients from rivers, particularly chalk streams. The predicted figure for phosphate offset from the West Chisenbury wetland is roughly 9% of the total required due to ABP. This is a relatively small proportion, but needs to be considered in the wider context. A project of this size is at an achievable scale when it comes to deliverability, encompassing just one field parcel, one landowner and a realistic value for funders to support. Greater quantity of phosphorus uptake could be achieved from constructed wetland systems, but the purpose of this project is to prove efficacy of natural systems. Demonstrating efficacy for phosphorus capture from this pilot project will enable the approach to be replicated at numerous locations up and down the catchment. This not only builds the amount of phosphorus being removed from the system, but it also provides the multiple benefits of river restoration, floodplain reconnection, habitat creation and improvement of SSSI/SAC river condition.

Since planning permission was granted for ABP, the field of nutrient neutrality

has been evolving rapidly (Natural England 2022b, 2023), and strategic mitigation schemes are now being developed by Local Planning Authorities and Natural England to unlock development that would otherwise fail the strict legal tests in the Habitats Regulations (Wiltshire Council 2023). Mitigation schemes are being funded partly by government and partly through funding from developers, for example through mechanisms such as the Community Infrastructure Levy (CIL). To date, the primary focus of mitigation schemes has been on measures such as constructed wetlands, changes in land management or retrofitting sustainable urban drainage systems within the catchment of an impacted site. However, if the monitoring delivers the predicted phosphate offset for the West Chisenbury project, it has huge potential to unlock private finance funding from developers for nutrient neutrality mitigation delivered through natural floodplain wetlands.

About the Authors

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Note

The Defence Infrastructure Organisation (DIO) is the estate expert for the Ministry of Defence, supporting the Armed Forces to enable military capability by planning, building, maintaining and servicing infrastructure. Responsibilities include acting as steward of the Defence estate, becoming an expert in sustainability, climate change and the environment, and providing advice that leads to environmentally sound infrastructure decisions.

References

- Halcrow and Geodata Institute (2009). *Strategic Framework for Restoration of the River Avon System*. Halcrow, Swindon.
- Land, M., Granéli, W., Grimvall, A. *et al.* (2016) How effective are created or restored freshwater wetlands for nitrogen and phosphorus removal? A systematic review. *Environmental Evidence*, **5**: 9.
- Natural England (2019). *European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Avon SAC Site Code: UK0013016*. Natural England, Peterborough.
- Natural England (2022a). *Introduction to Freshwater Wetlands for Improving Water Quality*. Natural England Joint Publication JP044. Available at <https://publications.naturalengland.org.uk/publication/4866931000868864> (accessed 26 January 2024).
- Natural England (2022b) *Nutrient Neutrality and Nutrient Mitigation. A Summary Guide and Frequently Asked Questions* (NE776). Available at <https://publications.naturalengland.org.uk/publication/6248597523005440> (accessed 26 January 2024).
- Natural England (2023). *Nutrient Neutrality Principles*. Natural England TIN186. Available at <https://publications.naturalengland.org.uk/publication/5031421117988864> (accessed 26 January 2024).
- Norfolk Rivers Ecology (2021). *River Avon Wetland Feasibility Assessment and Detailed Design Report*. Rivers Ecology, Holt.
- Wiltshire Council (2023). *Strategic Appropriate Assessment of Developments in Wiltshire Occurring in the River Avon SAC Catchment*. Available at [www.wiltshire.gov.uk/media/9239/Strategic-appropriate-assessment-for-River-Avon-SAC-to-31-03-2024/pdf/AA_River_Avon_SAC_to_31March2024_FINAL_1.pdf?m=638181117316630000#:~:text=The%20assessment%20is%20relevant%20to,\(SPA\)%20and%20Ramsar%20site](http://www.wiltshire.gov.uk/media/9239/Strategic-appropriate-assessment-for-River-Avon-SAC-to-31-03-2024/pdf/AA_River_Avon_SAC_to_31March2024_FINAL_1.pdf?m=638181117316630000#:~:text=The%20assessment%20is%20relevant%20to,(SPA)%20and%20Ramsar%20site) (accessed 26 January 2024).
- Wiltshire Wildlife Trust (2022). *West Chisenbury Wetland: Detailed Design Report*. Wiltshire Wildlife Trust, Devizes.

Sustainable Management of Freshwater Ecosystems: What Will it Take and What Can the Eddleston Water Project Tell Us?

Figure 1. Aerial view looking upstream along the recently recreated meanders and flood pond at Kidston. Photo credit: Colin McLean.



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Keywords: Eddleston, freshwater, nature-based solutions, natural flood management, river restoration, Tweed Forum

A review of the planning and delivery of the award-winning Eddleston Water project provided an opportunity to examine the approach taken to implement restoration of freshwater ecosystems utilising natural flood management. The importance of a scoping study and the development of a process-based monitoring strategy are recognised, as is the need to engage fully with a wide range of stakeholders at all stages from planning to dissemination of results. A crucial element has been the realisation of the ambition of scale.

“ Perhaps the most important lessons are about scale: timescales, spatial scales, scale of monitoring, scale of investment, scale of engagement and, not least, scale of commitment and leadership. ”

Introduction

The Eddleston Water project (EWP) is a rare example of a long-running, evidence-based, multi-partner project using nature-based solutions to deliver ecological restoration focused on freshwater ecosystems at a landscape scale. To the delight of the project team and the possible surprise of the audience gathered in Birmingham in June 2023, this (until-then) little-known project won

not only CIEEM's Best Practice Large-scale Nature Conservation Award, but also the much-coveted Tony Bradshaw Award. And a couple of months earlier this small Scottish river catchment was designated by UNESCO as the UK's first Ecohydrology Demonstration site.

Picking up on the Water theme for this edition of *In Practice* and as part of the newly created CIEEM Special Interest Group on Freshwater, we wondered what lessons we could share with members on sustainable management of freshwater ecosystems, and particularly around planning and delivery of the project. And while the comprehensive monitoring programme that is in place is undoubtedly one of the key elements that defines the project, perhaps the most important lessons are about scale: timescales, spatial scales, the scale of monitoring, the scale of investment, the scale of engagement and, not least, the scale of commitment and leadership shown by the partners involved in delivery.

The Eddleston Water project

Started with a scoping study in 2010, the EWP is Scottish Government's ongoing empirical study of the effectiveness of natural flood management (NFM) to reduce flood risk and improve freshwater ecosystems and habitats (for full details, see Eddleston Water website, nd). It uses a range of nature-based solutions to enhance biodiversity across the whole catchment, focusing on ecosystem functioning while maintaining the sustainable livelihoods of local farms.

Eddleston Water is a tributary of the Tweed in the Scottish Borders with a catchment of 69 km² draining south to join the main river at Peebles. It is a typical rural Scottish catchment, with a mix of forestry, rough grazing and improved grassland. The river was severely straightened at the start of 19th century to enable the building of a toll road to Edinburgh. Drainage to improve agricultural production followed which, along with the building of a railway embankment and further changes in land use, resulted in loss and degradation of freshwater habitats and increased flood risk downstream.

At the outset, the river was classified as being of 'bad' ecological status (EU

Water Framework Directive criteria), largely due to the historical impacts on the physical structure of the channel. Meanwhile, the Scottish Environment Protection Agency's (SEPA's) flood risk assessment showed nearly 600 properties at risk of flooding in Peebles under a 1:200 year scenario. Self-recovery of the biophysical condition of the river over the past 200 years has been limited, but water quality is generally good, and it is designated an EU Special Area of Conservation for salmon (*Salmo salar*), lampreys (*Petromyzon* spp.), otters (*Lutra lutra*) and the beds of water-crowfoot (*Ranunculus* spp.).

Managed by Tweed Forum and supported by the Project Board (SEPA, Scottish Borders Council and Scottish Government), the EWP works with over 20 landowners, farmers and foresters to deliver biodiversity conservation at landscape scale. Nature-based solutions have focused on four main types of intervention:

1. remeandering the previously straightened channel – 3.5 km
2. creating temporary storage ponds and associated wetlands – 38 ponds
3. native tree planting in upland and riparian zones – 330,000 trees over 210 ha
4. large wood placement in headwater streams – 115 high-flow restrictor log structures.

Scoping and the importance of scale

The project had the 'luxury' of what should be a necessity for all freshwater restoration: appreciation of scale. In part, this was due to the requirement for a wide-ranging scoping study, led by the University of Dundee, which investigated and proposed actions around three areas that have underpinned the project:

1. identification of *potential* NFM interventions at the catchment scale
2. production of a comprehensive monitoring strategy
3. production of a stakeholder engagement strategy.

Together, these have set the scene for the scale of our ambition.

In effect, the EWP began with a blank canvas extending from the headwaters where floods are generated (sources), down through the streams and main river (pathways), to the floodplain and the communities of Eddleston and Peebles (receptors). We recognised that any attempt at sustainable ecosystem management had to take this landscape view of freshwater in all its forms (including groundwater) and encompass measurement of system inputs (precipitation), outputs (river discharges and hydrogeomorphology) and outcomes (floods, habitats and species). Scoping at the whole-system scale enabled the development of a range of theoretical NFM interventions on the floodplain and in the wider catchment which could then be explored in more detail. Among others, these included potential options in the upland source areas to create ponds, plant riparian and tributary woodland, and to install engineered high-flow log structures; while exploring ideas to remeander the channel and create floodplain ponds further downstream. The one major set of interventions that have not so far been progressed is to alter grassland farming practices, such as reducing stocking density or introducing regenerative farming.

Negotiating potential opportunities

The task of 'negotiating' the location and installation of NFM measures was undertaken by Tweed Forum. Operating as a trusted intermediary, they are able to explore ideas and put together individual funding packages to compensate farmers willing to accommodate NFM measures on their land. Tweed Forum undertake any necessary paperwork and legal agreements are avoided, no specific payments are made and, if things don't go as planned, the Forum are there to deal with it. One consequence of this approach is that the timing, extent and style of interventions are a compromise reached through balancing restoration ideals, scientific design, project desires, funding opportunities and individual farmers' business plans and personal interests.

This approach has produced impressive results in terms of uptake, but they are



Figure 2. Lake Wood remeander reach 10 years after creation, showing development of in-channel sediment bars and riparian woodland. Photo credit: Colin McLean.

somewhat uneven across time and space. The timing, extent and design of remeandering undertaken on adjacent reaches of river, for example, differed with different landowners, as seen in the degree of sinuosity of the new channel at Cringletie (8%) and Lake Wood (47%; Figure 2) and the treatment of the riparian buffer zone in each. Gradually, more landowners have come on board, but without the ability (so far) to offer ongoing 'NFM management' payments, this relies on successful negotiation with a willing land manager. This has two consequences: firstly, the exact location of NFM measures is rarely the 'optimum' location or size to achieve maximum ecological or hydrological impact; and secondly, there are several planned and designed restoration initiatives that, despite discussions, have not been implemented. That they might be in due course is a bonus of having a project with a long-term vision of freshwater restoration, rather than a time-limited period in which to deliver set outcomes.

The scale of monitoring

As noted, the twin aims of the EWP are to examine the effectiveness of NFM measures to:

1. reduce the risk of flooding to downstream communities
2. improve habitats for wildlife and raise the 'ecological status' of the river.

As this encompasses the whole catchment, the monitoring strategy uses a multidisciplinary, process-based approach to assess the impact of measures on hydrology and ecology. This breadth of monitoring involved the integration of scientific disciplines and monitoring locations, underpinned by the establishment of a fine-scale hydrological monitoring network capable of providing the spatial platform upon which other monitoring programmes operate. We developed a Cascade Impact Monitoring approach, focusing on the impact of different elements on other aspects of the freshwater ecosystem:

Underpinned by a series of weather stations, hydrological monitoring covers surface (river gauging) and ground water; hydromorphology covers fluvial audits and detailed in-channel morphology; and ecology includes fish, aquatic macroinvertebrates and macrophytes. Other studies have covered the ecology of ponds, changes in land use patterns, ecosystem services and behavioural topics such as farmers' attitudes to NFM. We also assessed the economic costs and benefits of installing NFM measures across the catchment, measuring both flood damages avoided and benefits from complementary delivery of ecosystem services such as water quality, biodiversity, carbon and recreation.

Where possible, we employed a Before-After-Control-Impact (BACI) monitoring design, such as for assessing the impact of remeandering on channel morphology and aquatic macroinvertebrates; and the

Precipitation > hydrology > hydromorphology > ecology

effectiveness of high-flow restrictor log structures on delays in flood peaks. Where BACI is not possible, we look to compare the response to restoration measures from sub-catchments having contrasting environmental or hydrological characteristics.

The other key aspect of scale for monitoring is time. Unlike many studies, we were able to collect 2 years of data before any NFM measures were introduced, with by chance one of those years, 2012, recording the highest rainfall and flood event so far against which to compare results. Ideally, we would have longer to establish a more robust baseline, but we have been able to collect 10 years of data (and counting) since the first suite of measures was introduced. This scale of post-implementation monitoring allows us to explore the trajectory of recovery of the freshwater system in a way very rarely possible.

The scale of investment

A project that has already run for 13 years is not cheap, with approximately £2.9 million spent by 2022 (excluding significant in-kind resources from partners); of which capital works account for £1.3 m and monitoring, evaluation and modelling so far costing £1.1 m. The latter includes detailed, quality-controlled empirical survey methods, in addition to which we have developed a combined hydrological-hydraulic catchment model using open-source HEC-RAS2D software.

The majority of funds have come from Scottish Government or SEPA's Water Environment Fund with 5 years' matched funding from the EU Interreg programme through participation in the Building with Nature project. In addition to securing grants from forestry and agri-environment sources to support the maintenance of NFM measures, Tweed Forum have been able to access other

funding streams including local businesses, Scottish Borders Council, Woodland Trust, Forest Carbon and wind farm offset payments.

Stakeholder engagement and dissemination of results

The production of a stakeholder strategy enabled us to consider how best to engage with the full range of organisations and individuals with an interest in or influence over NFM on site and from a wider policy and practice perspective. We recently hosted visits from Scottish Government's directorate of Environment and Forestry, and NFM study tours from both East Lothian and Dumfries and Galloway councils.

Beyond policy-makers, practitioners are a key target for dissemination, often as part of conference or study tours (e.g. European Climate Change conference and, in 2023, CIEEM were here!) or more formal training courses including the Environment Agency and recently the Woodland Trust and Forest Research. To date, some 6000 individuals have been shown NFM measures in action across the catchment; a particular value of which is that it enables detailed discussions, something that can often lead to new research projects covering the full scale and diversity of scientific disciplines.

Perhaps the most important set of stakeholders are the landowners, farmers, foresters and local community itself, without whose agreement little can be achieved. Discussion with individual land managers is done face to face, always led by Tweed Forum. Although disrupted by COVID-19, we hold regular project update meetings in Eddleston village hall; an informal opportunity to let folk know what we have been doing and what we have discovered and to let them ask questions. This is definitely not a 'hard sell' to recruit more land managers to adopt NFM measures; rather, it is a chance to meet and talk one evening with tea and cakes provided by the local café.

The last part of our stakeholder strategy addresses the type of communications we use and again scale is everything. Reports are placed on the project website, but beyond that research outcomes head to academic, peer-

reviewed journals and reports to our funding bodies and partner organisations. We have contributed to short policy briefs and written numerous articles for targeted journals (e.g. the Environment Agency's *Current* magazine, and *Countryside Land Management*) and websites (Ecosystem Knowledge Network). That much of the river is visible from the main road between Peebles and Eddleston, as also from the new bike/walking path, provides another very real (albeit unwitting!) means of communication which, along with support from the local press, are great means of dissemination.

Results

Full details and reference to published papers and reports are available on the project website and in the 2021 report (see Spray *et al.* 2022) showing that through using NFM it is possible to recreate 'disrupted' hydrological and ecological processes at both the river reach and landscape scale. Highlights include:

- **Remeandering the channel** results in an increase in channel length (an additional 8–47%), which in itself increases the amount of riparian habitat available. Once recovered from disturbance, remeandered reaches show increased diversity compared to previously straightened channels, with more pools and riffles, especially where more sinuous channels have been created such as at Lake Wood. Ongoing analyses will demonstrate the trajectory of in-stream habitat and species recovery, for which we now have 10 years' post-intervention data.
- **Flood storage ponds** are designed to always hold some water, while having additional bunded capacity to accept larger volumes during floods. NFM ponds provide habitats for aquatic macroinvertebrates from over 50 families, including 25 high-scoring water-quality indicator species. Along with ongoing work on dragonflies, this shows the ponds are similar to UK ponds designed for wildlife conservation in terms of species richness, and their creation has also strengthened the local amphibian populations. Ponds can help reduce flood peaks but as storage volume is

“ The scale of post-implementation monitoring for the EWP allows us to explore the trajectory of recovery of the freshwater system in a way very rarely possible. ”



Figure 3. Riparian native tree planting in tributary catchment. Photo credit: Tweed Forum.

generally small compared to catchment area, this will only be effective for small flood events.

- **Riparian and headwater tree planting** will enhance terrestrial biodiversity (Figure 3), while the shading provided by bankside trees reduces water temperatures by 1.5°C (daily maximum), providing an element of climate change adaptation through the creation of cooler refuges for salmon. There is a strong relationship between land use, type of woodland and soil permeability, with NFM measures that seek to improve infiltration most effective in low-permeability catchments, and soils under mature broadleaf woodland having a much higher permeability (5–8 times) than under neighbouring grazed pasture. Modelling landscape-scale tree planting under different climate change scenarios shows up to 40% reduction in peak flows, and flood peaks delayed by 45 minutes.
- **Large wood placed in headwater streams** provides limited biodiversity benefit as, unlike beaver dams, these structures are designed to allow low flows to pass under them unhindered. However, installing them in series on the Middle Burn tributary shows them to be very effective in delaying the time between rainfall events and rising river levels by 2.5–7 hours for catchments in the headwaters up to 25 km².

Conclusions

Nature-based solutions and NFM specifically will not of their own deliver the step changes needed for freshwater ecosystem restoration, but they have an important role to play. Providing the evidence base for their effectiveness is crucial, but it is already clear that success will require a diverse range of measures across the whole landscape. Our work on environmental cost benefits provided by the NFM measures shows that the net present value (NPV) of flood damages avoided downstream (£950,000) is dwarfed by the equivalent NPV derived from other ecosystem services provided by these same measures (£4.2 m), including amenity, biodiversity, carbon and water quality, providing a policy challenge as to how best such flood schemes should be appraised.

Our current focus of work includes the development of a 'green market for NFM' to attract private finance to enable much more to be done on the ground. We hope to be able to offer landowners a revenue stream for 20 years as payment for providing NFM measures, while 'selling' the resulting downstream flood risk reduction and other ecosystem services to 'buyers' and 'investors'.

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References

- Eddleston Water website (nd). Available at <https://tweedforum.org/our-work/projects/the-eddlestone-water-project/> (accessed 24 January 2024).
- Spray, C., Black, A., Bromley, C. *et al.* (2022). *Eddleston Water 2021 Report*. A report for Scottish Government by Tweed Forum. Available at <https://tweedforum.org/wp-content/uploads/2023/02/Eddleston-Water-2021-Report.pdf> (accessed 25 January 2024).

Further reading

- Black, A., Peskett, L., MacDonald, A. *et al.* (2021). Natural flood management, lag time and catchment scale: results from an empirical nested catchment study. *Journal of Flood Risk and Management*, **14**: e12717.
- Spray, C., Black, A., Bradley, D. *et al.* (2022). Strategic design and delivery of integrated catchment restoration monitoring: emerging lessons from a 12-year study in the UK. *Water*, **14**: 2305.

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Marine Energy Today: Where Are We?

Caspian gull (*Larus cachinnans*) in the Arabian Sea. Photo credit: Ashleigh Kitchiner.



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Keywords: marine energy, oceans,
offshore, renewables

“ Marine energy
can offer a significant
contribution to regional, as
well as national, net zero
targets. ”

Marine energy, an emerging source of renewable energy that harnesses the power of the ocean to generate electricity, has significant potential to mitigate climate change. Despite the widespread acknowledgment of the promising advantages associated with marine energy, diverse opinions exist, often shaped by geographical nuances, stakeholder priorities and the perceived trade offs between renewable energy expansion and environmental preservation. Striking a balance among these perspectives stands as a pivotal endeavour, crucial for the conscientious and sustainable implementation of marine energy initiatives. Undoubtedly, the trajectory towards harnessing marine energy remains steadfast, underlining its enduring presence in our renewable energy future.

Marine energy is an emerging source of renewable energy that harnesses the power of the ocean to generate electricity. This type of energy, also known as marine and hydrokinetic energy or marine renewable energy, is a renewable power source that is harnessed from the natural movement of water. Due to the reliability of the tides, development of marine energy has the potential to provide a significant contribution to reducing our reliance on fossil fuels and mitigating climate change.

Why marine energy?

To combat the effects of climate change, the UK Government has committed to net zero emissions by 2050. Recently the UK and Canada strengthened ties for marine energy collaborations and the Scottish Government opened a consultation on its draft Energy Strategy and Just Transition Plan (ESJTP) as a route map of actions to deliver a net zero energy system. Although the focus is on the net zero transition, the National Grid System Operator has estimated that generation capacity will have to double by 2050 in line with increased energy demands (McKinsey & Company 2022).

Marine energy can offer a significant contribution to regional, as well as national, net zero targets. A recent study found that marine energy could “contribute to the system by producing 34 TWh/year, equivalent to 11% of the UK’s current annual electricity demand” (Coles 2021). In north west England, for example, a net zero target of 2040 has been agreed and the Mersey Tidal Power project is set to contribute to the target by providing power to local transport, heavy industry, data centres and the hydrogen economy.

Where are we now?

Significant progress has been made in the development and deployment of various marine energy technologies, such as tidal and wave; however, the deployment and utilisation of marine energy on a large scale is still limited compared to other renewable energy sources like solar and wind energy. Previously, the development of marine energy technologies faced various challenges, including high costs, technological limitations and regulatory hurdles. The costs associated with the installation, operation and maintenance of marine energy devices remained relatively high, which has hindered widespread adoption; however, technological advancements are continuously being made to improve the efficiency and reliability of marine energy devices.

In April 2008, Bristol company Marine Current Turbines installed SeaGen, which was the world’s first commercial-scale tidal energy generator, in Strangford Lough, Northern Ireland



Figure 1. The world’s first commercial-scale tidal energy generator, SeaGen, in Strangford Lough, Northern Ireland. Reproduced under the Creative Commons Attribution-ShareAlike 2.0 licence.

(Figure 1). From 2011 the Marine Energy Accelerator (MEA), a programme focused on reducing the cost of energy from wave and tidal stream technologies, supported technological innovations over 4 years, up to 2015, and set out clear pathways for future costs of energy reduction, with sufficient focus on innovation to ensure that the cost of energy from marine generators is competitive with other renewable technologies by the mid-2020s.

Nearing the 2020s, Scotland adopted a ‘deploy and monitor’ approach, with marine energy developments being built in phases. Scotland’s marine area contains 25% of Europe’s tidal energy resource (Scottish Government 2015). This tidal stream resource is found in the narrow channels and off headlands of many of the Western and Northern Isles and the north coast of mainland Scotland, with the Orkney Islands and the Pentland Firth containing much of the resource. Scotland has a semi-diurnal tide which leads to tidal sites experiencing high current speeds four times a day (during peak ebb and flood) with short periods of low current speeds in between. There is also a 14.8 day spring/neap cycle due to the interaction of the Earth, sun and moon. This means that tidal stream electricity generation would vary, with four peaks every day and two peaks every month; however, this is more predictable than other renewable energy sources such as wind.

In 2021, the UK Government announced a tidal energy investment package of £20 million per year in tidal stream electricity as part of its flagship renewable energy auction scheme, kickstarting a brand-new chapter for the tidal industry and creating jobs across the UK. Working with the European Marine Energy Centre (EMEC) and their accredited ‘plug-and-play’ facility helped tidal stream providers with berth consents and licensing through Marine Scotland. In addition, having an established grid structure helped with exporting electricity. Innovative ways of dealing with a constrained grid have been valuable, such as storing the energy as hydrogen and alternatives in a grid-scale battery. Future upgrades to the grid infrastructure will help all renewable technologies with export requirements, to which marine energy will contribute, mainly due to its predictability.

The regulatory frameworks and policies for marine energy differ among countries and regions, which can affect the pace of development and deployment. Balancing the challenges and potential environmental impacts with the need for clean energy generation remains a critical aspect in the development of marine energy projects. When developing a tidal range scheme, or any infrastructure project, the theoretical design life is often estimated. Engineers can calculate how long a scheme may last based on expected conditions, use and physical properties of the item. The design life of a tidal range scheme is typically about 120 years, with actual life possibly double that figure. Critically, the design proposed for many schemes allows for sea wall height increase (needed to combat rising sea levels) and technology/turbine overhauls and updates (every 25–30 years) to be carried out cost-effectively. This lifespan compares favourably to other low-carbon energy sources. For example, the life cycle of a nuclear plant may be 40–60 years while offshore wind farms are expected to last 20–30 years. The increased design life can highly influence regulatory frameworks and policies for marine energy.

As a result of the UK investment package and numerous research

projects, many tidal stream providers are now at commercial readiness, including Orbital Marine Power (OMP) with its floating tidal technology, and Simec Atlantis with its subsea technology. OMP has generated 2 GW of electricity in over 2 years of continual operation since deploying the O2 Tidal Stream Turbine in May 2021 (see www.youtube.com/watch?v=4d9zs0W9u2A; Figure 2). OMP will be ramping up to multiple arrays in the coming years at sites across the UK, starting with installing over 7 MW of generation at the EMEC. This is part of the Allocation Round 4 contract for difference (a contract for difference is a private law contract between a low-carbon electricity generator and the low-carbon contracts company, a Government-owned company) allocated by the UK Government, which, in 2022, was the first time in the industry that funds had been ring-fenced for the tidal industry. In addition, in 2023, in Auction Round 5, over 50 MW of tidal projects were

allocated with ring-fenced financial support for tidal energy. This has been enabled in part by technology advancements, continual improvement, changes in response to lessons learned and facilities such as Fastblade at the University of Edinburgh. Fastblade is the world's first regenerative fatigue test facility and has the aim of making tidal turbine blade technology more efficient and sustainable as well as keeping the levelised cost of electricity (LCOE) at a competitive level for the market.

Continued efforts in research, development and collaboration between industry, government and academia are crucial to realising the full potential of marine energy and achieving a more sustainable energy future. OMP, along with project partners, has recently been selected by the European Commission's Horizon Europe Programme to deliver a 9.6 MW multi-turbine tidal energy array, claimed to be a world first due to the partners involved (November 2023). There are

“ Research, development and collaboration between industry, government and academia are crucial to realising the full potential of marine energy and achieving a more sustainable energy future. ”

plans for a tidal barrier across the Wash estuary on the east coast of England, and OMP has secured backing from Centrica, according to developer Centre Port. The project could bring together expertise from Ocean Energy Europe, Laborelec, Marasoft, EMEC, Center for Wind Power Drives of RWTH Aachen University, Energie De La Lune and the University of Edinburgh.

What have we learned from offshore wind developments?

The journey of offshore wind development has been a source of



Figure 2. Orbital Marine Power (OMP) uses floating tidal technology. Reproduced under the Creative Commons Attribution-ShareAlike 4.0 licence.

valuable lessons, shaping the evolution of renewable energy initiatives and environmental stewardship. The main takeaways and insights garnered from this trajectory are that collaboration among various stakeholders, government bodies, industry players, environmentalists and local communities is fundamental. Successful offshore wind projects have highlighted the significance of engaging all stakeholders from the onset, fostering open dialogue and incorporating diverse perspectives in the planning and execution phases.

Offshore wind development has emphasised the crucial need for comprehensive environmental impact assessments. Understanding and mitigating potential ecological effects, such as habitat disruption, noise pollution and impacts on marine life, are essential. Experience shows us the importance of incorporating robust environmental monitoring and adaptive management strategies to minimise adverse effects on ecosystems and wildlife. The lessons learned from offshore wind development serve as guiding principles for future endeavours, stressing the importance of sustainability, collaboration, innovation and responsible development in the renewable energy landscape.

Potential ecological effects

Environmental organisations such as the World Wildlife Fund support the development of marine energy as a sustainable alternative to conventional fossil fuel-based energy generation. They see it as a way to combat climate change and reduce the environmental impact of energy production. However, some organisations raise concerns about the potential ecological impacts of marine energy on marine ecosystems. Tidal stream developments remove kinetic energy from the tidal stream and therefore lead to a reduction of tidal currents downstream of the development. It is therefore important to consider the balance between energy extraction and physical change, and how to optimise energy removal while minimising the environmental impact. There is also the potential for direct interactions between tidal stream developments and the biological component of the marine ecosystem,



Figure 3. Wind turbines off the coast of England.

such as benthic organisms, fish, marine mammals and diving sea birds, and there have been a number of recent comprehensive reviews (e.g. Copping 2016). For example, there is potential for marine mammals to collide with tidal turbines, although this is still not well understood. Copping (2016) highlights the significance of robust Environmental Impact Assessments and the importance of understanding and mitigating potential impacts on marine habitats, biodiversity and species, stressing the need for thorough assessments prior to project implementation. Not only that but projects must incorporate lessons learned and best practice, and future directions and innovation should also be considered.

Environmental organisations advocate for thorough Environmental Impact Assessments, effective mitigation measures and responsible siting of marine energy projects. This is possible with adequate baseline data and information on sites to provide information on distribution and abundance of species such as marine mammals and birds that may be impacted by noise or visual

disturbances. As environmental professionals, we are acutely aware of the complexities surrounding baseline data collection in any ecological or environmental study. Baseline data serves as a foundational understanding of the natural state of an ecosystem before any significant alterations or interventions occur, acting as a reference point for future assessments and comparisons. However, despite our best efforts, obtaining comprehensive baseline data can be challenging due to various factors. Ecological systems are intricate and dynamic, making it difficult to capture every nuance and interaction within a given environment. Additionally, limitations in resources, time constraints and the vastness of certain ecosystems, especially marine or remote areas, can impede our ability to gather exhaustive data.

Furthermore, in some cases, it may not be possible to entirely mitigate against certain natural phenomena or variables. For instance, while we strive to minimise human impact during a project or development, there might exist elements beyond our control, such as natural disasters or climate-related events, which can influence the environment

“ The challenges involved prompt us to adopt a nuanced and adaptive approach, emphasising the need for continuous monitoring, adaptive management strategies and a commitment to learning from the ecosystem’s responses. ”

despite our mitigation efforts.

Acknowledging these challenges doesn’t imply a lack of responsibility or effort; rather, it underscores the complexity inherent in environmental studies. It prompts us to adopt a nuanced and adaptive approach, emphasising the need for continuous monitoring, adaptive management strategies and a commitment to learning from the ecosystem’s responses.

Ultimately, while we strive to gather as much baseline data as possible and mitigate foreseeable impacts, we also recognise the importance of humility in understanding the limitations of our knowledge and control in the face of nature’s intricacies. Our commitment as environmental professionals remains unwavering: to diligently work towards preserving and safeguarding our natural world while acknowledging and learning from the challenges encountered along the way.

Communities

People living in communities near marine energy project sites can have varied opinions. Some communities see marine energy as an opportunity for economic development, job creation and energy independence. They may welcome the potential benefits associated with infrastructure investment and revenue generation;

however, others may have concerns about the visual impact, noise, disruption to fishing or navigation activities, and potential effects on local marine ecosystems. A recent report published by the London School of Economics’ Grantham Institute revealed tidal stream electricity generation could deliver sustainable economic growth, enhance net zero efforts, improve energy security and generate jobs across the UK (Serin *et al.* 2023). Key results from the report show that 12.6 GW of marine energy deployment would save the UK energy system over £1 billion a year (Serin *et al.* 2023).

Engaging and consulting with local communities throughout the planning and development process is crucial to address community concerns. In May 2014, Nova Innovation installed the first community-owned tidal turbine in Bluemull Sound in the Shetland Islands. The Nova 30 device had a maximum generating capacity of 30 kW and powered 30 homes. It was decommissioned in 2016. This trial deployment was a success and Marine Scotland applied a proportionate, risk-based approach to project consenting that recognised the potential benefits of marine energy and enabled the project to go forward. Lessons were learned from the Nova 30 project about turbine design, offshore operations and business management.

Overall, while there is general recognition of the potential benefits of marine energy, opinions can differ based on factors such as geographical location, stakeholder interests and the perceived trade offs between renewable energy development and environmental considerations. Balancing these perspectives is essential to ensure responsible and sustainable deployment of marine energy projects. But one thing is for certain: harnessing marine energy is here to stay.

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References

- Coles, D., Angeloudis, A., Greaves, D. *et al.* (2021). A review of the UK and British Channel Islands practical tidal stream energy resource. *Proceedings of the Royal Society A*, **477**(2255), 20210469.
- Copping, A., Sather, N., Hanna, L. *et al.* (2016). *Annex IV 2016 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World*. Available at <https://tethys.pnnl.gov/publications/state-of-the-science-2016> (accessed 18 January 2024).
- McKinsey & Company (2022). *Facing the Future: Net Zero and the UK Electricity Sector*. Available at www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/facing-the-future-net-zero-and-the-uk-electricity-sector (accessed 15 January 2024).
- Scottish Government (2015). *Scotland’s National Marine Plan*. Edinburgh: The Scottish Government. Available at www.gov.scot/publications/scotlands-national-marine-plan/ (accessed 15 January 2024).
- Serin, E., Andres, P., Martin, R., Shah, A. and Valero, A. (2023). *Seizing Sustainable Growth Opportunities from Tidal Stream Energy in the UK*. London School of Economics and Political Science, London. Available at www.lse.ac.uk/granthaminstitute/wp-content/uploads/2023/06/Sustainable-Growth-Opportunities-from-Tidal-Stream-Energy-in-the-UK-.pdf (accessed 18 January 2024).

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Beyond Mitigation: 20 Years of Biodiversity Gains from Managing a Compensation Wetland in Hong Kong



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Keywords: biodiversity gains, compensation, enhancement opportunities, threatened species, wetland

For over 20 years, AEC (Aurecon since 2023) has been advising MTR Corporation, operators of the Mass Transit Railway in Hong Kong SAR, China, on the management of a compensation wetland to mitigate for the ecological impacts of the Lok Ma Chau Spur Line. This project comprised the construction and operation of a new railway line and border crossing station connecting Hong Kong with adjacent Shenzhen. Mitigation measures for the project included the enhancement, management and monitoring of 32 ha of existing wetland habitats to create the Lok Ma Chau Ecological Enhancement Area. AEC Aurecon has been involved since the detailed design and construction stages to the present-day, long-term operation stage (including ecological monitoring and providing habitat management advice).

Introduction to the project

The Northwest New Territories of Hong Kong comprise a mosaic of habitats including large areas of wetlands dominated by commercial fishponds, and includes the Mai Po Inner Deep Bay Ramsar Site, which was designated in 1995. Deep Bay lies on the East Asian–Australasian Flyway and supports large/significant numbers of wintering waterbirds (Sung *et al.* 2021).

Immediately to the north is the city of Shenzhen and there are a series of cross-border links connecting the two.

The Lok Ma Chau Spur Line was proposed as the second rail link connecting Hong Kong with Shenzhen and required 7.4 km of new railway and a terminus with cross-border facilities. In 2002 the Environmental Impact Assessment (EIA) for the project was approved (BBV 2002); this required

that 32 ha of existing commercial fishponds be managed to enhance ecological value and compensate for the loss of wetland habitat arising from the project. This was subsequently approved and an Environmental Permit was issued, following which enhancement works commenced on the Lok Ma Chau Ecological Enhancement Area (EEA) (Figure 1).

The EIA identified those species of conservation importance that were predicted to be impacted by the project. These subsequently drove the design of the EEA and now inform the success of the wetland. The EEA was completed in 2006, and operational phase monitoring commenced in 2007.

Target species

The habitats in the EEA are primarily managed for the following target species:

- 32 wetland bird species (see Table 1)
- Eurasian otter (*Lutra lutra*) and leopard cat (*Prionailurus bengalensis*)
- herpetofauna and dragonflies.

Quantitative numerical targets were set for all bird target species where the

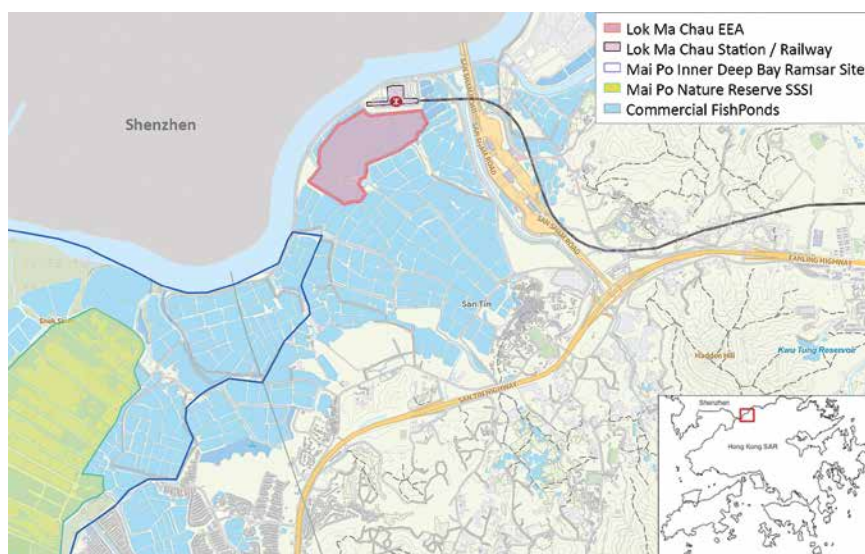


Figure 1. Map showing Lok Ma Chau EEA in the Northwest New Territories of Hong Kong.

density is required to be twice that of representative areas of commercial fishponds nearby (the control areas). Most other species do not have numerical targets, especially low-density species that are difficult to monitor accurately.

Habitat enhancement

Enhancement measures included the removal of existing aquaculture structures, installation of water control infrastructure (including an underground pipe network to allow water to be pumped between ponds

using electric pumps), reprofiling ponds to create islands and gently sloping pond margins to increase foraging opportunities for wading waterbirds. Habitat diversification included provision of reedbeds, lily ponds and marsh. Trees and shrubs were planted on some bunds and islands to provide screening from human disturbance and roosting habitat for waterbirds.

AEC Aurecon was primarily responsible for the detailed design of the EEA, with support on aspects such as the underground pipe network and associated electricity infrastructure, and supervised the contractor undertaking the enhancement works.

Routine management

Routine management measures include the adjustment of water levels, including drain-down of ponds on a rotational basis during the winter (dry season), which mimics the fish harvesting method carried out in traditional commercial fishponds. This

Table 1. Target species: birds.

Common name	Scientific name	Common name	Scientific name
Eurasian wigeon*	<i>Anas penelope</i>	Chinese pond heron	<i>Ardeola bacchus</i>
Eurasian teal	<i>Anas crecca</i>	Grey heron	<i>Ardea cinerea</i>
Japanese quail	<i>Coturnix japonica</i>	Great egret	<i>Ardea alba</i>
Little grebe*	<i>Tachybaptus ruficollis</i>	Intermediate egret*	<i>Egretta intermedia</i>
Black-winged stilt	<i>Himantopus himantopus</i>	Little egret	<i>Egretta garzetta</i>
Greater painted-snipe	<i>Rostratula benghalensis</i>	Greater spotted eagle	<i>Clanga clanga</i>
Pheasant-tailed jacana	<i>Hydrophasianus chirurgus</i>	Eastern imperial eagle	<i>Aquila heliaca</i>
Pintail snipe	<i>Gallinago stenura</i>	Eurasian coot	<i>Fulica atra</i>
Swinhoe's snipe	<i>Gallinago megala</i>	Pallas's grasshopper warbler	<i>Locustella certhiola</i>
Common snipe	<i>Gallinago gallinago</i>	Zitting cisticola	<i>Cisticola juncidis</i>
Wood sandpiper*	<i>Tringa glareola</i>	Red-billed starling	<i>Spodiopsar sericeus</i>
Great cormorant	<i>Phalacrocorax carbo</i>	White-cheeked starling*	<i>Spodiopsar cineraceus</i>
Black-faced spoonbill	<i>Platalea minor</i>	White-shouldered starling*	<i>Sturnia sinensis</i>
Yellow bittern*	<i>Ixobrychus sinensis</i>	Bluethroat	<i>Luscinia svecica</i>
Cinnamon bittern*	<i>Ixobrychus cinnamomeus</i>	Yellow-breasted bunting*	<i>Emberiza aureola</i>
Black-crowned night heron*	<i>Nycticorax nycticorax</i>	Japanese yellow bunting	<i>Emberiza sulphurata</i>

Note: target species should have a density at Lok Ma Chau twice that of control areas, except those with an asterisk for which this target level is not required.

“Many lessons were learned. Having a clear understanding of the habitat requirements of the target species was undoubtedly critical. Subsequent and ongoing adaptive management has likewise been important for fine tuning habitats and building on unexpected benefits.”

practice supports large numbers of piscivorous waterbirds, especially ardeids and spoonbills (Aspinwall and Company 1997).

Water quality is monitored and adjusted, primarily to maintain fish stocks. Vegetation is managed on a regular basis: grass is cut frequently on most pond bunds to maintain suitable loafing sites for waterbirds and emergent vegetation is controlled in open water ponds and unwanted plant species (primarily exotic invasives) are removed.

Fish are stocked as food for birds (mostly exotic tilapia purchased from local fishpond operators), to maintain water quality and to control emergent vegetation in open water habitats. Removal of invasive exotic species such as golden apple snail (*Pomacea* spp.) and red imported fire ant (*Solenopsis invicta*) is also conducted. Access for monitoring and management is controlled, especially during the winter when numbers of large waterbirds, especially disturbance-sensitive winter visitors, are at their highest.

Ecological monitoring and adaptive management

Following the establishment of the EEA in 2007, the numbers of target species using the EEA and two nearby control areas have been monitored. Birds are monitored weekly at all three sites using walked transects.

Based on the monitoring data, management is adaptive: short-term management actions (for example, water level adjustment) are planned and reviewed on a weekly basis; medium-term actions, such as vegetation management and fish stocking



Figure 2. Black-faced spoonbill (*Platalea minor*). Photo credit: Paul Leader

schedules, are reviewed seasonally; whereas a substantive review of success in meeting habitat and faunal targets is conducted every 5 years.

Lessons learned and key biodiversity gains

Inevitably, many lessons were learned during the process. Having a clear understanding of the habitat requirements of the target species was undoubtedly critical to the success of the project. However, subsequent and ongoing adaptive management has likewise been important for fine tuning habitats and building on unexpected benefits. An important lesson has been

to keep well-vegetated habitats as simple as possible. For example, in marsh areas we planted a complex mix of species, but these ultimately proved time consuming and difficult to maintain, and these areas, while now comprising only a handful of wetland plant species, are easy to maintain and still support the relevant target species.

Bird target species generally average five times the density recorded in the control areas, and many scarce or disturbance-sensitive species that occur regularly within the EEA are typically absent from the control areas. Such species include Eurasian otter, eastern imperial eagle (*Aquila heliaca*) and greater spotted eagle (*Clanga clanga*),

Table 2. Globally threatened bird species recorded in Lok Ma Chau EEA since 2014.

Common name	Conservation status	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Peak count since 2014
Falcated duck (<i>Mareca falcata</i>)	NT	–	–	✓	✓	✓	✓	✓	✓	✓	✓	12
Common pochard (<i>Aythya farina</i>)	Vu	–	✓	–	–	✓	✓	–	✓	–	–	2
Ferruginous duck (<i>Aythya nyroca</i>)	NT	–	–	–	✓	✓	✓	–	✓	✓	–	2
Japanese quail (<i>Coturnix japonica</i>)	NT	✓	–	–	✓	✓	✓	–	✓	✓	✓	2
Oriental stork (<i>Ciconia boyciana</i>)	En	–	–	–	✓	✓	–	–	–	–	✓	16
Black-faced spoonbill (<i>Platalea minor</i>)	En	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	305
Northern lapwing (<i>Vanellus vanellus</i>)	NT	–	–	–	–	–	–	–	–	✓	–	2
Black-tailed godwit (<i>Limosa limosa</i>)	NT	–	–	–	–	–	–	–	–	–	✓	1
Curlew sandpiper (<i>Calidris ferruginea</i>)	NT	–	–	–	✓	–	–	–	✓	✓	–	5
Red-necked stint (<i>Calidris ruficollis</i>)	NT	–	–	✓	✓	✓	–	✓	✓	✓	–	14
Grey-tailed tattler (<i>Tringa brevipes</i>)	NT	–	–	–	–	–	–	–	–	✓	–	1
Greater spotted eagle (<i>Clanga clanga</i>)	Vu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	4
Eastern imperial eagle (<i>Aquila heliaca</i>)	Vu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3
Collared crow (<i>Corvus torquatus</i>)	Vu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	13
Manchurian reed warbler (<i>Acrocephalus tangorum</i>)	Vu	–	–	–	–	–	✓	✓	✓	✓	–	1
Styan's grasshopper Warbler (<i>Helopsaltes pleski</i>)	Vu	–	–	–	–	–	✓	–	–	–	–	1
Rustic bunting (<i>Emberiza rustica</i>)	Vu	–	–	–	–	–	–	–	✓	✓	✓	2
Yellow-breasted bunting (<i>Emberiza aureola</i>)	CE	–	–	✓	✓	✓	✓	✓	✓	✓	✓	45

Note: species names in bold are target species (see Table 1). CE, Critically Endangered; En, Endangered; NT, Near Threatened; Vu, Vulnerable (Birdlife International 2024).

pheasant-tailed jacana (*Hydrophasianus chirurgus*), wintering geese (*Anser* spp.), and, in some winters, Oriental stork (*Ciconia boyciana*).

A notable biodiversity gain arising from the project has been the provision of habitat for globally threatened bird species. In the past 10 years, 18 species have been recorded (Table 2), of which 13 are *not* target species. During the same period, only four of these species were recorded in the control areas, which comprise areas of commercial fishponds.

The EEA has supported 1–7% of the world population of the globally threatened black-faced spoonbill (*Platalea minor*), with up to 305 birds present (Table 3). The species breeds in the Demilitarized Zone of the Korean peninsula and winters in southern China and south east Asia (BirdLife International 2024). Hong Kong has long been a winter stronghold for the species and the enhancement work at the EEA supports the importance of Hong Kong to the species. Under Ramsar Sites Criterion 6 (Ramsar 1971), the EEA meets one criterion for identifying Wetlands of International Importance: “A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.” This is a remarkable achievement for a small mitigation wetland and a notable conservation win; especially so in the context of its small size of 32 ha. The smallest Ramsar Site in China is 300 ha (Mao *et al.* 2021).

In 2017 the status of yellow-breasted bunting (*Emberiza aureola*) was revised to Critically Endangered in 2017 by BirdLife International (2024) and it had



Figure 3. Oriental stork (*Ciconia boyciana*). Photo credit: Paul Leader.

been added as a target species for the EEA in 2013 as part of a comprehensive management review. Since then, areas similar to traditional rice paddy have been managed to provide foraging habitat for this species during autumn. A peak count of 45 birds in 2023 is the highest in Hong Kong since 2014 for this species.

Both Eurasian otter and leopard cat are recorded regularly. Eurasian otter is by far the scarcer of the two, reflecting its rarity and low density across the Deep Bay area (McMillan *et al.* 2020, Hui and

Chan 2023). Leopard cat is present most nights, but it is entirely nocturnal there and is only detected via camera traps.

Other biodiversity gains include species that are of conservation concern at a local level. For example, provision of nest boxes to encourage the breeding of white-shouldered starling (*Sturnia sinensis*), a locally rare breeding bird species, has resulted in up to 100 pairs breeding. At the start of this initiative the total Hong Kong breeding population for this species was only 50 pairs (Pang *et al.* 2023).

Table 3. Global and Hong Kong wintering population of black-faced spoonbills between 2013 and 2022.

	Population (% of which at EEA)*									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
World	2725 (5%)	2726 (6%)	3272 (7%)	3356 (5%)	3941 (8%)	3941 (5%)	4463 (3%)	4864 (3%)	5222 (3%)	6162 (1.3%)
Deep Bay, Hong Kong	351 (40%)	252 (63%)	411 (53%)	371 (49%)	375 (81%)	350 (59%)	383 (29%)	361 (43%)	336 (51%)	369 (21%)
Peak count in EEA	140	160	219	180	305	205	112	157	172	78

*Findings of the International Black-faced Spoonbill Census (Yu *et al.* 2023).

Conclusion

The management of the EEA has always been wildlife-led and was an early example in Hong Kong of the benefits of pursuing a nature-positive approach. The project proponent has demonstrated a long-term commitment to the EEA and its biodiversity, which is unparalleled in the region. The EEA is widely regarded as an exceptional example of ecological mitigation in Hong Kong by academics, non-governmental organisations and government officials. It is a showcase site and should be used as a template for future wetland mitigation and enhancement. This can be attributed to:

- provision of a dedicated stand-alone compensation wetland
- realistic construction and operational budgets
- committed project proponent (MTR Corporation), experienced and professional consultants (AEC Aurecon) and contractor working together
- wildlife-led management with surveys conducted by an experienced, established ecological team (AEC Aurecon) who truly understand the site and its complexities.

The EEA is central to the proposed Northern Metropolis Development Strategy of the Hong Kong SAR Government (2021). The success and experiences gained from the monitoring

“ The EEA is widely regarded as an exceptional example of ecological mitigation in Hong Kong by academics, non-governmental organisations and government officials. ”

and adaptive management of the EEA should be heeded and will be fundamental in helping to guide creation and operation of other wetland enhancement projects proposed under this scheme to maximise opportunities for nature and generate significant biodiversity gains.

Due to the ambitious approach taken by the project proponent, the EEA goes beyond statutory requirements to comprehensive biodiversity enhancement, something many other organisations fail to foresee, let alone achieve. With bird target species numbers averaging five times those in the control areas, it is inevitable that a wetland of this size that is conscientiously managed will benefit additional species of conservation importance. They should be factored into future management. As has been demonstrated, the scope to increase the carrying capacity of a compensation wetland for more than just its target species can be remarkable.

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References

- Aspinwall and Company (1997). *Study on the Ecological Value of Fish Ponds in Deep Bay Area*. Executive Summary/Final Report to Planning Department Hong Kong SAR Government. Aspinwall and Company Hong Kong Limited in association with Wetlands International, Wetlands Advisory Service.
- BBV (Binnie Black and Veatch Hong Kong Limited) (2002). *Sheung Shui to Lok Ma Chau Spur Line. Environmental Impact Assessment Report*. EIA Report to Hong Kong SAR Government. Available at www.epd.gov.hk/eia/register/report/eiareport/eia_0712001/Index.htm (accessed 18 January 2024).
- BirdLife International (2024). *IUCN Red List for Birds*. Available at <http://datazone.birdlife.org> (accessed 18 January 2024).
- Hong Kong SAR Government (2021). *Northern Metropolis Development Strategy*. Available at www.policyaddress.gov.hk/2021/eng/pdf/publications/Northern/Northern-Metropolis-Development-Strategy-Report.pdf (accessed 18 January 2024).
- Hui, M.K.Y. and Chan, B.P.L. (2023). Analysis of a 131-year longitudinal dataset of the Eurasian otter *Lutra lutra* in Hong Kong: implications for conservation. *Oryx*, **2023**: 1–9. doi:10.1017/S0030605323001163.
- Mao, D., Wang, Z., Wang, Y. *et al.* (2021). Remote observations in China's Ramsar sites: wetland dynamics, anthropogenic threats, and implications for sustainable development goals. *Journal of Remote Sensing*, **2021**: article 9849343.
- McMillan, S.E., Hau, B.C.H. and Bonebrake, T.C. (2020). Eurasian otter conservation: contrasting experiences in the UK and Hong Kong. *In Practice*, **107**: 25–29.
- Pang, C.C., Stanton, D.J., Leader, P.J. *et al.* (2023). White-shouldered starling *Sturnia sinensis*, version 1.0. In: Carey, G.J. (ed.), *The Avifauna of Hong Kong*. Available at <http://hkbird.net/species/0380/045700> (accessed 18 January 2024).
- Ramsar (1971). *The Ramsar Sites Criteria*. Available from www.ramsar.org/sites/default/files/documents/library/ramsarsites_criteria_eng.pdf (accessed 19 January 2024).
- Sung, Y.-H., Pang, C., Li, T.C. *et al.* (2021). Ecological correlates of 20-year population trends of wintering waterbirds in Deep Bay, South China. *Frontiers in Ecology and Evolution*, **9**: 658084.
- Yu, Y.T., Li, C.H., Kong, P.Y. *et al.* (2023). *The International Black-faced Spoonbill Census Report 2023*. Available at www.hkbws.org.hk/cms/en/component/phocadownload/category/33-bfs-census-report (accessed 18 January 2024).

Conservation and Resilience of Turks and Caicos Islands Wetlands



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The Turks and Caicos Islands (TCI) wetlands Ramsar site stands as a globally significant ecosystem, providing vital habitats for endemic, Endangered and Near Threatened species. Each of the habitats in the TCI wetlands plays a crucial role in sustaining biodiversity and ecosystem services. This article, from the Overseas Territories Special Interest Group, considers how these ecosystems contribute to biodiversity, coastal protection and natural capital by acting as breeding and feeding grounds, and natural buffer zones against storm surges, erosion and sedimentation. Further, we evaluate the potential impact of future climate on the wetlands, and develop satellite-based indices to track their condition. These indices help establish a monitoring framework and build capacity. The preservation of the TCI wetlands emerges not only as a regional imperative but also as a global contribution to biodiversity conservation in the face of climate change.

Introduction

The Turks and Caicos Islands (TCI) Ramsar site (Figure 1) constitutes a rich tapestry of habitats, including coral reefs, seagrass meadows, mangrove forests, salinas, blue holes and pine forests, spanning over 580 km². These

ecosystems, intertwined with surrounding environments, yield manifold benefits; from storm mitigation and wave dissipation (Soanes *et al.* 2023) to carbon sequestration and water storage. This paper underscores

the wetlands' significance, for both their biodiversity and the indispensable ecosystem services they provide, especially in the context of global climate change. Monitoring the wetlands proves challenging due to restricted access and inherent dangers associated with working in such areas.

The project leverages remote sensing data to delineate wetland characteristics and devise monitoring indicators, spotlighting potential issues. It seeks to instil an understanding of the wetlands' importance for the well-being of local communities and biodiversity. Furthermore, the project aims to provide scientific evidence to reinforce the international standing of these wetlands, recognised by the conservation community as among the most significant in the Caribbean for a diverse range of bird species, regionally significant flora and internationally endangered fauna.

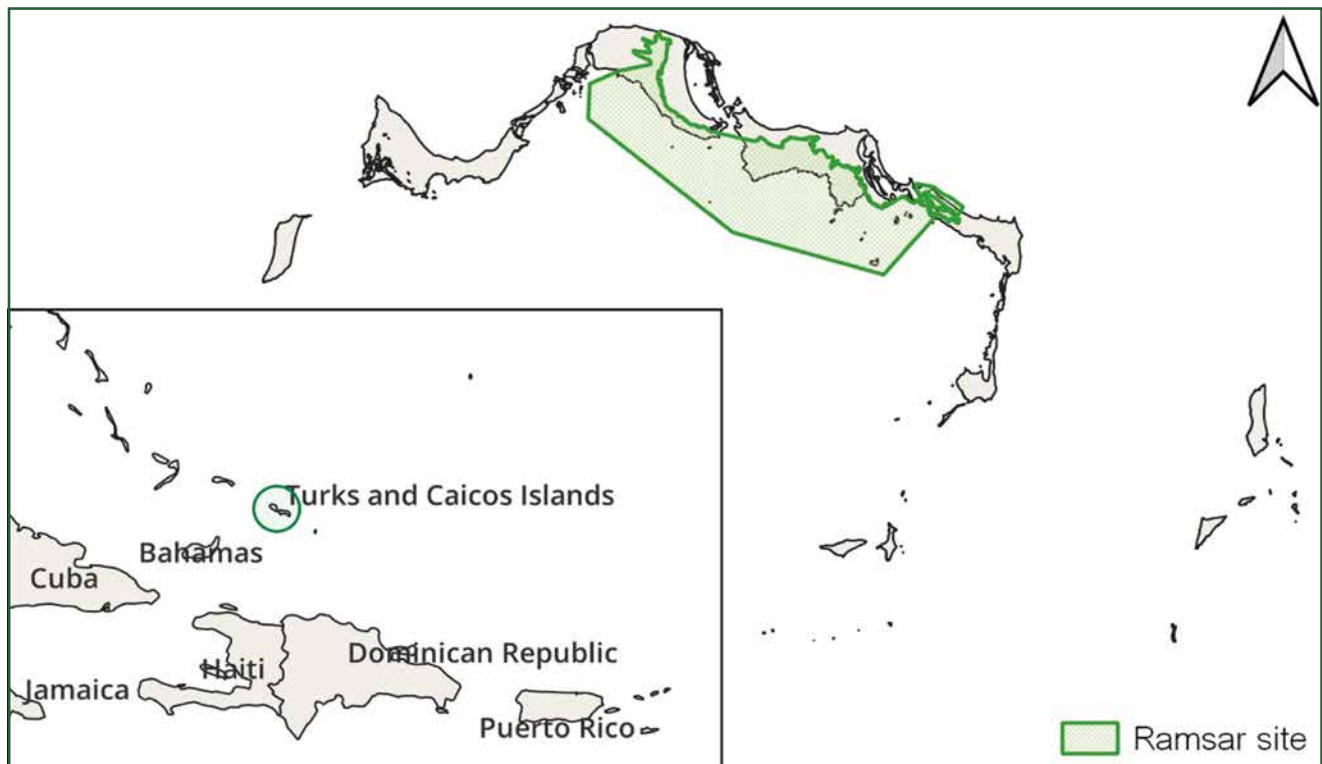


Figure 1. Location of the Turks and Caicos Islands, and its Ramsar site.

Significance of the Turks and Caicos wetlands

Each of the habitats in the TCI wetlands contributes significantly to the region's natural capital, playing a crucial role in sustaining biodiversity and ecosystem services.

- Intricate coral reef structures provide essential breeding and feeding grounds for numerous marine species, supporting the local fishing industry and helping to mitigate wave energy, providing protection from storms.
- Seagrass meadows act as vital nurseries for juvenile fish, providing a safe and nutrient-rich environment for their early development. They are an important source of marine carbon.
- Mangrove forests serve as a natural buffer to the land, protecting coastal areas from storm surges and providing critical multi-species breeding sites; they trap sediment run off from the land, helping build the shore and protect marine habitats against sedimentation.
- Intertidal mudflats and salinas (salt marshes) are essential for migratory birds, offering abundant food sources and resting areas during long journeys.

- Blue holes (marine sinkholes), with their unique underwater formations and ecology, are still yielding species new to science.
- Caribbean pine forests, limestone forests (a unique forest type existing on limestone grounds in tropical latitudes) and caves contribute to terrestrial biodiversity, providing habitats for endemic species and contributing to carbon sequestration.
- Sand dunes play a role in shoreline stabilisation, protecting against erosion and providing habitats for specialised plant and animal species.

These habitats collectively form the natural capital of the TCI, supporting ecological resilience, cultural values and sustainable resource management.

The wetlands serve as vital habitats and foraging grounds for the Endangered green sea turtle (*Chelonia mydas*), the Vulnerable West Indian whistling duck (*Dendrocygna arborea*), and regionally significant flora and bird species. Additionally, they play a crucial role in carbon sequestration, storm mitigation, water purification and groundwater recharge (Nyman 2011). The wetlands hold cultural, financial and ecological significance for the TCI, supporting food sources, drinking water, agriculture and tourism.

Threats to TCI wetlands

The Ramsar site faces an escalating array of threats that jeopardise its ecological integrity and resilience. Sea level rise and saltwater intrusion pose imminent dangers, particularly for low-lying areas, allowing more saline water to permeate the internal sections of the land and affecting well water (Parra *et al.* 2016). The vulnerability of these wetlands to changes in rainfall patterns and increased drought durations amplifies the risk, leading to dry conditions in salinas, impacting migratory birds breeding and feeding grounds.

Natural disasters, in terms both of intensity and frequency, contribute to the fragility of TCI wetlands. With the islands situated in a region prone to hurricanes and storm surges, the impact of these events can be catastrophic, altering the landscape and disrupting the ecosystems' delicate balance. Increases in ultraviolet radiation, a consequence of climate change, present an additional threat, negatively influencing the growth cycles and amounts of crucial wetland species. Migration and spawning cycles, as well as seed and fruit production and dispersal, are increasingly vulnerable to these changing environmental conditions (Zlatev *et al.* 2012).

Invasive species further exacerbate the challenges facing TCI wetlands. Encroachment of species like *Casuarina* spp., *Sargassum* spp. and the invasive pine scale insect (*Toumeyella parvicornis*) have dire consequences for native flora and fauna (Malumphy et al. 2012). The rapid disappearance of Caribbean pine (*Pinus caribaea*) across TCI due to invasive species is emblematic of the pervasive impact. Furthermore, increasing residential and commercial development brings about localised pollution. It also threatens ground-nesting birds, sea turtles and iguanas. Additionally, it intensifies unregulated activities such as fishing, poaching and charcoal burning. These factors contribute to the degradation of vital wetland habitats (Wood 2019).

Understanding the dynamic functions of the Ramsar site and monitoring some of the key aspects and processes, we aim to build an appreciation of its importance to local inhabitants. Recognising the site's overall value is key to mitigating the many anthropogenic threats.

Mapping and monitoring challenges

There are a number of challenges in mapping and monitoring the 586 km² Ramsar site, across three islands (Ramsar Site Information Services 2002). Much of it is difficult and dangerous to

traverse, with few access points and navigable trails (Figure 2). The field team often have to walk 4–8 km per site visit. The majority of the project's first fieldwork phase involved cutting and marking pathways for the team members to follow subsequently.

Technology as key enabler

Mapping the largely inaccessible land has been enabled by recent advances in technology. In particular, satellite imagery helps us to identify key features and functions by designing indicators that will aid wetland monitoring in the future and highlight potential issues in a timely manner.

The Joint Nature Conservation Committee (JNCC) created the habitat map as part of an earlier project, using machine learning random forest models from high-resolution optical imagery. A lot of sample points and training data are needed to build a good classification model. However, due to the limited fieldwork, aerial photography interpretation had to supplement the available samples to generate sufficient data points for each habitat category. The map's accuracy forms a solid baseline which fieldwork can update. This project has allowed a more accurate description of some areas, particularly around the coast of East Caicos, to be added by fieldwork. To

“ Satellite imagery helps us to identify key features and functions by designing indicators that will aid wetland monitoring in the future and highlight potential issues in a timely manner. ”

understand more of the surrounding areas, the field team used a drone to visualise areas in the vicinity of the survey points (Figure 3). The information gained was then fed into the models.

The project utilised WorldClim data, a comprehensive global climate database, for understanding the impact of climate change. This provides high-resolution climate data that includes variables such as temperature and precipitation. With a spatial resolution of 1 km², WorldClim facilitates a detailed examination of climatic conditions. By 2080, TCI is predicted to have an increase in mean annual temperature of 5°C. In contrast, rainfall is predicted to decline; its patterns will change to include more frequent severe storms and longer periods of drought.

Satellite-derived indicators

There are very limited staff and financial resources available to Department of Environment and Coastal Resources (DECR) to monitor the changing



Figure 2. East Caicos offers no escape from torrential rain, unbearable sun or hordes of mosquitos. Photo credit: Christopher May.



Figure 3. An aerial view of East Caicos, taken from a drone survey. Photo credit: Christopher May.

dynamics of the Ramsar site, or deal with any disturbances to the ecosystem. This is exacerbated by the sheer size of the area under their protection, and the difficulty in accessing the more remote parts. As such, four satellite-derived indicators have been developed to track the condition of the entire region, allowing officials to gain an understanding of what is happening in the Ramsar, where and when it occurred.

1. **Fire/disturbance indicator.** The wetland ecosystem operates in a naturally fire-driven environment. Fires are ignited primarily by natural storms. Despite the regularity of fires, there is currently limited documentation, and the occurrence of fires largely resides in the collective memory of TCI officials. The development of a fire/disturbance indicator allows an understanding of where fires occur. With proper record keeping, it would document the natural fires as distinct from those started deliberately, or accidentally, by human activity. Over time it will enable the assessment of whether these fires are increasing in number. It will also allow DECRA officials to proactively address any fire-driven threats. The indicator identifies areas of vegetation that have experienced rapid and extensive loss in moisture content.

2. **Sedimentation in the shallow water marine environment.** The wetland system processes run from ridge to reef. Anywhere where there is excess erosion from the land from the ridge down to the shoreline can potentially increase sedimentation into the sea. Excess sedimentation can smother coral reefs and interfere with seagrass beds. However, sediment tends to be trapped where mangroves occur naturally on the shore, building up the land and preventing damage to the marine environment. This indicator tracks the relative concentration of suspended sediment across the Ramsar site, highlighting those areas of most concern.

3. **Coastal change.** Within the wetland system, the area where the land meets the sea is highly dynamic. While tides have a limited impact, only varying by approximately 50 cm, the effects of tropical storms, hurricanes and seasonal changes bring about considerable changes to the coastline. To identify these fluctuations, this indicator systematically tracks and analyses the gains and losses of coastal land.

4. **Drought stress.** Periods of sustained drought can impact the health and vitality of wetland vegetation, ultimately affecting the stability of

the ecosystem, the biodiversity it supports and the overall resilience to anthropological and climatic changes. By monitoring drought stress in wetland species, conservation efforts can be better informed, and proactive, targeted measures can be taken to safeguard those areas most affected. This indicator examines land surface temperature over time and compares it to vegetation health. Areas of concern are highlighted where vegetation health decreases with stable or increasing temperature.

Impact

In the course of this project, we successfully established a comprehensive baseline for the diverse habitats in the Ramsar site in the TCI. This foundational knowledge serves as a critical reference point for understanding the ecological dynamics and changes over time in this internationally significant wetland area.

The project actively contributes to capacity building by enhancing the technical capabilities of the DECRA staff and engaging local students in the fascinating complexity of the wetlands and the species they support. Through strategic outreach efforts the project has built up the knowledge of the importance of the wetlands to both

islanders and visitors. This engagement instils a deeper understanding of the wetlands' ecological significance, fostering a sense of shared responsibility for their preservation.

Importantly, our use of technology has enabled the potential for timely and remote monitoring of the Ramsar site, offering a dynamic understanding of ongoing and past events. This capability enhances the prioritisation of fieldwork and allows for the development of targeted conservation strategies, optimising our efforts to safeguard these critical habitats.

Furthermore, the data generated from our research hold broader utility, as they contribute valuable insights to other scientific studies. By sharing our findings, we actively contribute to the collective understanding of wetland ecosystems, promoting collaboration and synergy in the pursuit of effective conservation practices.

Lessons learned

The gained experience offers key lessons for future remote wetland conservation. The dynamic ecosystem, with natural processes such as fire-driven environments, tidal fluctuations and mangrove buffering, served as inspiration for the satellite-based indicators, suggesting that mimicking nature's own systems can lead to effective monitoring solutions. Furthermore, there is a need to adapt technological tools to the specific context, ensuring they align with the unique challenges and opportunities presented by such a remote environment.

Successful projects in these areas require a commitment to community messaging, not just for knowledge dissemination but also on a reciprocal exchange for the future. Engaging with school children can cultivate a deeper appreciation of future climate mitigation while garnering a local understanding and historical context from the older residents.

Conclusion

In conclusion, the preservation of the TCI wetlands emerges not only as a regional imperative but also as a global contribution to biodiversity conservation in the face of climate change. The significance of these internationally recognised wetlands extends beyond

“ The dynamic ecosystem, with natural processes such as fire-driven environments, tidal fluctuations and mangrove buffering, inspired satellite-based indicators, suggesting that mimicking nature's own systems can lead to effective monitoring solutions. ”

their local context, emphasising the interconnectedness of ecosystems on a global scale. The integration of technology, particularly remote sensing and monitoring tools, has proven instrumental in comprehending these vast, remote and otherwise inaccessible wetlands. By harnessing the power of

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technology, we enhance our ability to monitor and understand these critical ecosystems, ultimately supporting their long-term resilience. Moreover, a pivotal aspect of our efforts lies in training and capacity building for TCI staff, empowering them to leverage new data and technology effectively. This not only strengthens local expertise but also ensures the sustainable management of the wetlands for future generations. Furthermore, our work serves a dual role, not only in the advancement of scientific knowledge but also in fostering community awareness. By helping local residents understand the broader significance of the Ramsar site, we cultivate a sense of stewardship and collaboration, reinforcing the importance of collective efforts in the preservation of these ecologically vital wetlands.

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References

- Malumphy, C., Hamilton, M.A., Manco, B.N. *et al.* (2012). *Toumeyella parvicornis* (Hemiptera: Coccidae), causing severe decline of *Pinus caribaea* var. *bahamensis* in the Turks and Caicos Islands. *Florida Entomologist*, **95**(1): 113–119.
- Nyman, J.A. (2011). Ecological functions of wetlands. In: W.J. Junk (ed.), *Wetlands: Integrating Multidisciplinary Concepts*. Springer, Berlin, pp. 115–128.
- Parra, S.M., Valle-Levinson, A., Mariño-Tapia, I. *et al.* (2016). Seasonal variability of saltwater intrusion at a point-source submarine groundwater discharge. *Limnology and Oceanography*, **61**: 1245–1258.
- Ramsar Sites Information Service (2002). *North, Middle & East Caicos Islands*. Available at <https://rsis.ramsar.org/rsi/493> (accessed 21 November 2023).
- Soanes, L.N., Pike, S., Barker, D. *et al.* (2023). Opportunity mapping for nature-based solutions: mitigating storm surge and land erosion in the Caribbean. *Nature-Based Solutions*, **4**: 100095.
- Wood, K. (2019). Turks and Caicos Islands. *British Birds*, **112**: 264–281.
- Zlatev, Z.S., Lidon, F.J.C. and Kaimakanova, M. (2012). Plant physiological responses to UV-B radiation. *Emirates Journal of Food and Agriculture*, **24**(6): 481–501.

Do UK Survey Licences for Otter Support Best Practice?



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resting site

Under the Habitats Regulations, resting/breeding places of otters (*Lutra lutra*) are protected from damage and disturbance, and ecologists are expected to identify such structures. Following an extensive programme of research, we now believe there is a more robust evidence base for what survey protocols are needed to identify such sites. In this article we

(1) summarise some key aspects we believe represent evidence-based best practice for identification of otter resting and breeding sites, and (2) critically review the licensing conditions for otter surveys in the UK nations. Licensing for surveys with respect to otter holts varies between nations and in some cases could inhibit robust data collection, and thus we call for these

to be reviewed. We also discuss the thorny issue of differing perceptions of disturbance, which inevitably accompanies our call for more intensive monitoring. We argue that there are potential repercussions resulting from suboptimal survey that outweigh any perceived disturbance from camera-trapping.

Best practice for surveying otter holts

Many terms are used to describe otter resting sites. A holt, by definition, is an otter's resting or breeding site which is enclosed, either underground such as in burrow systems in riverbanks or peatlands, or in hollow trees or rock piles. Here we use the term holt to mean an enclosed resting or breeding place, but where we want to specifically discuss a resting place or breeding place, we use that term. It is not our intention to provide a full protocol for field surveys of otter resting/breeding sites here (including how to locate potential sites), but rather highlight some key principles of monitoring, and the evidence base, that we believe in some cases would be prohibited by some licensing conditions. We are planning fuller surveying guidelines but they are too extensive for this article. The principles presented are based on our own field experience and research, including long-term (>6 years) monitoring of a holt (Findlay *et al.* 2017), trials investigating how and why camera traps can fail to record otters (Findlay *et al.* 2020) and, to our knowledge, the single largest camera-trapping study of otter holts (monitoring 26 sites for an average of 375 days each over a 4-year period across the River Tweed catchment; Findlay *et al.* 2023). This work is open access (see References).

Camera traps are necessary since field signs are not reliable

Field signs such as spraints and footprints can be useful to identify presence of otters in an area. However, at a time when otters occupy most of the UK, there should be a presumption of presence and surveys should aim to locate resting sites to ensure they are protected. We found no statistical link between the presence and abundance of field signs (including spraints, spraint piles, presence of bedding, footprints or presence of runs) close to a structure and whether that structure was a resting site or not (Findlay *et al.* 2023). Note, although we did find that observing bedding collection on camera-trap footage itself was a good indicator of a resting site, presence of bedding debris as a field sign is not reliable since it may not be present

where resting is occurring, or other vegetation remains might be confused for bedding. The lack of any relationship between field signs and whether or not a structure functioned as a resting site was due to situations where either (1) active resting sites had few or no field signs nearby, or (2) we monitored structures that camera-trapping revealed were never rested in, but which were visited and sprainted at regularly. This is an important distinction: just because a site is visited (even regularly) by otters, it may not be a resting site.

The only field sign we found that appears to strongly indicate a resting site is the presence of a latrine, used by the resting animal(s) to defecate away from the sleeping chamber (something we saw regularly on camera traps at resting sites). Latrine sites are distinct in form and function from spraint sites, which are used primarily for communication. As we know latrine sites can be concealed within the resting site and invisible to a surveyor, apparent absence of a latrine does not categorically indicate absence of a resting site. Thus, it remains that with current technology the only reliable way to assess sites as resting and/or breeding sites is using camera-trapping. Camera trapping can (1) directly observe resting (for example, an animal entering a structure and then leaving after prolonged period), (2) capture other resting-associated behaviours such as bedding collection or (3) directly observe breeding information such as pregnant or lactating females, or cub emergence or occupation.

Camera traps should be placed close to the structure entrance(s)

For camera-trapping to be effective to observe otter resting or breeding behaviours, they need to reliably detect otter activity. Camera trap passive infrared triggers (triggered by the contrast between an animal's body heat and the background) are far from perfect, and can miss animals either by failing to trigger, or else they do trigger but the animal is already out of view by the time the camera activates (Findlay *et al.* 2020). Otters' speed of movement and frequently wet coat (which potentially is a closer match to the background temperature) exacerbate

this. Research shows that increasing distance between the animal and camera trap is a significant negative predictor of trigger probability, as is coat wetness (Findlay *et al.* 2020, Lerone *et al.* 2015, Rowcliffe *et al.* 2011). Trigger probability of passing otters drops rapidly with distance from camera, particularly when the otter is wet (trigger probability of only 50% at 3–4 m, depending on camera-trap model) or when it is running (trigger probability of only 50% at 3 m) (Findlay *et al.* 2020). At a holt studied over several years, we have shown that a camera placed 1.6 m from the entrance recorded substantially more activity than a camera placed at 4.2 m (Findlay *et al.* 2017). Placing camera traps too far from the entrance of a potential resting site has a high risk of missing important information, which might lead to incorrect assessment of the structure and subsequent uncontrolled and unlicensed disturbance to, or destruction of, a protected site.

Camera traps need to be in place for a several weeks

Another key aspect to consider with camera-trapping is how long to monitor for, something which has hitherto been based on some balance of logistics and guesswork, understandably so in the absence of data on resting activity at individual sites. At six independent resting sites identified and monitored for at least a year each in the River Tweed catchment (Findlay *et al.* 2023), we found that the minimum camera-trapping duration that would be required to be 95% sure of correctly identifying a resting site was about 15 weeks' continuous monitoring during winter–spring or two 5.5 week periods, one in winter and one in spring, and that was when targeting surveys to the optimal time of year for our southern Scotland study area. From discussion with other ecologists, we suspect this is substantially longer than generally expected.

Although this optimal survey duration and timing could vary between regions, our study at least demonstrates that in one region such a time commitment would be required. Our study area is not atypical in terms of landscape and habitats of many areas of the UK and most of our study structures were in rural locations in a variety of common

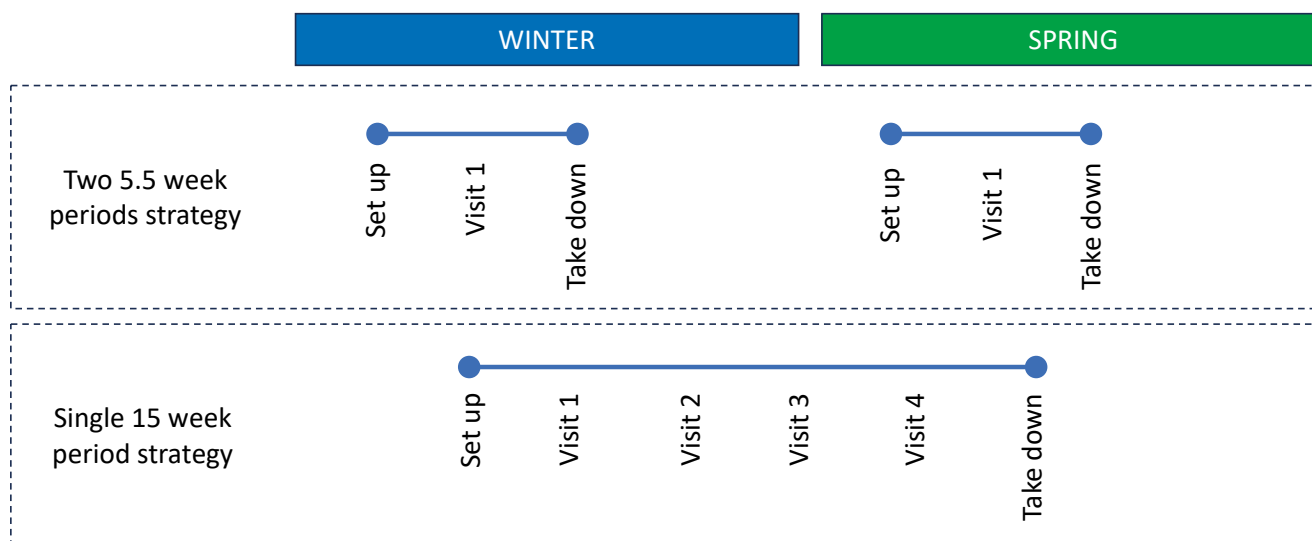


Figure 1. Hypothetical visitation schedules for camera-trap monitoring of structures to identify or rule out otter resting sites appropriate for the River Tweed catchment (Findlay *et al.* 2023). Our analysis suggested two potential strategies, each requiring six visits to the structure: (a) a minimum of 5.5 weeks in winter and again in spring or (b) a minimum of 15 weeks across the winter/spring period. Visits between setting up and taking down are necessary to avoid data loss risk (see main text). Note these are not prescriptive recommendations for all regions, but a demonstration that such a time commitment could be required.

habitats including pasture, riparian woodland and scrub. We have found that visits to change SD cards and batteries about every 3 weeks strikes a good balance between (1) the risk of data loss (SD card filled/depleted batteries/theft) and (2) minimising visitation frequency. With such a protocol, our minimum survey recommendations for the River Tweed catchment to have a 95% chance of identifying a resting site would require a minimum of six visits, including setting up, maintenance and removing camera traps (Figure 1).

Do licence conditions in the UK support or hinder best practice?

The approach to survey licences, which derogate any disturbance to otters from camera-trapping resting or breeding places in the UK, varies in terms of issuing administration. Licensing bodies play a key role in protecting species against potential harm. However, in the case of identification of otter resting and breeding sites, we believe that some licensing conditions support evidence-based best practice, while some could

prevent it (Table 1). Although licence conditions may vary depending on context, all of the conditions in Table 1 were specified when it was clear the survey aim was identification of resting or breeding sites.

A key difference between regions is whether the survey licence is issued to a person (for use on any site in the region) or whether the licence is issued for a particular site. This difference has important implications because a personal licence means the ecologist has more flexibility and can act

Table 1. Pertinent issuing details and conditions of the UK licensing administrations for camera-trapping of potential otter resting and breeding sites, based either on email exchanges with each licensing authority or licences issued to MF. We present a subjective categorisation of whether these conditions support good otter surveys (using what we argue is evidence-based best practice; see section Best practice for surveying otter holts). Blue, facilitates best practice; orange, could restrict best practice.

Issuing administration	Issuing details		Conditions of methodology	
	Entity the licence is issued to	Time to issue for a site	Minimum distance of camera traps to resting site	Number of visits to resting site allowed
Natural England	The site	Target 30 working days	4 m	Five per year
Natural Resources Wales	The site or the county (negotiable)*	30–40 working days	No standard condition	No standard condition
NatureScot	The person (covering unlimited sites)	Not applicable as issued to person	Left to licence holder	Left to licence holder
Northern Ireland Environment Agency	The site	Maximum 15 working days	Only specifies not to be inside holt or block/obscure runs	Must not entail 'frequent visits'

*For NRW, if issued just to the site, and given the 30–40 working days issuing time, this could prevent camera-trapping of sites in good time.

immediately, potentially lengthening the duration of camera-trapping in the project timeframe, whereas there can be a substantial delay while a site licence is obtained. As natal holt may only be used for 2–3 months, the resulting worst case scenario would be the loss of that essential window to confirm that a structure is used for birthing or housing very young cubs.

In terms of placement of camera traps, the minimum 4 m distance to a resting site specified by Natural England is not, to our knowledge, based on any concrete evidence and in fact has potential to seriously reduce detection probability of the otters (Findlay *et al.* 2017). This potentially impacts data quality and, most importantly, could result in misidentification of a resting or breeding site. Likewise, limiting the number of visits by the ecologist to five (as with Natural England), and without a minimum number of days between visits specified, leaves practitioners potentially able to visit a resting site every few days over 2 weeks, which would be a failure of the licence condition to reduce disturbance, while not facilitating a longer survey duration as we found would be required on the River Tweed catchment (Figure 1). With sensible maintenance intervals of 3 weeks or so, monitoring could be forced to cease before any resting occurs if the five-visit maximum is reached.

A balanced view of disturbance

A potential argument against what we consider would be best practice (see above) is that the placement of cameras close to holt and for longer periods would cause too much disturbance. The concept of disturbance has a subjective element, and we argue against the perception that any behavioural response to a camera trap represents disturbance. Novel objects in an area that is frequented regularly by a mammal are likely to be investigated, which could involve staring, sniffing or scratching at the object. From our experience, novel objects are common outside otter holt where flood debris and litter frequently appear. We argue that there is a difference between such behavioural responses and evidenced disturbance.



Figure 2. Still from camera-trapping video of an otter outside a resting site sleeping in front of a camera placed close to the structure entrance (shown in Figure 3). A second camera placed further from the entrance missed this resting activity.

European Union guidance (European Commission 2021, p26) on the interpretation of disturbance in Article 12 describes disturbance as an act that affects “the chances of survival, the breeding success or the reproductive ability of a protected species, or that leads to a reduction in the occupied area or to a relocation or displacement of the species”. Whereas we have observed behavioural responses such as sniffing camera traps, we have never observed any responses that suggest displacement or impairment to survival or breeding. In fact, we have had otters choosing to sleep directly in front of camera traps (Figure 2) at several locations, and seen repeated use of sites for resting, for rearing young cubs and natal activity while our camera traps were *in situ* and close (approximately 2m) to the holt entrance. Our 6 year study of a breeding and resting site in Fife showed no statistical reduction in activity following visits to change camera-trap batteries or SD cards (Findlay *et al.* 2017); in this analysis we showed that probability of resting, use of holt for breeding, or scent-marking activity were not related to the number of days since the site had been visited for camera-trap changes.

Our view is that camera traps themselves are not an issue if set to avoid the resting site entrance and run/path to that entrance, even if placed close to the entrance. Visits by ecologists to set up and maintain equipment have greater potential to disturb if there are no mandatory

“ The concept of disturbance has a subjective element, and we argue against the perception that any behavioural response to a camera trap represents disturbance. ”

controls in licence conditions. We follow a strict protocol at camera-trap sites to minimise impacts at the structure. We typically swap in refreshed camera traps (always using noiseless models with ‘no glow’ illumination) into wooden frames which cuts out the need to struggle with proprietary camera-trap straps (Figure 3). This means we avoid changing SD cards and batteries in the field, so routine maintenance visits take less than 5 minutes. While it is incumbent on the ecologist to take precautions against disturbance, the licence conditions should enforce sensible working practice which controls the risk but, at the same time, derogates the ecologist against breaking the law if an otter is disturbed despite following all the licence conditions.

When considering disturbance to otter resting or breeding sites, we believe that a key question must be asked in a survey licensing context. That is, what is the greatest potential risk for otters: (1) the risk that camera-trap surveys will disturb otters, something the evidence disputes where strict protocols are followed in setting up and visiting the camera traps; or (2) the risk that poor



Figure 3. Example of camera-trap set-up at a potential resting or breeding site. Cameras are placed close to maximise detection probability while avoiding any obstruction to the entrance and run(s) and in pre-designed emplacements. This means that maintenance visits are quick because replacement camera traps with correct settings can be swapped quickly but maintain the same viewing angles. A view from the closer (left) camera can be seen in Figure 2.

survey protocols, ignoring the evidence (through well-meaning precaution), miss key observations that would identify sites correctly as a resting or breeding site, which ultimately means a protected site is unintentionally heavily disturbed or destroyed?

Conclusions

There is now strong evidence to suggest that the only current reliable way to identify or, importantly, rule a site out as a resting or breeding site is through the use of camera traps, and these need to be placed relatively close to holt entrance(s) and for a sufficiently long period. Field signs may be useful for identifying presence of otters in an area, but are not a reliable way to identify if a structure is used for resting or not; the only reliable sign we found is the presence of a latrine (distinct from a spraint site or pile), but in some cases these are hidden, so absence of a latrine does not imply a site is not a resting place, and camera traps are needed. Where camera-trapping is done with strict protocols to minimise potential disturbance by the ecologist when

setting up and visiting to check/swap camera traps this, we believe, will provide the best outcomes for otters. Some aspects of some licensing authorities' issuing processes and conditions do not currently facilitate best practice and we would call on these bodies to review this situation.

More broadly, we believe a change in attitude towards otter surveys is needed. Otters seem to be frequently perceived as an 'easy and low-effort' species, often with a single survey undertaken in tandem with a water vole (*Arvicola amphibius*) survey. We need a sea change in otter surveying, moving away from the idea that a quick survey based on field signs, or short period of camera-trapping (with camera traps placed cautiously far from a structure), are sufficient. An object of CIEEM's charter is to "advance ... the standards of practice of ecology", and licensing needs to support new approaches by facilitating surveys that follow evidence-based methodologies. Surveying guidelines for other taxa have changed recently in response to scientific evidence (Collins 2023) and we believe it is time for a similar process for otters.

References

- Collins, J. (ed.) (2023). *Bat Surveys for Professional Ecologists: Good Practice Guidelines*, 4th edn. The Bat Conservation Trust, London.
- European Commission (2021). *Guidance Document on the Strict Protection of Animal Species of Community Interest under the Habitats Directive*. Available at <https://op.europa.eu/en/publication-detail/-/publication/a17dbc76-2b51-11ec-bd8e-01aa75ed71a1/language-en/format-PDF/source-search> (accessed 16 January 2024).
- Findlay, M., Briers, R., Diamond, N. and White, P.J.C. (2017). Developing an empirical approach to optimal camera-trap deployment at mammal resting sites: evidence from a longitudinal study of an otter *Lutra lutra* holt. *European Journal of Wildlife Research*, **63**(6): 96.
- Findlay, M.A., Briers, R.A. and White, P.J.C. (2020). Component processes of detection probability in camera-trap studies: understanding the occurrence of false-negatives. *Mammal Research*, **65**: 167–180.
- Findlay, M.A., Briers, R.A., Ingledew, R.P. and White, P.J.C. (2023). An evidence-based approach to identifying resting sites of Eurasian otter (*Lutra lutra*) from camera-trap and field-sign data. *Wildlife Biology*, **2023**: e01036.
- Lerone, L., Carpaneto, G.M. and Loy, A. (2015). Why camera traps fail to detect a semi-aquatic mammal: activation devices as possible cause. *Wildlife Society Bulletin*, **39**: 193–196.
- Rowcliffe, M.J., Carbone, C., Jansen, P.A., Kays, R. and Kranstauber, B. (2011). Quantifying the sensitivity of camera traps: an adapted distance sampling approach. *Methods in Ecology & Evolution*, **2**: 464–476.

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Water Vole Survey, Mitigation and Licensing: An Update

Figure 1. Water vole (*Arvicola amphibius*). Photo credit: Gary Dowzall.



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Keywords: American mink, displacement, reintroduction, Species Conservation Strategy, survey

Since publication of the *Water Vole Mitigation Handbook* in 2016 there have been several published studies relating to the effectiveness of mitigation techniques, changes to licensing in England and the drafting of a Species Conservation Strategy to

be piloted in East Anglia. These factors, alongside the experiences of the authors in undertaking surveys, reviewing survey reports, and designing and implementing mitigation, are discussed in this article with the aim of providing an update for practitioners.

Introduction

In 2016 the Mammal Society published the *Water Vole Mitigation Handbook* (Dean *et al.* 2016), coinciding with the introduction of licensing for the displacement of water voles (*Arvicola amphibius*) in England and Wales. The *Mitigation Handbook* set out guidance on the circumstances in which to use displacement, defined a 'spring' season for its use and described key steps. It also provided guidance on trapping and relocation of water voles and described how to design and undertake surveys in development scenarios. Prior to the

book's publication there was only limited published guidance available on these topics (primarily, selected chapters of the *Water Vole Conservation Handbook*; Strachan *et al.* 2011). And prior to the introduction of licensing for displacement there was variation in how and when this technique was used, and no practical way of monitoring or controlling it. These events were therefore significant milestones in the protection of water voles.

Since 2016 there have been several studies of water vole mitigation techniques, the introduction of a new licensing purpose in England and the development of new approaches to licensing for inclusion within a Species Conservation Strategy (SCS), to be piloted in East Anglia. Natural England (NE) is currently finalising a definition for the favourable conservation status of water voles in England. This will be used to underpin the work of the SCS and other conservation projects.

This article aims to provide an update for practitioners who undertake water vole surveys, or design or implement water vole mitigation. It focuses on water voles associated with wetland habitat.

New licensing purpose in England

The Environment Act 2021 brought in a host of new environmental protection and nature recovery measures and commitments. Significantly for water voles it enabled NE to issue wildlife licences for 'reasons of Overriding Public Interest' for animal and plant species listed on Schedules 5, 6 and 8 of the Wildlife and Countryside Act 1981 (W&CA) as of 1 January 2023.

Prior to this, in the absence of a suitable licensing purpose for development, NE issued licences for displacement or trapping and translocation of Schedule 5 species, such as water vole, under the purpose of 'conserving wild animals'.

Species Conservation Strategies are different to other conservation strategies in that they are supported by a legal duty on public bodies to cooperate in their preparation and implementation.

A licence may now only be issued if it passes two new legal tests, that:

1. there is no other satisfactory solution; and
2. the grant of the licence is not detrimental to the survival of any population of the species of animal or plant to which the licence relates.

In practice, NE already applied these tests to licensing decisions under the W&CA. However, now that they are legal tests, they must be given more explicit consideration in the decision-making process. For example, it is unlikely that projects that propose trapping and removal of water voles permanently from a local population can be licensed unless it can be shown that this will not adversely impact that local population. This has implications for water vole mitigation planning for developments.

NE has produced new and updated licence application and return forms available online (www.gov.uk/government/collections/water-vole-licences).

Species Conservation Strategy

SCSs were introduced by the Environment Act 2021. They are different to other conservation strategies in that they are supported by a legal duty on public bodies to cooperate in their preparation and implementation. A pilot project for water vole is being developed in East Anglia. Work to underpin the SCS has been undertaken to examine the extent and nature of the protection that water voles receive through planning, development and licensing. Opportunities to bolster water vole populations through strategic mink control and habitat creation are also being considered.

Effectiveness of displacement

The displacement technique involves manipulation of habitat occupied by water voles with the intention of encouraging the animals to move into adjacent areas. It was developed in the late 1990s in response to water voles being listed as a priority for conservation and their inclusion on Schedule 5 of the W&CA. The effectiveness of this technique has been debated ever since.

Advice in the *Mitigation Handbook* on the use of displacement and its likely effectiveness was based on two studies (Dean 2003, Markwell 2008) and anecdotal evidence. Since then, there has been further published research on this topic that practitioners should be aware of.

- Gelling *et al.* (2018) investigated the movement and fate of water voles in response to vegetation removal over a 50 m length of bankside, radio-tracking animals both before and after vegetation removal at different sites on lowland river systems in spring and autumn. Findings indicated that, in both seasons, there was no overall movement of water voles out of areas where vegetation had been removed, although there was movement of individual water voles both in and out of the affected areas.
- Baker *et al.* (2019) undertook a similar investigation in grazing marsh habitat, using vegetation removal and water draw-down (to ensure the channel remained dry over a period of 7 days). They found that water voles vacated the affected area, although one animal moved into the affected area for a short period of time.

These studies draw different conclusions about the effectiveness of displacement. This may be due to water draw-down being used in the study undertaken by Baker *et al.* (2019) but not by Gelling *et al.* (2018), although it should be noted that water draw-down is not feasible in many cases. It may also be due to the studies being undertaken in different habitats and landscapes, and where the extent of the water vole population and available habitat is likely to have differed, or another unknown factor. The debate over the effectiveness of this technique continues.

Change in seasonal restrictions on use of displacement

The *Mitigation Handbook* recommends that displacement should only be attempted during spring. At this time of year territories are at their largest; the loss of a relatively small amount of habitat (50 m or less) is likely to affect less than half of the territory of a single female. However, Gelling *et al.* (2018) found no significant difference between



Figure 2. *Water Vole Field Signs and Habitat Assessment* (Dean 2021).

spring and autumn displacement in terms of the likely effectiveness or the likely impact on individual water voles. Although displacement in autumn may affect more individual animals (as territory size is smaller then), the loss of one individual animal, if displacement doesn't work, would be less damaging to the colony or population than would be the case if that occurred in spring.

Having only a spring window for displacement causes problems for developers but also for water voles. Where developments are due to commence in autumn or winter, for example, and displacement is needed, the spring window has resulted in working areas being kept as unsuitable habitat over the entire summer breeding season, with negative consequences for breeding success. As a result, the conditions of NE's Class Licence for displacement in relation to development projects (CL31) have been amended to allow water vole displacement in autumn (15 September to 31 October inclusive) as it may be preferable to prolonged deliberate degradation of the habitat. Autumn displacement has been permissible under NE's Class Licence CL24, which can be used by registered drainage authorities, since licensing for displacement was first introduced.

While permissible under either CL24 or CL31, displacement in autumn at sites supporting very high densities of water voles should generally be avoided,

particularly where this affects 30 m or more of habitat, as this scale of work could affect an entire female territory.

The pros and cons of autumn displacement will need to be considered by practitioners on a case-by-case basis.

Trapping and relocation

Where it is necessary to relocate water voles by trapping, the *Mitigation Handbook* recommends that this is undertaken during spring in most parts of Great Britain (1 March to 15 April), although this trapping period may need to be extended into late spring/early summer in parts of Scotland or at upland sites. Trapping, for any reason, should *not* be undertaken during summer (peak breeding and a high likelihood of dependent young being abandoned) or winter (when the animals are relatively inactive, and therefore difficult to trap). The relocation of water voles in autumn was discussed in the *Mitigation Handbook* as a last resort option due to concerns over the likelihood of relatively young animals released at receptor sites in autumn surviving the winter. Subsequent to the handbook's publication, Baker *et al.* (2018) provided evidence that releasing juvenile water voles into receptor habitat in autumn does not necessarily result in an increase in overwinter mortality rates. It should be noted, however, that the study had a small sample size and was conducted in south east England where

winters are likely to be relatively mild compared to elsewhere. Further research is needed to determine the circumstances where autumn releases of water voles may be appropriate.

Reintroduction

Reintroduction is defined as "the translocation of an organism to areas from which it has been lost. It aims to re-establish a viable population of the focal species within its natural range" (Defra 2021). Numerous projects have attempted to reintroduce water voles to parts of Great Britain where they have become locally extinct. There are published guidelines for reintroductions, and other forms of translocation, in England (Defra 2021) and Scotland (NSRF 2014), which are based on the global best practice guidance from the IUCN (2013). These establish general principles for the reintroduction of any species. A research project, funded by People's Trust for Endangered Species and NE, and led by Merryll Gelling and Mike Dean, is currently underway to allow the production of specific guidelines for water vole reintroductions.

The research will include a search for available evidence on water vole reintroductions that have taken place, as well as translocations (including those undertaken for development purposes), with publication of detailed good practice guidance scheduled for 2025.

The authors would be pleased to receive details of any projects that may provide useful evidence to inform the study.

Water vole surveys

The *Mitigation Handbook* set out a clear description of how to undertake water vole surveys for development projects, including how to carry out desk studies (Section 3.2), the importance of a detailed habitat assessment alongside a field sign survey and how to undertake these elements (Section 3.3) and examples of appropriate study areas. Despite this the authors are aware of numerous examples of poor practice. This led to the publication of a new practical guide to undertaking water vole surveys (Dean 2021; Figure 2) that suggests an approach to habitat assessment for water voles, to encourage consistency, and includes detailed advice on the identification of field signs.

This article provides an opportunity to highlight some guidance for surveys, based on recent examples of poor practice.

1. Field sign surveys should not be done outside of the recommended survey season (mid-April to end of September in most cases). Habitat assessments should also be undertaken during this period, as habitat suitability can be very difficult to judge during winter. Where surveys are undertaken out of season it is vital that this is highlighted as a limitation, and a precautionary approach to determining likely presence or absence of water voles must be undertaken. Note that applications for a NE licence will need to include photographs of the affected habitat taken during the recommended survey season.
2. Desk studies provide useful information and should always be undertaken except for very small-scale works (see Box 1 in the *Mitigation Handbook*). Water vole populations in urban or suburban situations are often well known among local residents. However, it is important to remember that an absence of desk study records is not evidence of absence of water voles.
3. Surveys should extend beyond the site boundaries in most cases. Water

voles are mobile and can respond to changes in habitat suitability over the course of a season and can colonise habitat within a relatively short timeframe. When water voles are present and likely to be affected by a proposed project, surveys outside of the site will be vital to allow:

- a. an assessment of impacts such as fragmentation;
- b. determination of the importance of the affected population; and
- c. selection of the appropriate approach to mitigation, such as whether there is sufficient alternative habitat to allow displacement.

The necessary extent of the surveys beyond the site boundaries will vary dependent on the scale of the works, the availability of desk study records and the nature of the landscape, but is likely to be approximately 1–2 km around the site in most cases. For surveys outside the site boundaries

sufficient information can normally be gathered from a lower level of survey effort than would be used for on-site surveys: sampling at 50 m intervals or 'spot checks' at publicly accessible locations, for example.

Novel survey and monitoring methods

There are new approaches to monitoring water voles which could augment survey results and aid in determining the most appropriate mitigation technique. In areas where surveying via traditional methods is difficult, it may be possible to confirm presence via environmental DNA analysis of water samples. Similarly the use of detection dogs may be an effective tool for locating water vole latrines in hard-to-access habitat. However, to date neither method has been formally recognised and both have their own limitations. As such they should only be used in conjunction with standard survey methods.



Figure 3. A mink raft with smart trap. Photo credit: Ewan Hitchcoe.

An approach of predicting likely presence of water voles based on habitat suitability has been successfully trialled on a project in Broadland (Bullion *et al.* 2023). However, the criteria used do not include consideration of factors likely to be relevant elsewhere, such as presence of American mink (*Neogale vison*, formerly *Neovison vison*), proximity of known water vole colonies or habitat connectivity. Application of the habitat suitability assessment to predict water vole presence outside of landscapes supporting well-connected wetland habitat and extensive water vole populations is therefore not recommended.

Mink control

The impact of American mink on water vole presence has long been understood. Mink control will play an important role in any efforts to improve the conservation status of water voles, such as the SCS (described earlier in

this article) or any reintroduction. It is also likely to be a requirement of many mitigation strategies and licence applications, particularly where trapping and relocation of water voles is proposed.

Linking mink control projects across a landscape or catchment will ultimately strengthen the resilience of water vole populations. The Mink MApp smartphone app (www.minkmapp.uk) was launched in early 2023 to unify mink control initiatives and encourage the inception of new projects to fill gaps where no control is underway. It offers individual projects a secure system where their data can be uploaded, visible only to themselves and the Mink MApp team, and could serve as a contact for ecologists to identify if mink control is occurring in an area. This will be particularly helpful for small-scale projects that struggle to deliver effective mink control, which should be undertaken at a landscape scale.

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Mink control in the east of the country is currently spearheaded by the Waterlife Recovery Trust (WRT). The WRT are expanding from their original core zone in East Anglia, aiming for ultimate eradication of mink throughout Great Britain. Relying on a network of 'smart' rafts, which send an SMS notification when a trap is triggered, the WRT has predominantly removed breeding mink from Norfolk, Suffolk and Cambridgeshire and has demonstrated that total mink eradication is an achievable objective.

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References

- Baker, R., Scott, D.M., Keeling, C. and Dwight, C. (2018). Overwinter survival and post-release movements of translocated water voles: implications for current mitigation guidance. *European Journal of Wildlife Research*, **64**: article 56.
- Baker, R., Scott, D. and Dwight, C. (2019). The response of water voles *Arvicola amphibius* to 'displacement' when using water draw-down and habitat removal in grazing marsh habitat, lowland England. *Conservation Evidence*, **16**: 37–42.
- Bullion, S., Coomber, F. and Green, J. (2023). Application of Habitat Suitability Assessment as an alternative approach to predicting water vole populations on large sites. *In Practice*, **122**: 37–41.
- Dean, M. (2003). Development mitigation for water voles: a research project into the effectiveness of 'displacement' as a mitigation technique. *In Practice*, **39**: 10–14.
- Dean, M. (2021). *Water Vole Field Signs and Habitat Assessment: A Practical Guide to Water Vole Surveys*. Pelagic Publishing, Exeter.
- Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). *The Water Vole Mitigation Handbook*. The Mammal Society, London.
- Defra (2021). *Reintroductions and Other Conservation Translocations: Code and Guidance for England*. Defra, London.
- Gelling, M., Harrington, A.L., Dean, M. *et al.* (2018). The effect of using 'displacement' to encourage the movement of water voles *Arvicola amphibius* in lowland England. *Conservation Evidence*, **15**: 20–25.
- IUCN (2013). *Guidelines for Reintroductions and Other Conservation Translocations*, version 1.0. IUCN Species Survival Commission, Gland.
- Markwell, H. (2008). Large scale mitigation: a case study using water voles. *In Practice*, **62**: 7–10.
- NSRF (National Species Reintroduction Forum) (2014). *The Scottish Code for Conservation Translocations. Best Practice Guidelines for Conservation Translocations in Scotland*. NSRF.
- Strachan, R., Moorhouse, T. and Gelling, M. (2011). *The Water Vole Conservation Handbook*, 3rd edn. Wildlife Conservation Research Unit, Oxford.



Biodiversity Net Gain and Solar Farms: Could the Sale of 'Excess' Biodiversity Units Threaten Nature Recovery?

Figure 1. A UK solar farm situated on grassland in West Sussex, not a suitable BNG off-setting site say Suffolk Wildlife Trust. Copyright Adobe Stock.



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Key words: Biodiversity Net Gain, BNG, excess units, nature recovery, offsetting, solar farms

Biodiversity Net Gain's (BNG's) successful contribution towards nature recovery is compromised by the Government's decision to allow the ability to trade 'excess' on-site biodiversity units to other developments as off-site units (offsetting). Development sites are generally sub-optimal for offsetting, which should support nature recovery,

delivering the Lawton report's principles of 'more, bigger, better and joined'. Given the high proportion of predicted net gains on solar farms attributable to routine land management changes and unrealistically optimistic habitat creation plans, there is a risk that the sale of excess units generated by solar farms could further undermine BNG's support for nature recovery.

By the time you read this, Biodiversity Net Gain (BNG) will be a mandatory requirement for many planning applications in England, and considered by CIEEM members on a weekly, if not daily, basis. Suffolk Wildlife Trust believes that BNG could not only assure development does not decrease biodiversity but that it could contribute to nature recovery at a landscape scale. However, this potential is reduced if development delivers only 10% BNG – within the realms of typical statistical uncertainty in most ecological studies and the lowest level to give confidence in avoiding losses (Defra 2019) – and



“ The potential of BNG is reduced if development delivers only 10%. It is further undermined by the sale of ‘excess’ on-site biodiversity units for use as offsetting by other developments. ”

further undermined by the sale of ‘excess’ on-site biodiversity units (referred to here as units) for use as offsetting by other developments (Defra 2023).

Solar farms can deliver ecological benefits in addition to renewable energy and BNG reports for solar farms regularly predict significant gains. Assessments undertaken on sites developed prior to BNG introduction show gains between 20 and 100% are common, with many units delivered by standard practice changes to on-site habitats (Solar Energy UK 2022, 2023). The sale of these as excess units could

reduce the overall ecological benefits of solar farms, divert investment from Local Nature Recovery Strategies (LNRs) and conflict with BNG’s original principles.

BNG on solar farms

Solar farms are typically located on agricultural land with low baseline value and grassland is typically established beneath and between the rows of solar panels for ease of long-term management and maintenance. This can contribute to uplift in on-site units of more than 100% across a site.

Industry guidance encourages developers to treat the area under solar panels as available for plant growth (Building Research Establishment 2014), but there is high variability in post-development grassland habitats proposed in solar farm BNG reports. The type and condition of grassland under solar panels has a huge impact on the post-development units, and what those units could offset under

Biodiversity Metric trading rules. This is of huge significance to this discussion.

Inconsistency in post-development assessment is due in part to the lack of a standard approach to how post-development habitat features of solar farms should be treated in the Metric. The latest version (v2.0) of the UK Habitat Classification, on which many Metric habitats are based, suggests under the secondary code Solar Panel Array that users should, “Record the strips of solar panels as u1b6 [other developed land] and the strips of vegetation between the rows separately”. This code is compatible for use with primary codes including grassland and scrub.

Unpublished evidence from 15 years of ecological monitoring by Suffolk Wildlife Trust from one solar farm in Suffolk shows the detrimental impact of shading on botanical communities. This supports the position of ecological consultants who propose treating post-development grassland beneath, between and immediately surrounding solar panels as *modified grassland* in *poor* condition.

It should be of concern that so many solar farm BNG reports propose medium or higher-distinctiveness grassland between and beneath solar panels without evidence that such habitats are achievable, and of greater concern if the resulting units could be sold to offset habitat loss elsewhere (Natural England 2023).

Selling excess biodiversity units

Notwithstanding our position that the minimum level of BNG should be raised to 20% to give greater assurance of meaningful gains and support nature recovery, the sale of excess on-site units threatens not just BNG’s contribution to nature recovery but overall confidence in delivering genuine biodiversity gains (Rampling *et al.* 2023).

A housing development selling its excess on-site units would effectively reduce its net ecological benefits by allowing these units to be used to offset biodiversity losses elsewhere. The greater the proportion of the development’s excess on-site units used in this way the more marginal the net ecological benefits across the board become. The same is true of solar

farms, although we recognise the potential for creation and enhancement of peripheral habitats on land adjacent to solar farms to generate genuine off-site units.

From the perspective of a development needing *off-site* units to achieve its required BNG (Development A), buying excess *on-site* units from another development (Development B) would be unlikely to deliver any of the potential benefits of off-site BNG for strategic nature recovery and the Lawton report's principles of 'more, bigger, better and joined' wildlife sites in an ecological network (Lawton *et al.* 2010). That being the case, it is our view that on-site habitat creation and enhancements, while important for enabling development to deliver biodiversity gains, are fundamentally unsuitable for generating off-site units for use by development elsewhere.

Nature recovery implications

The sale of excess on-site units could significantly reduce habitat creation and enhancement in the places delivering the greatest ecological benefit, such as those identified in LNRSs, or even see units within strategic habitat banks go unsold; this would be economically disastrous for offsetting providers while delivering little for nature recovery (Rampling *et al.* 2023).

Assessments for a proposed solar farm straddling the Suffolk–Cambridgeshire border have calculated an uplift of over 1000 units, representing a 37.45% gain across the 1000 ha scheme (Sunnica Energy Farm Project Team 2023), which would be one of the largest in Europe. Under rules allowing the sale of excess units, this solar farm could have more

than 800 units available for sale. Putting this in perspective, a 100 ha arable site formally identified within a LNRS, where habitat could be created with a primary focus on nature recovery, could deliver around 730 units of grassland and scrub mosaic habitat with far greater ecological benefits. Were this practice to become commonplace, there is the very real prospect that demand for off-site units in some areas could be entirely met on solar farms and other development sites.

An additional consideration is that solar farms are treated as temporary developments, with operational lifetimes of 30–40 years. If, upon decommissioning, these sites revert to arable land, any contribution to nature recovery is potentially lost. In contrast, habitats within a LNRS strategic network are far more likely to be retained beyond the 30 years of a BNG agreement and create the legacy for nature recovery aspired to in BNG's founding principles.

A final thought

Solar farms can deliver biodiversity benefits and are increasingly important in the push towards net zero. Allowing the sale of excess on-site units threatens to diminish the biodiversity benefits of solar farms, and other developments, to a level that is arguably insufficient to deliver significant and meaningful ecological uplift. The decision simultaneously reduces the contribution of BNG to funding habitat creation in LNRSs purposely designed to fulfil the bigger, better and more joined-up approach desperately needed to tackle the biodiversity crisis.

“ A 100 ha arable site formally identified within a LNRS, where habitat could be created with a primary focus on nature recovery, could deliver around 730 units of grassland and scrub mosaic habitat with far greater ecological benefits than selling excess on-site units. ”

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References

- Building Research Establishment (2014). *Biodiversity Guidance for Solar Developments*. BRE, St Blazey.
- Defra (2019). *Biodiversity Net Gain and Local Nature Recovery*. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839610/net-gain-ia.pdf (accessed 22 January 2024).
- Defra (2023). *Local Nature Recovery Strategies*. Available from www.gov.uk/government/publications/local-nature-recovery-strategies/local-nature-recovery-strategies (accessed 17 January 2024).
- Lawton, J.H., Brotherton, P., 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 January 2024).
- Natural England (2023). *The Biodiversity Metric Supporting Documents* (JP039). Available from <https://publications.naturalengland.org.uk/publication/6049804846366720> (accessed 17 January 2024).
- Rampling, E. E., zu Ermgassen, S. O. S. E., Hawkins, I., & Bull, J. W. (2023). Achieving biodiversity net gain by addressing governance gaps underpinning ecological compensation policies. *Conservation Biology*, **00**, e14198. <https://doi.org/10.1111/cobi.14198>.
- Solar Energy UK (2022). *Everything Under the Sun: Facts About Solar Energy*. Solar Energy UK, London.
- Solar Energy UK (2023). *Solar Habitat: Ecological Trends on Solar Farms in the UK*. Solar Energy UK, London.
- Sunnica Energy Farm Project Team (2023). *Biodiversity Net Gain Assessment*. Available from https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010106/EN010106-005558-6.7%20Biodiversity%20Net%20Gain_v5_%5BCLEAN%5D.pdf (accessed 17 January 2024).

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Meeting the Challenges of Evidence-based Ecological Consultancy



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Keywords: best practice guidance, ecological consultants, effectiveness of interventions, emerging evidence, evidence-based practice, research partnerships

Recommending and implementing practices to mitigate and compensate for the impacts of development on biodiversity are the bread and butter of ecological consultancy. In a time of unprecedented biodiversity loss it is more important than ever that such interventions are demonstrably effective in achieving positive conservation outcomes. In this opinion piece by the CIEEM Academia Special Interest Group we question whether this is the case and challenge the profession (including ourselves) to do better.

Practising ecological consultants employ a library of guidance documents to support their advice and actions to mitigate and compensate for impacts on protected species and habitats. Familiarity with this guidance is a preoccupation for career development in consultancy, and a review of any handful of commercial ecology reports will likely reveal the same standard citations provided as

evidence for best practice in relation to a range of taxa. Furthermore, adherence to this body of guidance is expected by local authorities, Statutory Nature Conservation Bodies (SNCBs) and commercial clients, and hence a network of key stakeholders is invested in this approach. But just how much of this guidance is based on sound evidence?

A landmark opinion piece by Sutherland *et al.* in 2004 described how conservation practice was all too often based on anecdote rather than on a clear understanding of the evidence for the effectiveness of measures. The authors advocated the adoption of evidence-based conservation practice, following in the footsteps of the successful incorporation of systematically evaluated evidence into clinical practice in human medicine. Evidence-based approaches advocate the use of a range of relevant information to inform decisions on interventions and thereby improve outcomes. There are different kinds of evidence, including the results of scientific studies, practitioner experience and expert opinion, and their effective incorporation into the decision-making process requires that their relative strengths are understood and communicated.

So how well are ecological consultants doing in rising to the challenge of evidence-based practice? Sadly, there is mounting evidence that routine practices in the industry are often underpinned by inadequately evidenced guidance or even no evidence at all (e.g. Sutherland and Wordley 2017, Downey *et al.* 2022). The effectiveness of many ecological mitigation and compensation measures, for example, has not been formally assessed, and instead best (or

good) practice is frequently dictated by anecdote and opinion which becomes 'received wisdom'. A recent detailed assessment of a sample of ecology reports submitted in support of planning applications identified 446 recommendations relating to 65 different measures, 56% of which were informed by guidance but with only 10% of the cited texts including empirical evaluations of their effectiveness (Hunter *et al.* 2021). Hence, the majority of measures recommended by consultant ecologists were not demonstrably based on robust evidence. Some studies of the available evidence have concluded that routinely practised mitigation interventions may even have counter-productive outcomes.

One study of the impact of bat derogation licences issued in relation to 1776 roosts in England reported an overall negative outcome for conservation (Stone *et al.* 2013). A more recent analysis of data from routine mitigation measures implemented to compensate for the loss of bat roosts on 71 development sites showed that following the interventions bat abundance and richness had either been maintained or improved in fewer than half of those sites (Collins *et al.* 2020). Reptile translocations are another widely practised mitigation intervention and yet there is little evidence to support their effectiveness (Germano *et al.* 2015). In a recent example of one of the very few UK studies of this practice, the poor recovery of translocated reptiles across six sites was attributed to dispersal away from the receptor site, suggesting that these interventions may not be adequately compensating for the loss of populations to development (Nash *et al.* 2020). Similarly, a systematic review of evidence from great crested newt mitigation activities at development sites found no conclusive evidence for their effectiveness in maintaining populations, whereas follow-up surveys at 18 sites identified post-mitigation population declines (Lewis *et al.* 2016). It would appear that practices based on little or no reliable evidence are widely recommended and implemented, with largely unknown consequences. Perhaps even more concerning is that some

approaches have continued to be used despite the availability of evidence that demonstrates they are ineffective (Sutherland and Wordley 2017). A case in point is the use of bat gantries which have been shown to be ineffective at providing routes of safe passage for bats over roads (Berthinussen and Altringham 2012). Given the scale at which the ecological consultancy industry operates, the consequences for biodiversity of implementing ineffective or even potentially harmful interventions are clearly significant. Furthermore, ineffective mitigation practices waste resources and undermine the professional standing of ecological consultants.

There are many reasons why ecological consultancy finds itself in this troubled state. Consultants operate in an environment where mitigation and compensation measures are a legal requirement to reduce or offset the impacts of development on biodiversity. The SNCBs are therefore obliged to produce or signpost to sources of guidance, even where reliable evidence is in short supply. This evidence shortfall is further perpetuated by a dearth of post-intervention monitoring and commercial constraints which impede evidence gathering, such as insufficient time, money and the imperative to act. These circumstances have created inertia in the system and encouraged a formulaic reliance on existing guidance which is then used to 'instruct' rather than to 'guide' action. There may also be a cultural dimension to the problem as many (although not all) consultant ecologists who have not been trained as scientists (i.e. to PhD level) might be unfamiliar with how to access and critically appraise emerging scientific evidence. But even those consultants with the required skills and experience would likely struggle to justify spending the necessary time unless the cost of doing so was factored into projects.

In recent years there has been a growing recognition of these issues among ecological consultants and the SNCBs (see Natural England 2020), but what can we do to meet these challenges? Downey *et al.* (2022) list some principles for evidence-based practice, including the need to collate and review the available scientific

“ A landmark opinion piece by Sutherland *et al.* described how conservation practice was all too often based on anecdote rather than on a clear understanding of the evidence for the effectiveness of measures. ”

“ For ecological consultants to access and use the expanding evidence base we need to raise the profile of existing sources of information on the effectiveness of conservation practices and provide training in how to recognise and assess different types of evidence. ”

evidence, to regularly update guidance and, when communicating recommendations, to be clear about the sources and strengths of evidence used to inform them. These are useful guiding principles but constraints on time and costs mean that incorporating them into the daily routine of ecological consultancy in a commercial setting is not easy. Nevertheless, these are challenges that the profession must face. So how do we find efficient ways for practising ecological consultants to access and use the expanding evidence base? A good place to start might be to raise the profile of existing sources of information on the effectiveness of conservation practices (e.g. www.conservationevidence.com/) and to provide training in how to recognise and assess different types of evidence. Consultant ecologists could also usefully be encouraged to consider some of the formal frameworks that have been developed to guide evidence-based decision-making (e.g. www.evidence2decisiontool.com/shiny/evidence2decisiontool/). These initiatives should help us understand how to use the available evidence more efficiently, although for many interventions there is little or no reliable information on their effectiveness. There is a clear need therefore for scientific trials to assess mitigation and compensation interventions. Although these will incur costs and may be time-consuming, given that many such interventions are being implemented routinely in connection with development projects, there is no shortage of potential opportunities to collect the necessary information. In some instances, post-intervention monitoring data may already exist but is dispersed throughout many separate reports, with the

potential for collation and analysis. The challenge will be to develop ways of working together with researchers in academia to make the most of these opportunities. Forging more avenues of direct engagement between ecological consultants and academia will help to foster new partnerships to deliver a better evidence base and ultimately better outcomes for nature.

The CIEEM Academia Special Interest Group (ASIG) is committed to playing its part in meeting these challenges. As a small voluntary group there are limits to what we can achieve but over the coming years we aim to showcase and signpost sources of evidence that may help practising ecological consultants, to encourage initiatives to train ecologists in how to assess evidence and use it to inform decision-making, and to facilitate discussion and collaboration between academics and practitioners. In the coming months we will be developing a programme of related actions, so if you would like to support us in this endeavour or have any suggestions then please get in touch (see About the Authors).

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References

- Berthinsen, A. and Altringham, J. (2012). Do bat gantries and underpasses help bats cross roads safely? *PLOS One*, **7**(6): e38775.
- Collins, J.H., Ross, A.J., Ferguson, J.A., Williams, C.A. and Langton, S.D. (2020). The implementation and effectiveness of bat roost mitigation and compensation measures for *Pipistrellus* and *Myotis* spp. and brown long-eared bat (*Plecotus auritus*) included in building development projects completed between 2006 and 2014 in England and Wales. *Conservation Evidence*, **17**: 19–26.
- 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.
- Germano, J.M., Field, K.J., Griffiths, R.A. *et al.* (2015). Mitigation-driven translocations: are we moving wildlife in the right direction? *Frontiers in Ecology and the Environment*, **13**(2): 100–105.
- Hunter, S.B., zu Ermgassen, S.O.E., Downey, H., Griffiths, R.A. and Howe, C. (2021). Evidence shortfalls in the recommendations and guidance underpinning ecological mitigation for infrastructure developments. *Ecological Solutions and Evidence*, **2**(3): e12089.
- Lewis, B., Griffiths, R.A. and Wilkinson, J.W. (2016). Population status of great crested newts (*Triturus cristatus*) at sites subjected to development mitigation. *Herpetological Journal*, **27**(2): 133–142.
- 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)*. Natural England, York.
- Stone, E.L., Jones, G. and Harris, S. (2013). Mitigating the effect of development on bats in England with derogation licensing. *Conservation Biology*, **27**(6): 1324–1334.
- Sutherland, W.J. and Wordley, C.F. (2017). Evidence complacency hampers conservation. *Nature Ecology & Evolution*, **1**(9): 1215–1216.
- Sutherland, W.J., Pullin, A.S., Dolman, P.M. and Knight, T.M. (2004). The need for evidence-based conservation. *Trends in Ecology & Evolution*, **19**(6): 305–308.

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 December 2023 issue of *In Practice* we described a situation where you are the lead ecologist for an infrastructure improvement scheme, where dormice are known to be present and a licence is in place, but design changes mean that additional areas of vegetation require clearance. You advise your client that a licence amendment is required, but the contractor is adamant that they cannot wait until an amendment is obtained. They propose to use a methodology identical to that for existing (licensed) habitat areas, including checks by an Ecological Clerk of Works prior to commencement.

Our thoughts

The lead ecologist and named ecologist (if they are not the same person), should advise the contractor in writing that (1) the appropriate approach would be to re-negotiate their contract with the client to take this delay into account; and (2) that if the client is unwilling to do so, any works undertaken 'at risk' must be approved by the named licensee, as they are ultimately responsible for activities carried out under the licence. A third option (in England) would be to recommend seeking advice through Natural England's (NE) Discretionary Advice Service (DAS) to identify a way forward.

If the contractor is instructed by the client to proceed on an 'at risk' basis, you as the lead ecologist have a delicate balance to achieve. On one hand, ecological oversight of the work will be positive as this will ensure the risk to dormice is minimised, by use of appropriate clearance methods and by searching vegetation beforehand for active nests. On the other hand, doing so – or asking members of your team to do so – is likely to feel like colluding with the contractor to avoid the proper process.

The first issue to consider is whether it is possible to continue working on the scheme on that basis. This discussion needs to involve the lead/named

ecologist and a director or senior member of their company, as there are potential legal implications for the company in either case (e.g. being involved in vegetation clearance works which breach licence conditions, or being in breach of contract for walking away from the project). It might be appropriate for the consultancy to seek legal advice to help make this decision.

Clearly, while walking away from the project will avoid exposure to any offences under the Conservation of Habitats and Species Regulations 2017, as amended, there will be reputational consequences for the ecology consultancy in doing so, and further work from that client or contractor is unlikely. Walking away from the project may well also not result in the best outcomes for dormice, if it means works are done without ecological supervision.

There is not normally an obligation to report works being done contrary to the terms of a licence, but for some species and licence types there may be (e.g. NE Bat Mitigation Class Licences). Clearly any legal obligations for reporting should be adhered to.

Provided the named ecologist and director/senior member of the ecology consultancy feel able to do so, it may therefore be better for the ecology team to continue working on the scheme.

If so, this will need to be communicated

very carefully to the contractor and client, and all the ecology team need to have an awareness, following the client's decision to proceed on an 'at risk' basis, that participating in discussions over how and when this work is done may be perceived as tacit approval of the 'at risk' approach, contrary to the terms of the licence. It would be appropriate to caveat any advice given from this point on, along the lines of: *"We consider that the most appropriate course of action remains to await the licence amendment, however if the client and contractor intend to proceed 'at risk', the following measures should be adopted..."*

If the works do proceed 'at risk', it will be appropriate to focus on outcomes for dormice: are the works minimising risk of harm through their timings and working methods? Are the client and contractor committed to the additional compensation included in the licence amendment request, even if the clearance is carried out outside the licence? The lead ecologist and/or named ecologist would lose the ability to influence these if they walk away from the job, but by being pragmatic and continuing to engage with the contractor and client, may be able to ensure that the mitigation and compensation is in line with, or even exceeds, that committed to in the licence application.

This approach should be explained to ecology team members working on the project, and assurances provided if required that ecologists checking vegetation on site prior to clearance have the support of their employer in doing so, despite the difficult circumstances.

Prior to those inspections, a decision should be made between the licence holder, named ecologist and lead ecologist about what action to take if an active dormouse nest was found in vegetation to be cleared. Whilst working 'at risk' in areas outside the current licence extents and relocating dormice from those areas will both breach the terms of the licence, the latter is a more significant breach and should be avoided. It should be noted that Wildlife & Countryside Act offences (e.g. intentional or reckless disturbance

of a dormouse in its place of shelter) would also potentially be applicable in that situation, as well as the disturbance clauses under the Habitats Regulations.

It is not recommended that the licence amendment request is withdrawn, as this would also withdraw the corresponding compensatory measures. Informing NE in advance of works taking place is likely to provoke an investigation, but not doing so could again be perceived as 'colluding' with the client. Pragmatically, the best course of action may be to provide a detailed licence report promptly after works are carried out, with an explanation of what work has been carried out, including when, how and why it was carried out ahead of obtaining the licence amendment. This would be signed by

the named ecologist, and the client representative who, as licensee, is ultimately responsible.

If the named ecologist and/or company director/senior member of the consultancy do not feel able to continue working on the site on an 'at risk' basis, this decision, and the reasons for it, should be communicated to the client/contractor without delay. If the contractor persists with that approach, it may be appropriate to walk off the job. If so, the named ecologist should cooperate with any application to NE to appoint an alternative named ecologist, and should provide the new ecology team with information they will need in order to ensure the best possible outcomes for dormice in the circumstances.

The next dilemma

So, now for this issue's dilemma.

You are an experienced consultant ecologist and, having recently changed roles, you are passed a project where the proposed development will involve abstraction of water. This project had an Ecological Impact Assessment (EclIA) undertaken and submitted as part of the planning application. The client has got back in touch as the local planning authority (LPA) ecologist has requested further details, in particular: an assessment of the status (habitat type and condition) of grassland that the proposed development will directly impact and an assessment of the likelihood of impacts to priority wetland habitats within a nearby non-statutory designated site.

You review the existing report prepared by another consultant within your organisation and note the botanical survey was undertaken in the winter and identified low-diversity grassland, whilst noting that the survey was undertaken at an inappropriate time of year for botanical surveys. You prepare a scope of work to visit the site in summer to undertake an updated botanical survey, update the EclIA based on the findings and undertake Biodiversity Net Gain assessment. The revised scope includes a hydrology assessment and you explain to the client that this task is important to gain understanding of the likely impacts on priority wetland habitats; but this latter task is not commissioned.

You proceed with the site visit and identify a priority grassland habitat in good condition and other habitats within the main area proposed for the development. You provide an interim update of the findings to the client, particularly highlighting the change in value of the grassland habitat. Also, you are aware that there is a planning meeting before you will be able to provide the updated EclIA. You get acknowledgement from the client that the interim update has been received.

In the days before submitting the EclIA report you check the planning portal and the application has been approved with conditions. There is no reference to your interim findings or the outstanding EclIA report. The updated EclIA report highlights a residual impact to priority grassland habitat and hydrological interaction with the non-statutory designated site which requires monitoring. In spite of subsequent emails to the client, it becomes clear that neither your report, nor your interim findings, were ever presented to the LPA.

What do you do?

Membership Update



Stuart Parks

Head of Membership
and Marketing,
CIEEM

I am always conscious that, thanks to necessary lead times, when I am reporting back to you on how CIEEM membership has fared during the last calendar year we are already a quarter of the way through the next. However, since it is in the main positive news, I'll persevere in anticipation that this year will build upon the progress made in the last.

And what a busy year 2023 turned out to be. In the subscription year that ended on 30 September 2023, the membership team administered 1904 applications from both new members and current members applying to upgrade their membership level. In the 3 months that followed, through to the end of December 2023, a further 600 successful applications were processed. This is of course great news for CIEEM

as a professional body, but no less important is the fact that a growing proportion of these applications are from eager new professionals wanting to build a career in the vital sectors in which you are also working. You are likely to have read elsewhere that we continue to focus efforts on supporting employers in the sector to provide better experiences for these new professionals that are applying to CIEEM in such numbers. Examples of excellent practice are out there and we see our role as, in part, to shine a spotlight on these when they are shared with us.

It is fair to say that this volume of interest brings with it some clear challenges for us in terms of processing times and we are very aware that the time it can take to realise an outcome for applications to some grades of membership is a source of frustration to applicants. Work has already started to explore other ways of administering applications that can reduce the time without lowering the standard, and alongside this we have started the process of identifying other ways in which professional competence can be evidenced, assessed and recognised.

Despite the workload, our efforts are not just focused on welcoming new members. Our ambition for membership growth and our commitment to existing members means we strive to maintain a focus on improving our services and increasing our relevance to those of you

that regularly renew your membership. It is great to be able to report to you that 87% of members renewed their membership last year. In fact, if you're an Associate or Full member who renewed your membership you are one of 97% who did so. It is this continued support that underpins so many of our services and activities. Thank you. However, we do not take this level of support for granted and we know that the landscape in which you work, study or volunteer is changing and, in some instances, presenting new and different challenges and opportunities. We plan to spend more time this year finding out more about you as the more we know, the better we can shape our current work and future plans to meet your evolving needs. We will share our findings with you and provide ways to enable you to input some more as we seek to turn your feedback into action where needed.

About the Author

Stuart has been working in membership and marketing roles in the non-profit sector for over 20 years now and enjoys finding new ways to improve the member experience. If you see him at a conference or event do say hi as he loves to chat with members.

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Your Registration Authority



**Sarah Cox CEcol
CEnv MCIEEM**

Chair, CIEEM
Registration Authority

Ecology is exciting, dynamic and challenging. More than a simple catalogue of animal and plant species, it is the study of the often-complex interrelationships between living organisms, including humans, and their physical environment. It also provides information on the benefits of healthy ecosystems and how we can use resources in a sustainable way. Today, the unpredictability of climate changes, combined with political, legal, economic and social drivers for change, needs enthusiastic, forward-thinking ecologists to draw together the necessary information and deliver workable solutions to achieve our natural environment ambitions.

Chartered Ecologists are at the forefront of this work; collectively and individually rising to the challenge. They are experts and leaders in their fields; enthusing, guiding and making the strategic, often fundamental decisions shaping our sector.

As the Registration Authority (RA), it is our role to set and maintain the standards set for our Chartered Ecologists, and to oversee the assessment process. This year is starting with a lot of change, with both new leadership and members. It is the perfect opportunity for us to refocus and define our next chapter, building on

the legacy provided by the enormous efforts of our outgoing Chair Penny Anderson, Vice-Chair David Parker, and Jenny Neff and Michael Willis who have all been members of the RA since it was established in 2013.

I am delighted to be the new Chair of the RA. My name is Sarah Cox. I'm a full-time working parent from the north east of England. I work for Temple, a privately owned, UK-based, multi-disciplinary SME. My career to date has included working with and for NGOs, academic institutions and consultancies for the past 20+ years. Importantly, I have been extremely fortunate to engage with, learn from and collaborate with many, many inspiring, supportive and genuinely passionate people. All of whom have shaped and influenced who and where I am today.

My vision for our RA is to become more visible, to reach out to current Chartered Ecologist registrants, not least to remind them how incredible they all are; to engage with our wider sector to promote our Chartered Ecologists; and to encourage and guide new applicants through the process of becoming Chartered themselves.

We need more of you to be recognised as ambassadors to champion the natural environment. The Register of Chartered Ecologists has grown to 249 Registrants at the time of writing, but the number of applicants remains relatively low. Most recently we have made some significant changes to the application process, such as welcoming applications from professional ecologists who are not currently CIEEM members and from current members who have been at the Associate level for some time. This is proving to be an increasingly attractive proposition as the demand for Chartered status among employers and potential clients increases.

So, I would ask you all to think about what Chartership means to you? Are you Chartered? Are you thinking about becoming Chartered? Are you worried about the time you need to set aside to become Chartered? What is stopping

you? These are the questions we hope to answer and respond to this year – to empower you to join the Register and to continue to lead and inspire.

Box 1. Find out more about becoming a Chartered Ecologist

To find out more about the process of gaining Chartered status, please visit www.cieem.net/chartership for more information and to request an application form and further guidance. If you would prefer to have an informal chat in the first instance, please contact membership@cieem.net to arrange this. We can also deliver short webinars for groups of employees about gaining Chartered status; again please contact the Membership team to discuss whether this might be possible for your company or organisation.

If you are a current Chartered Ecologist and would like the RA to consider specific issues related to any aspect of administering the Chartered Ecologist Register, whether that is to do with application and assessment processes, benefits of gaining CEcol status, or even the promotion and profile of the Register, the RA would be very happy to hear from you. Contact membership@cieem.net in the first instance to discuss how to input.

About the Author

Dr Sarah Cox CEcol CEnv MCIEEM has been working for more than two decades as a professional ecologist, including working with and for NGOs, academic institutions and private consultancies. Sarah is currently Divisional Director at Temple, a privately owned, UK-based, multi-disciplinary SME. Sarah became a Chartered Ecologist (CEcol) in 2014, subsequently becoming a volunteer CEcol assessor. Having joined the Registration Authority in 2020, Sarah took up the role as Chair in December 2023.

Contact Sarah at: sarahcox@cieem.net

Policy Activities Update



Douglas Lewns
Policy Officer, CIEEM

Overall update

Since the last edition of *In Practice* the UK Government's Department for Environment, Food and Rural Affairs (Defra) confirmed the 'go-live' date for Biodiversity Net Gain (BNG). On 12 February, BNG became fully mandatory for any new planning applications made for major developments under the Town and Country Planning Act 1990 (subject to exemptions). Smaller developments will have to wait a bit longer, with BNG applying to these sites from 2 April. Nationally Significant Infrastructure Projects will join them in 2025.

Alongside this, just as we were coming into the new year, the Office for Environmental Protection (OEP) published its report on the government's progress in improving the natural environment in England. The report slammed government progress, and it found that the government *"remains largely off track to meet its environmental ambitions"*. This is the second OEP report to provide an assessment of the government's new Environmental Improvement Plan (EIP), and, by and large, despite some progress being made, substantial challenges remain and at its current pace the government will not meet its stated ambitions, statutory targets or commitments for nature, climate and the environment.

UK and England

The policy team has been hard at work preparing for BNG becoming mandatory in England, and we have dedicated a page on our website to Biodiversity Enhancement Approaches (www.cieem.net/biodiversity-enhancement-approaches), providing a one-stop shop for information on how the different UK Nations and the Republic of Ireland are approaching biodiversity enhancement during development.

We have also continued our work with the Institute of Chartered Foresters following the joint position paper published in August 2023. We are now exploring further development of this work with the Woodland Trust and Forestry Commission.

Our England Policy Working Group is preparing for any consultations arriving early in the year as well as exploring how they can work with CIEEM's Green Jobs for Nature programme to help get more people into nature-related roles and alleviate the capacity crisis.

Scotland

In Scotland, our Scottish Project Officer Annie has been engaging with the head of the First Minister's policy unit David Fleetwood to see how CIEEM can work with his team to push the environment and nature in Scottish policy.

Alongside this, the Scotland Policy Working Group submitted its response to the Scottish Government's consultation on Tackling the Nature Emergency: Consultation on Scotland's Strategic Framework for Biodiversity, adding high-level advice and guidance into how best to approach enhancing biodiversity.

The Working Group is also in the process of preparing to respond to Scottish Government consultations on Managing Deer for Climate and Nature, and Climate Change National Adaptation Plan 2024-2029.

Wales

Our Wales Project Officer Mandy and the Wales Policy Working Group have been hard at work preparing for CIEEM's 2024 Wales Conference: Peatland Restoration: Approaches and Challenges in Wales, which was held in Swansea on 31 January.

Alongside this, the Working Group is working on responses to two Welsh Government consultations. The Sustainable Farming Scheme will replace the Common Agricultural Policy (CAP) legacy schemes from 2025. It sets out 'universal' actions which farmers will have to undertake in return for a universal baseline payment, including at least 10% of farms under tree cover. The Working Group also expects to respond to a white paper which sets out its proposals for an environmental governance body for Wales, along with embedding environmental principles in Welsh law and to introducing targets and statutory duties for the protection and restoration of biodiversity in Wales.

Ireland

CIEEM's Ireland Policy Group has recognised the pressing need for national guidance on biodiversity enhancement in the Republic of Ireland and Northern Ireland with the publication of the Briefing Paper: Biodiversity Enhancement for New Developments in Ireland. The briefing paper reviews the options available for this process, sets out the current situation and gives some initial recommendations on how these enhancements could be implemented in an Irish context. The paper can be found on the CIEEM Resource Hub.

CIEEM's Irish Section has also launched a call for partners to take part in a research project on increasing capacity in the professional ecology sector in Ireland. CIEEM has proposed a 12 month project to start to address many of the issues associated with the capacity crisis, and is offering a fixed-term, part-time employment contract.

The Group is also preparing responses to the National Parks & Wildlife Service's Hen Harrier Threat Response Plan, and the Irish Government's National Adaptation Framework.



Infographics charting our policy engagement and activities across the UK and Ireland in 2023

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



Further priorities

The policy groups are now settling into the year and are preparing for what looks to be a busy year! As ever, we are always on the lookout for how CIEEM can make the most of its position to push nature and climate to the forefront of policy.

Contact Douglas at: douglaslewns@cieem.net

Green Jobs for Nature: We Need Your Help

The twin environmental crises of biodiversity loss and climate change that we are facing mean that the work of those in the sector (i.e. you!) is ever more important. But 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, the Green Jobs for Nature communications and outreach campaign aims to promote nature-focused careers to 13–23-year-olds across the UK and Ireland, with a specific focus on young people from backgrounds currently under-represented in our sector: young people of colour, young people who are differently abled or disabled, and young people from lower socio-economic households.

Central to the campaign is the www.GreenJobsForNature.org website which is packed with useful information about what a green job for nature is, how to get one and who you can work for. There are over 110 job profiles from those working in the ecology and environmental management sector featured on the website to promote the variety of jobs and the wide range of employers.

To inspire the next generation of ecologists and environmental managers, we need your help to provide useful insights and practical advice to encourage young people into our sector.

“ Send us your job profile to help us expand the breadth of job roles and showcase as many as possible. ”

There are a number of ways that you can get involved:

- Send us your job profile providing an insight into your role to help us continue to expand the breadth of job profiles so that we can showcase as many different roles as possible: <http://greenjobsfornature.org/job-profile-form>
- User-generated content is key in helping us to engage and interact with young people. We are looking for 30–60 second video clips that you can make using a smartphone. These will then be used on the website and social media channels to bring to life what it is like working in the industry. You could talk about: what inspired you to work in a nature-related role; what you like about your job; what top tips would you give to those looking at joining the sector; etc.
You can upload your video clip here: <http://greenjobsfornature.org/upload-photos-and-videos>
- Have a look at the www.GreenJobsForNature.org website and let us know if you feel there is anything missing or needs updating.
- Help us raise the profile of the website to ensure we are reaching our key audience – through your internal communications with staff

and their families, your external stakeholders, use of your website and social media channels and newsletters, etc.

- Follow Green Jobs for Nature on Instagram (www.instagram.com/greenjobsfornature/) and TikTok (www.tiktok.com/@greenjobsfornature) and share posts among your networks, family and friends.
- Link your website and social media channels to the Green Jobs for Nature website and social media channels.
- Contact us if you are interested in becoming a Green Jobs for Nature and/or EDI Partner (diversity@cieem.net).
- Contact us if you would like to write a blog – for example: providing career advice for young people; what is it like being a career-changer; your hopes for the future of the sector; your experience of working in the sector from an underrepresented group; etc.
- Help raise the profile of careers in ecology and environmental management among secondary school pupils by signing up to become a STEM Ambassador (www.cieem.net/i-am/stem-inspiring-the-next-generation).

Next steps

If you would like to get involved in any or all of the above please do get in touch with Sally, Craig and Natarnya at info@greenjobsfornature.org – we look forward to hearing from you and how you would like to become involved.

**CIEEM**

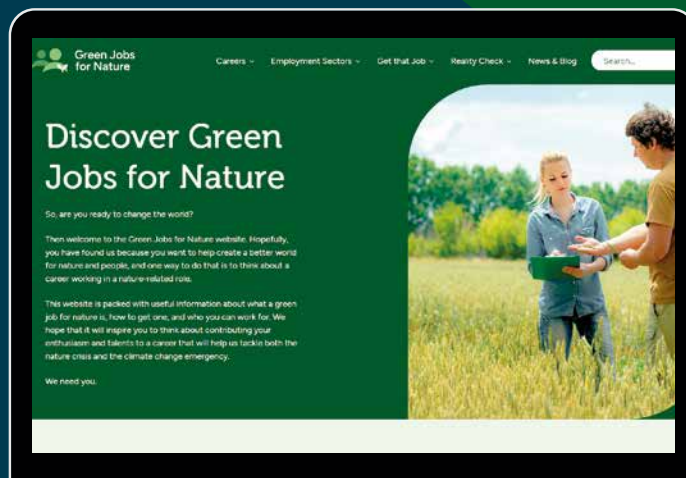
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And we're looking for more people to get involved.

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Planning Your Future Training

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

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.

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 jobs and CIEEM 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, so do get in touch to discuss your needs.

Key highlights

The training team is currently planning the programme for the next 6–12 months. In the meantime, some highlights over the coming months are:

- **Introduction to Bat Ecology and Bat Surveys** (10:00–13:00 on 14 & 15 March) delivered online by Katie Pollard. This course will focus on the skills need by ecologists to carry out bat surveys to a high standard, in line with current legislation and best practice. We will look at key aspects of bat ecology, important bat identification features and primary legislation in relation to bats. We will review key bat survey requirements and methods and how to prepare for surveys and select appropriate survey equipment. A range of roost types for the different species in the UK will be discussed, highlighting key roost signs, to aid roost identification.
- **The Importance of Meres and Mosses** (10:00–13:00 on 11 & 12 April) delivered online by Lorna Bointon. This course will cover identification of different types of peatland (e.g. bog, mire, fen) and recognition of bog habitats (e.g. raised, blanket, quaking, etc). Participants will also learn about peat formation and edge habitats (e.g. lagg) and the positive and negative indicators that help inform management techniques. Participants will understand the environmental importance of mosses and meres (e.g. in terms of flooding, water quality, carbon sequestration) along with the importance of meres and mosses as wildlife corridors or 'stepping stones'.
- **Introduction to Habitat Survey and Mapping, Ireland** (10:00–17:00 on 18 April) delivered in person in Ireland by George Smith. This course will provide an introduction to habitat survey and mapping. Habitat surveying is a fundamental method of gathering information about the ecology of a site. It is a main focus of Preliminary Ecological Appraisal and a basic requirement of Ecological Impact Assessment. Habitat mapping provides important baseline information for managing and monitoring ecosystems or species and also for ecological research.
- **Phase 1 Habitat Survey** (25 & 26 April) in Scotland. This two-day training course is delivered by Adrian Davies. This course is aimed at consultants, botanists and ecologists involved in the conservation, surveying and classification of habitats in Scotland. This course is designed as an introduction to identify the characteristics of main Phase 1 habitats. This will involve excursions (weather permitting) to a range of habitats within the JNCC

Phase 1 Habitat Survey System. Methods or appraisal for ecological habitat assessment in relation to land management will be discussed and debated.

- **Train the Trainer for Ecologists** (16 & 17 October) in 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.

Early careers training

In April, our fifth intake of the Early Careers Training Programme will begin with 16 participants from across the sector, and from across the UK and Republic of Ireland.

Comprised of 12 days of training, the programme helps early career ecologists and environmental managers gain a solid foundation in key areas. The training will be taken over a 18–24 month period and include a mix of core modules and a range of optional modules for delegates and employers to choose from based on their interests and specific areas of work.

If you would like to be part of the April or Autumn 2024 intake, or would like further information, please email us at training@cieem.net.

Team of trainers

We are very grateful to continue to work with a range of expert trainers to meet the training needs of our members and those working across the sector. As we continue to look to grow the programme to meet this demand, we are keen to grow our team of trainers.

So if you are interested to find out more, then please do get in touch with us at training@cieem.net and we can set up an initial call to discuss opportunities.

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



Why Neurodiversity is Good for Biodiversity



Helen Musgrove

Director of
Psychological
Consulting, Lexxic

What is neurodiversity?

Neurodiversity refers to different ways our brains are wired and process information. 15–20% of the population is neurodivergent. Neurodivergent is a term used to describe individuals whose way of processing information differs from the majority. Neurodivergent individuals may have one or more neurodifference, including dyslexia, dyspraxia, dyscalculia, ADHD, and Autism Spectrum Condition as well as some less common neurodifferences.

The neurodiversity movement proposes that neurodifferences should be

recognised and respected in the same way as other human variations. Instead of labelling people with 'deficits' or 'disorders', it takes a balanced view of an individual's unique strengths and challenges.

The value of neurodiversity and neuro-inclusion to your organisation

A neuro-inclusive organisation values neurodiversity, creates a sense of belonging for all employees and removes barriers which prevent equal outcomes. To be neuro-inclusive means acknowledging, proactively supporting and empowering neurodivergence at every point of the employee life cycle and customer journey.

There is a strong business case for neuro-inclusion. In a world where the competition for talent is fierce, creating a culture where all employees are understood, valued for their talents and treated equitably can increase

talent acquisition, engagement, retention and loyalty.

According to the *Harvard Business Review*, companies that embrace neurodiversity can gain a competitive advantage. This is because neurodivergent individuals often possess strengths which are critical to our future economy. These can include:

- creativity, innovation and big-picture thinking
- leadership skills
- energy and hyperfocus
- attention to detail, logic, problem-solving
- new perspectives, honesty and integrity.

Neuro-inclusive organisations which empower individuals to maximise these strengths and remove barriers to their success can increase productivity, revenue and reputation. Leading organisations such as JP Morgan Chase, GCHQ and SAP are recognising these benefits:

- “Compared to peers, the Autism at Work employees were 48% faster and as much as 92% more productive.” (JP Morgan Chase)
- “Neurodiversity is key to keeping Britain safe. At GCHQ, some of our most talented and creative people have a neurodiverse profile.” (GCHQ)
- SAP’s neurodiversity programme has resulted in “productivity gains, quality improvement, boosts in innovative capabilities, and broad increases in employee engagement”. (SAP)

Diversity of thought is also vital if we are going to find the innovative solutions we so urgently need to the significant challenges faced by our planet. At the moment, the ecology and environmental management sector is one of the least diverse in the economy!

The legal case for neuro-inclusion

Employers should also be aware that whilst neurodivergent individuals may not choose to identify as disabled, many will meet the disability definition under the Equality Act (2010). Employers are therefore required to provide reasonable adjustments to support them at work. Adjustments are changes to the working environment or working arrangements that remove or reduce the disadvantage someone experiences at work as a result of their disability. They are often inexpensive and easy to implement, and can frequently be incorporated into wider working practices (e.g. flexible working arrangements).

Creating a neuro-inclusive workplace in practice

Adjustments are important, but it is leadership, culture and systemic change that will enable your organisation to become truly neuro-inclusive. So what does this mean in practice? At Lexxic, we work with organisations to take action across the employee life cycle and customer experience. Here are some of our top tips:

Leadership and culture

- Senior leaders should be committed to, and accountable for, neuro-inclusivity. They can provide a platform for people to share stories and role model neuro-inclusive practice.

- Raise awareness of neurodiversity across the organisation, through training and guidance.
- Focus on ensuring that individuals feel psychologically safe to share experiences and access support.
- Listen to the views of neurodivergent individuals, e.g. via an Employee Resource Group, and ensure these are taken into account. Gather data to understand and address any barriers they may experience, e.g. to progression.

Recruitment

- Job descriptions should be unambiguous and focused on the specific skills required for the role. Including specific statements around neuro-inclusion can encourage applications from neurodivergent candidates.
- Application forms and processes should minimise adverse impacts for neurodivergent candidates. You could use work samples or work trials which give candidates the opportunity to showcase their skills in practice.
- Candidates should be offered information about adjustments proactively.
- Recruiting managers should be trained in how to get the best from neurodivergent candidates, e.g. how to structure interview questions and minimise unconscious bias.

Adjustments

- Make a range of adjustments and assistive technology available to support neurodivergent individuals – everyone is different.
- Have a clear process for requesting and accessing relevant adjustments promptly.
- Be ready to adapt ways of working to meet the needs of neurodivergent individuals.
- Support individuals to understand adjustments that might be useful (e.g. through workplace needs assessments with an expert psychologist).

Environment

- Understand the impact the environment can have on concentration, attention and sensory overload.

- Adopt universal design principles, so that neuro-accessibility is incorporated into the design of workspaces and customer environments.
- If needed, adapt the environment to suit neurodivergent individuals, e.g. providing quiet spaces or fixed desks.

Talent management

- Support the development of neurodivergent employees with a strengths-based approach.
- Minimise barriers and enable neurodivergent employees to thrive in areas they are best at.
- Ensure performance management systems don't discriminate against neurodivergent employees.

Communications

- Ensure communications are accessible (e.g. concise, unambiguous, plain English, neurodiversity friendly formatting, compatible with assistive technology).
- Share messages internally and externally in a range of formats (e.g. video, verbal, written).

About the Author

Helen Musgrove is Director of Psychological Consulting at Lexxic. Lexxic (www.lexxic.com) is a specialist psychological consultancy with a mission to create a world where all minds belong. You can find more practical advice to help you get started on your neuro-inclusion journey in Lexxic's new Neurodiversity Smart Employer Guide – available from the CIEEM website.





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From the Country Project Officers



Elizabeth O'Reilly
– Ireland Project Officer

Hello everyone,
What an exciting start to 2024 it has been.

Organisation is well underway for our annual Irish conference, entitled **Examining the Practical Impacts of Environmental Policy and Legislation on Ireland's Ecology**. Booking is now open and we hope to see you there for what is shaping up to be a great day.

Our Lunchtime Chat webinars kicked off for the year with Linda Huxley from Swift Conservation Ireland joining us in February, and we are looking forward to hearing from BEC consultants and NPWS on the Woodland Management Plan for Glenveagh National Park at the end of this month. See the website to book and for future events.

You will hopefully have seen the *Briefing on Biodiversity Enhancement for New Developments in Ireland* that was launched the end of 2023. We have been continuing engagement work on this topic and look forward to more discussions with stakeholders and members.

There is ongoing work by the Ireland Section to address the capacity crisis in the sector and we look forward to updating you all soon. In the meantime, CIEEM is engaging with universities across the island. We have participated in the Queens Environmental and Conservation Careers Fair, sponsored the Best Biodiversity Prize at ENVIRON conference, and several volunteers are giving careers talks across the island. If this work is appealing to you, please get in touch with me for more information.

But for now, I will leave it at that and look forward to updating you again in the next edition.

All the best, Liz

Contact Elizabeth at:
Elizabeth@cieem.net



Mandy Marsh
– Wales Project Officer

S'mae pawb / Hello everyone

At the end of January

we held our first Wales in-person conference since before COVID-19. The theme was **Peatland Restoration: Approaches and Challenges in Wales** and we were delighted to welcome key speakers from Natural Resources Wales (NRW) and the National Peatland Action Programme, led by Dr Pete Jones MBE, as well as speakers from as far afield as Hadrian's Wall and Nottingham. The conference was held in Swansea and we must thank NRW for hosting a field trip to nearby Crymlyn Bog the following day.

As if that wasn't exciting enough, CIEEM as a whole is proposing to hold its 2024 Autumn Conference in Cardiff. Keep an eye out for updates – definitely one for your diaries!

I'm delighted to be working with our new Policy Officer, Dr Ashley Buchan, who will be overseeing policy issues in Wales, Scotland and Ireland. Currently we are working on responses to Welsh Government's Sustainable Farming Scheme consultation – huge thanks to the volunteer members of our Wales Policy Group who generously give their time and expertise.

We are still short of job profiles to support our Green Jobs for Nature campaign. We know there is a skills shortage in the sector, so please help to encourage the next generation by submitting your job profile (warts and all) at <https://greenjobsfornature.org/job-profile-form/> and use the opportunity to shout out about life in Wales!

Hwyl, Mandy

Contact Mandy at:
MandyMarsh@cieem.net



Annie Robinson – Scotland Project Officer

Hello everyone,
Our first event of 2024 was on **The**

Amplification of Plant Disease Risk through Ecological Restoration with Dr Ruth Mitchell of the James Hutton Institute. This highlighted the risks that non-native plant pests and pathogens pose when conducting management operations during ecological restoration. February saw us teaming up with the Early Careers Special Interest group for a networking event. I encourage you to get involved in the Special Interest Groups (<https://cieem.net/i-am/member-networks/>) and attend the wonderful array of events they organise. There are now eight SIGs so hopefully something for all our members. We were delighted to welcome five new members to the Scotland Committee at the end of 2023. The Scotland Committee has been busy planning a range of events for 2024. Please let us know what events you want to see happening.

The start of the year saw another consultation for the Scottish Policy Group. In 2023 there was a real focus on workshops and consultation on Scotland's Strategic Framework for Biodiversity and in 2024 there will be lots of work related to the upcoming Natural Environment Bill. We really value members' support and expertise in policy work, please get in touch if you would like to be involved in the Scotland Policy Group.

Look forward to seeing you at a Member Network event and please get in touch anytime if you have ideas/feedback to share.

All the best, Annie

Contact Annie at:
AnnieRobinson@cieem.net

British Ecological Society

Priorities for Freshwater



India Stephenson

Policy Officer, British Ecological Society

What should England's priorities for freshwater be? We asked the experts

The Environment Act 2021 introduced targets for environmental improvement in England, including much-needed targets for biodiversity. The clock is ticking and as we enter 2024, there are only 6 years left to achieve the key target to halt the decline in species abundance by 2030.

Freshwater invertebrates will make a substantial contribution towards this target, as they make up nearly a quarter of the D4 indicator which is being used to measure progress towards it.

What priority actions should Defra take to reverse freshwater biodiversity loss in this short time? The British Ecological Society held a workshop in November 2023 with 37 aquatic ecologists and civil servants to help them decide.

Priority actions

The experts agreed that changes to farming to mitigate agricultural pollution should be a top priority for restoring England's waterways. Given that almost 70% of England is farmland, this is likely to deliver the greatest and most widespread benefits.

Measures within Defra's Environmental Land Management Schemes that reduce agricultural run-off need to be heavily incentivised to improve uptake. The highest payments should be for the difficult actions that provide the best benefits. These should include regenerative agriculture practices to

reduce the use of fertilisers, pesticides and herbicides, and buffering waterways by farming back from rivers, fencing off watercourses to keep livestock out and planting riparian woodlands.

Better monitoring and greater sanctions for wastewater treatment works are also essential for preventing sewage overflows. Particular priorities in the short term are putting a stop to combined sewage overflow dry spills, and targeting small, failing sewage plants and those in headwaters to improve biodiversity along the entire length of a river. Simultaneously, projects to update wastewater infrastructure need to incorporate climate risk.

Metals were also implicated as having one of the biggest impacts on biodiversity. Reducing contamination flowing into waterways would result in a substantial change, and reducing zinc and copper dissemination in particular would have the greatest benefit for macroinvertebrates.

It was also suggested that improving connectivity within rivers and floodplains should be a priority, as it will improve functioning and resilience, allowing systems to recover more quickly. Removing barriers to the flow of water such as dams has a big impact, but needs to be done in a strategic, connected way involving stakeholders to ensure barriers are removed both up and downstream.

Smaller water bodies are vital for connectivity, but are often overlooked in monitoring and protection. Connectivity can be improved quickly by creating new ponds and restoring old ponds.

Currently monitoring is patchy in terms of time, space and types of chemicals being monitored. Monitoring should be systematic and use multiple sources, including new eDNA and high throughput mass spectrometry approaches, machine learning and citizen science. Without a monitoring uplift, it will be impossible to know if

Defra's biodiversity targets are achieved, or to trace sources of pollution and resolve conflict over who is responsible.

Increasing the level of monitoring would provide the data to develop and train predictive models. This will allow ecologists to work with water systems modellers to develop models that dynamically link water quality with biodiversity indicators. The experts also agreed that we need biodiversity indicators that are sensitive to a range of pressures, and the current indicators and 'good ecological status' approach presently being used are assessed in the full report.

Waterways are connected by nature and the above actions need to be undertaken in a joined-up approach between the four nations of the UK. Actions should be prioritised using evidence, rather than responding to the public narrative, which is sometimes in contrast with what the evidence says. The BES is hopeful that by prioritising these actions with the best outcomes for biodiversity, Defra can turn the tide on biodiversity loss in the aquatic environment.

Visit the BES website (www.britishecologicalsociety.org/) to read the full report, which also includes the experts' feedback on Defra's targets for water quality and the indicators it is currently using for the aquatic environment. You can also stay up to date by following @BESPolicy on X (formerly Twitter).

By Members For Members

North East England Geographic Section

Great crested newt District-Level Licensing: the role of the delivery partner

District Level Licensing for development projects impacting great crested newts has been rolled out across the UK, and provides an alternative to site-based mitigation licensing that removes the need for newt surveys and exclusion/relocation of newts. Developers pay to fund the costs of pond creation to compensate for lost ponds or terrestrial habitat, but the opportunity to do so

depends on the creation of a pond bank by a local delivery partner. This ensures that newly created ponds are always available to compensate for development losses, so the delivery partner's role is critical to the success of District Licensing as a whole.

The CIEEM North East England Member Network set up an event hosted by the Durham Wildlife Trust, Natural England's

local delivery partner for the area between the Rivers Tyne and Tees. The event was based at Rainton Meadows Visitor Centre, and involved fantastic presentations on the Trust's pond creation work for the District Licensing scheme. They then went to visit two sites to see this in progress, followed by a discussion session back at the centre.



Aren't volunteers amazing!?

At the time of writing in December 2023, it is with a heavy heart that this is my last week as Volunteer Engagement Officer at CIEEM, as I am moving on to a new role at the British Trust for Ornithology (after 4 fantastic years at the Institute). However, throughout my career to date I never cease to be overwhelmed by the awe-inspiring contributions of volunteers towards conservation, ecology and the environmental management sector. I have been fortunate enough to have met so many enthusiastic, passionate and knowledgeable people whom, whatever their circumstances, give so much of their time and skills to the Institute.

Taking CIEEM Member Network and Special Interest Group volunteers as

an example, collectively they organised and led 56 different events for CIEEM members in 2023, engaging with over 1800 people. They also attended careers events at universities throughout the UK and Ireland, giving the Institute wider recognition in areas it simply wouldn't have been possible to do otherwise. This year has also seen contributions from all three new Special Interest Groups (Freshwater Ecology, Freelance Practitioners and Early Careers) which all look set to be a fantastic additions to the Institute.

Allow me to have this space to say a huge thank you to all volunteers who I have worked with during my time here, but also to those who I haven't. Know that all your efforts do not go unnoticed. I know that the Institute

will continue to develop the CIEEM Volunteer Achievement Awards scheme first launched in 2023, as well as work on more ways to recognise the vital work that you do. The Institute has gone from strength to strength during my time here and this is, in no small part, down to the time that volunteers give. Volunteers are the lifeblood of CIEEM, so if you are part of our team, please keep doing what you are doing. I hope we cross paths again in the future but, between now and then, I hope you get lots of opportunities to enjoy nature and that your wildlife sightings are both plentiful and spectacular. Over and out!

Drew Lyness

Volunteer Engagement Officer, CIEEM

Yorkshire & Humber Geographic Section

Members Gather for Botanical Identification Events

We had another busy year for botanical workshops, providing an opportunity for members to network and increase their ecological skills and knowledge. The year started with a visit to Denton Estate near Ilkley to practise identification of winter trees, by working through keys and looking at notable features of a range of species present in the woodlands and parkland.

Last July we braved the torrential rain to record all the vascular plants we could find at Littleworth Park in Barnsley, with permission from Yorkshire Wildlife Trust. This site contained an interesting mixture of habitats including patches of grassland showing acidic and calcareous influences, which is reflective of the site's former land use as a colliery and for landfill. Despite the weather, we recorded 91 species of plant, and were treated to a singing song thrush and thrumming woodpecker.

The weather was kinder during our subsequent August visit to Rodley Nature Reserve in Leeds, and our event coincided with a moth-trapping event run by the Reserve's volunteers. During this visit, attendees again gathered to practise plant identification, identifying 98 species despite covering just a fraction of the reserve! This site gave attendees a chance to look at a range of pond and marginal species, as well as hedgerow, grassland and arable field margin species.

There is enduring high demand for our botanical workshops, partially driven by the need for members to improve their botanical identification and habitat classification skills for upcoming mandatory Biodiversity Net Gain. Therefore, we look forward to holding more of these events next year and seeing many of our members there!



Photos by Clare Cashion

From the Patrons

Save the Teifi



Jane Davidson

CIEEM Patron, Chair of Wales Net Zero 2035, and author of *#futuregen: Lessons from a Small Country*

Everyone has a river that they love, so let me introduce you to mine – Afon Teifi, 76 miles from source to sea. I've hiked up many times to its source in the Cambrian Mountains and followed it down as it passes through bogs, pastures, small towns, villages, forests, farmland and gorges, into a dynamic estuary at Poppit Sands from where it enters Cardigan Bay. I swim all year round and also kayak upriver to the 12th century Cilgerran Castle which looms high above the river. There is a severe meander where the river feels primeval with no human influence in sight – apart from the pink masses of Himalayan Balsam now lining its deep waters.

On the lower parts of the Teifi, the wildlife used to be rich. Otters and a huge variety of wetland birds were plentiful. When I lived here in the 1980s, salmon and sewin were caught aplenty using the ancient tradition of coracles or illegally through seine nets – indeed one of our local pubs was nicknamed 'The Netpool'. Now it is 'catch and release' on all salmon, grayling and brown trout – i.e. no fish retained, with the salmon facing possible extinction over the next decade.

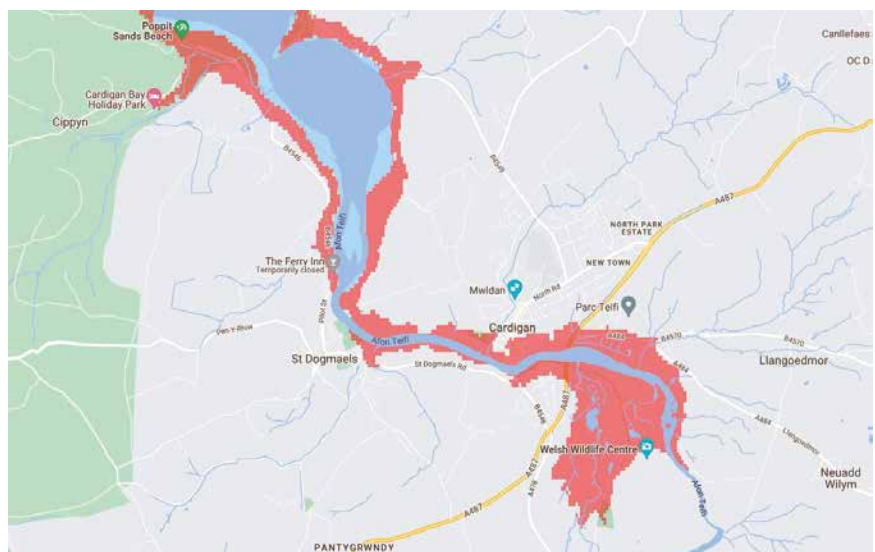
The Teifi is susceptible to regular flooding, particularly in Aberteifi (Cardigan) when the river in spate is backed up by a spring tide. Climate Central modelling (<https://coastal.climatecentral.org/map/14/-4.6713/52.0884/>) of land predicted to be below annual flood level in 2030 – only 6 years away – includes the road through the centre of Cardigan, the A-road to Carmarthen and the B-road to Poppit Sands. This is shown by the red areas on the map below.

The Teifi is damaged by illegal sewage outflows. Poppit Sands may be a blue flag 'excellent' bathing beach between May and September, but as we hardy cold water swimmers have learned to our cost, Dwr Cymru Welsh Water (DCWW) has been spilling sewage with increased gusto: In 2023, DCWW had to admit that between 40 to 50 wastewater plants were illegally spilling untreated sewage for a cumulative total of 1146 days from 2018 to the end of May 2023. DCWW said that the decision was taken with "customer bills in mind" – not the health of our environment or current and future generations. And where were the

prosecutions? The regulators Ofwat and Natural Resources Wales were missing in action.

The Teifi also suffers from high levels of phosphates from land management (mal)practices. The lower parts of the Teifi failed 50% of its phosphates targets but it is the only significant river in Wales where phosphates linked to land use/farming (28%) are much lower than those linked to sewage (67%).

So here we have it; the river I love is both uniquely individual and yet demonstrating characteristics which are ubiquitous across the UK: fringed by invasive species, depleted of species and habitats, contributing to increased flood risks (particularly where its course has been changed or housing has been built on flood plains), and its own ability to survive is threatened continuously by sewage and phosphates linked to land use. In 2021, the Save the Teifi community group (<https://teifi.one/>) was formed, aiming to build a partnership between communities, landholders, regulators, local authorities and DCWW to work together, not least by using citizen science and actively caring for this very special environment.



Areas of Aberteifi (Cardigan) predicted to be below annual flood level by 2030 (shown by red shading). Source: Climate Central. Reproduced with permission.

Last year, 2023, should be a wake-up call. For Wales, our hottest year on record; for the UK as a whole, the second hottest, after 2022. The destruction of the Teifi is happening in the public eye, in a country with a Well-being of Future Generations Act which requires the enhancement of biodiversity. So, despite ministers, parliaments and regulatory bodies being in place across the UK to improve water quality, tackle pollution, increase biodiversity, prepare for climate change and protect the public, the response everywhere has been inadequate. So really, this is happening on all our watch.

But something else is happening as well – the rise of the angry and active citizen demanding action on cleaning UK waters. Perhaps influenced by our re-found love of nature during COVID, the call for clean waters is now clearly on the agenda. Feargal Sharkey is probably the most famous indefatigable campaigner for clean seas and rivers and has captured the public mood. Across the UK, citizens have held politicians to account on sewage discharges. In December 2023, we saw the Universities Superannuation Scheme cut its investment by 62%.

Now is a potential moment of change, of standing up for nature. And I can report some good news on the Teifi as well. On 27 November 2023, the Welsh Climate Minister, Julie James MS announced the Teifi Demonstrator

Catchment project (www.gov.wales/written-statement-launch-teifi-demonstrator-catchment-project) to showcase collaborative approaches to water quality improvements and build habitat resilience along the whole river. Leaning into the five ways of working required by the Well-being of Future Generations Act, this is a project that is preventative, long term, integrating outcomes, collaborative and involving people about whom decisions are being made. The first 6 months of this year will involve collaborative project design, with a 5 year delivery/evaluation focus. The ambition for the project is to

develop a model which can be scaled up and replicated in other Welsh river catchments in the future.

Following the announcement, Save the Teifi Community group said: *"We believe that establishing the Teifi Demonstrator project is a major step forward not just for the Teifi but for all the rivers in Wales. We look forward to working with stakeholders and other community groups to restore the river for the benefit of nature and society."*

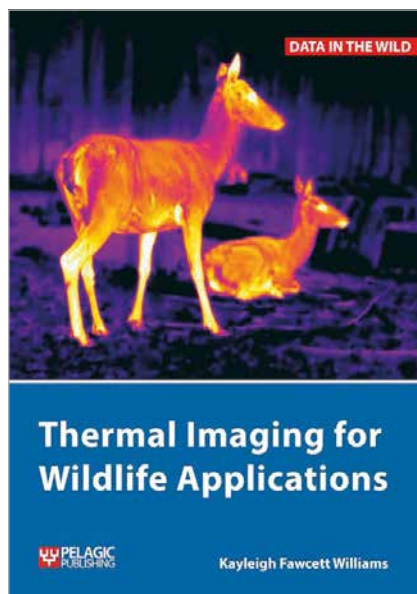
My measure of whether this is a success will be once again to see the fish leap while I swim in the first designated bathing water in a river in Wales.



Photo credit: Save the Teifi Group.

BOOKS AND JOURNALS

Compiled by the Academia Special Interest Group



Thermal Imaging for Wildlife Applications

Fawcett Williams, K. (2024)
Pelagic Publishing, London, 148 pp

This book is essential reading for anyone wishing to use thermal imaging as a wildlife surveying tool. We are fortunate to have a multitude of new survey tools at our disposal, but these are only of use if they are used appropriately within correct parameters. This point is made expertly, and repeatedly, with different examples. The frequent links made between specific use, published papers and equipment used (including make, model and manufacturer where possible) allow described studies to be both compared and repeated. This information is supported by comprehensive appendices, which provide lists of relevant scientific papers, resources and suppliers. The fast development of this technology does mean that some equipment information could quickly become dated, but underlying principles will remain valid. The excellent understanding the author has of those underlying principles is reflected in how well they are explained. This includes a comprehensive review of variables which may impact success, together with a number of 'snippets of information' boxes. These provide

information vital to a good understanding of thermal imaging, with perhaps the most notable being that it is not possible to detect animals behind solid objects. The practicalities of equipment use (e.g. weight, expense, damage risk) are discussed, together with the advantages of use in combination with other technologies (e.g. drones). The benefits of attention to detail (e.g. detection distances, thermal difference between animal and environment, analysis software settings, equipment technical specifications), test surveys and appropriate expertise at every stage of the process are subjects repeatedly returned to. A negative result can reflect incorrect equipment and/or equipment use rather than reality. A thorough read of this book will significantly help in preventing such an outcome. Novel applications are discussed, not just looking for animals themselves. This includes detection of polar bear thermal trails, bat flight paths and cetacean exhale blows. There are even (as yet largely unrealised) opportunities to use this technology to find sick and injured animals. Additionally, by allowing nocturnal surveys in addition to diurnal ones, an improved understanding of a species' behavioural ecology can be obtained. Surveys carried out by this technology can be both more effective and efficient than manual surveys. This also applies to automated data collection and analysis, with potential for improvements in this area to significantly expand the use of the technology in the future. As ever, success would depend on a thorough understanding of capabilities and limitations. As one might expect from such a comprehensive subject review, the history of thermal imaging associated with specific groups of animals is also covered. Not surprisingly large animals (deer) were the first subjects in the 1960s and 1970s. In short, this is an excellent book. One caveat though: it does not include comparison with infrared techniques. Can someone please write a similar book for this now too?

locations.

Paper Review  OPEN ACCESS

Large positive ecological changes of small urban greening actions

Mata, L., Hahs, A.K., Palma, E. *et al.* (2023)
Ecological Solutions and Evidence 4(3),
e12259. <https://doi.org/10.1002/2688-8319.12259>

Small-scale 'greening' initiatives are often recommended for incorporation into urban development projects by ecological advisors and local authorities. However, there is very little empirical evidence that such actions lead to sustained positive ecological outcomes. This study provides some of the first empirical evidence that small-scale interventions can make a significant contribution to the ecological enhancement of urban areas. It focuses on an unremarkable 195 m² patch of lawn with two native trees in a highly urbanised setting which was then subjected to topsoil replacement and planting with 12 native species. Observations over a 4 year period revealed a substantial increase in a range of measures of ecosystem diversity and functioning, including insect species richness, the diversity and complexity of plant communities and the number and diversity of plant-insect interactions. Importantly the study showed that although rapid colonisation was the initial driver of insect richness this was soon replaced by survival as the dominant demographic process, as would be expected in a self-sustaining ecosystem. The study not only demonstrates the value of this specific urban greening intervention, but also describes a useful analytical framework for monitoring ecological changes arising from other small-scale interventions which could further improve the evidence base for practitioners.

Harnessing practitioner knowledge to inform the conservation of a protected species, the hazel dormouse *Muscardinus avellanarius*

Phillips, B.B., Crowley, S.L., Bell, O. and McDonald, R.A. (2022) Ecological Solutions and Evidence 3(4), e12198. <https://doi.org/10.1002/2688-8319.12198>

This article begins by highlighting the importance of robust evidence to inform conservation decisions and acknowledging that, in addition to the published literature, there is a wealth of additional information held by non-academic experts and practitioners. The authors used research interviews to explore the apparent 72% decline in dormouse populations between 1993 to 2014 despite the protection measures, widely attributed to habitat loss, fragmentation and climate change. They identified the opportunity presented by mechanism in the Environment Act 2021 for developing 'Species Conservation Strategies' to identify the actions required to restore populations, as required by a statutory obligation to maintain a 'Favourable Conservation Status'. To begin to build an evidence base, a review of the international scientific and 'grey' literature was undertaken and revealed a focus on woodland/hedgerow management, and nest boxes, although there is little published on the effect of different commercial forestry practices other than coppicing. This was complemented by semi-structured interviews with 38 dormouse experts and practitioners in Devon and Dorset. These suggested dormice are more adaptable than presented in the literature, being found in a wider range of habitats and – interestingly – the negative effect of deer on populations. The importance of scrub habitats was stressed, with the implication that this should be acknowledged in policy, as well as linear features such as road and railway verges. Knowledge gaps were identified, specifically that no studies appear to have been carried out that evaluate the effectiveness of mitigation measures, such as the routine interventions carried out as part of planning and development with concerns expressed about lack of enforcement and the quality of habitat creation and management raising the potential benefit of off-site compensation. Uncertainty was also expressed regarding available survey data, with limitations of existing methods identified including that it is unknown when, why and how much dormouse use nest boxes, tubes and tunnels placed at a convenient height for surveyors while dormice are considered most active in the canopy, and the availability of natural nest sites. It is a thought-provoking article. Hopefully it will stimulate sharing of more survey data, particularly from non-wooded habitats – there is little published on dormice on road verges and nothing on rail sides although work must be taking place in these

Stakeholder perspectives on the prospect of lynx *Lynx lynx* reintroduction in Scotland

Bavin, D., MacPherson, J., Crowley, S.L. and McDonald, R.A. (2023) People and Nature 5(3), 950–967. <https://doi.org/10.1002/pan3.10465>

Understanding the social feasibility of a species' reintroduction is key to feasibility studies and the reintroduction's potential success. The debate over reintroducing lynx to Scotland has sparked diverse opinions, and this paper challenges the simplistic 'for and against' narrative often portrayed by the media. A survey gauged the sentiments of various stakeholders influencing Scottish environmental management which included non-governmental organisations and individuals. From the analysis methods used five distinct perspectives emerged. "Lynx for Change" advocated strongly, emphasising the ecological importance of top predators for ecosystem health. "Lynx for Economy" supported reintroduction, foreseeing tourism benefits for local economies. "Scotland is not Ready" expressed conditional support, feeling unprepared for lynx. "We are not Convinced" remained open to discussion but questioned the current strength of the case. "No to Lynx" strongly opposed, arguing that people had replaced lynx as top predators during their long absence. The different views focused on potential impacts on sheep farming, rural livelihoods, protected wildlife and the extent of human intervention in managing the environment. Despite a prevalent lack of trust among Scottish groups, there was consensus that collaborative efforts were crucial for constructive discourse. Recommendations highlighted equal consideration for the concerns of those affected by conservation initiatives alongside nature restoration objectives, aiming to foster trust and avoid conflicts between people and wildlife in the ongoing exploration of lynx reintroduction.

A horizon scan of issues affecting UK forest management within 50 years

Tew, E.R., Ambrose-Oji, B., Beatty, M. *et al.* (2022)

Forestry: An International Journal of Forest Research 2023, 1–14.
<https://doi.org/10.1093/forestry/cpad047>

With the current focus on the climate crisis and biodiversity emergency tree planting and woodland management are being seen as fundamental components of the UK's journey towards net zero and a more sustainable future. This multiple-author paper describes the results of an extensive investigation involving a diverse cross section of stakeholders who first identified 180 issues potentially affecting woodlands and then narrowing this long list to 15 priority themes. These ranged from the effects of environmental shocks and perturbations to changing political and socio-economic drivers, and the complex emerging interactions between them. The most highly ranked issue was “catastrophic forest ecosystem collapse”, reflecting not only agreement between stakeholders that such a collapse is a likely prospect but also acknowledging the potential implications for both the sector and wider society. These are included as a graphical abstract, a PowerPoint slide with each issue represented by an icon and is good to see the potential of Taskforce on Nature-related Financial Disclosures to drive transparency and investment in nature-positive management as number 8. The conclusion – perhaps unsurprisingly – is that the response must be a more adaptive approach to management, identified as a cross-cutting issue across all the themes, and that this must be synergistic and coherent involving landscape-scale planning. It ends with a call for this horizon-scanning exercise to promote debate and lead to action, specifically more research and evidence-based policy and practice. A thought-provoking article and an essential read for anyone involved in woodland management.

Toward conciliation in the habitat fragmentation and biodiversity debate

Valente, J.J., Gannon, D.G., Hightower, J. *et al.* (2023)

Landscape Ecology 38, 2717–2730.
<https://doi.org/10.1007/s10980-023-01708-9>

Ecologists, environmental managers and land use planning professionals make frequent reference to the importance of landscape-scale conservation planning, particularly in the context of the climate emergency and biodiversity crisis. However, these authors highlight that this strategy is hampered by disagreements over the effect of habitat fragmentation on biodiversity that originated in the 1970s, with the transfer island biogeographical theory to the terrestrial context. They argue that we in the ecology community should be responsible for helping to reconcile different views across scales, from patch to landscape systems, and methodological approaches to advance conservation planning within a landscape ecology framework. This requires the development of consistent guidance for landscape managers and policy makers, and in this article a set of principles are formulated, highlighting the need to identify potential reasons for the disparate conclusions in fragmentation research, and suggestions are made for research that would lead to consensus by developing and testing multiple competing hypotheses with research group collaborations and acknowledgement of multiple interacting factors to move the fragmentation debate forward.

This is a timely reminder that we practise on the basis of previous experience and research findings that have become the basis of guidance, policy and legislation. However, while we would probably call ourselves scientists, we sometimes forget that progress has always moved in fits and starts with stable periods of normality, punctuated by moments in which established theories are challenged, tested and debated. This is particularly important in the current context of the unprecedented speed of biophysical environmental change and the continuation of statutory focus on specific protected areas.



Penny holding her first wild beaver field sign find from UK!

How did you get into the sector?

By accident. When I graduated (in 1984) there were few openings in ecology. I did voluntary work before I landed a job based at Bristol University completing a national survey of badgers. I spent 5 years in a camper van travelling from Land's End to John O'Groats, which was brilliant, but I had to hand back the keys, eventually! By then, I'd figured what I loved most was doing surveys, so in 1990 I started The Badger Consultancy. Shortly after, I was introduced to Dave Lewns (whom I later married), and together we designed and built the first artificial setts to compensate for setts lost to development.

What does your current role involve?

After nearly 30 years running a small business, I joined AtkinsRéal to lead on the badger work on East-West Rail (re-opening a disused railway line). I found I loved being part of a large Ecology Team, and so stayed on! I work on a range of projects (road, rail, coastal realignments, etc.). My role tends to be as technical lead for mammals, so that involves helping colleagues to design surveys, interpret data, compile impact assessments and design mitigation strategies.

What is your favourite part of your current role?

The problem solving. I love it when I get a call which says: "I don't know if you're going to be able to help me, but..." I enjoy working with other professions: engineers who are prepared to consider novel approaches, or contractors who grasp the idea and start to make suggestions for how they can accommodate wildlife.

What is your least favourite part of your current role?

A closed mind – someone who has no interest in meeting me halfway.

Why did you join/get involved with CIEEM?

I joined CIEEM early on as I was keen to support the organisation, although, it took a while before I found the time to volunteer (two children and your own business is quite a lot of work). I became a trainer, then joined the Professional Standards Committee, and then stood as Vice President for Wales. And I will step into the President role in November. I find it very rewarding, a great way of networking/meeting like-minded people.

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

Capacity – having the right people with the right skills (and enough of them!).

Who is your hero and why?

David Attenborough, who else? His *Life on Earth* series was the backdrop to my A-levels. Then, one of my tutors at university – Pat Morris – introduced me to mammalogy and fieldwork. Once you've radio-tracked hedgehogs, there is no going back!

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

Getting people to recognise the value of nature, and grasp the urgency and universality of the biodiversity and climate change crises!

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

Join your local Wildlife Trust or special interest group (mammal, fungi, whatever). You'll find a wealth of people keen to pass on their skills. Some of the most knowledgeable people I have met were in local groups!

What is your favourite animal, plant, fungus, bacterium or archaeon?

I'd love to say something obscure, but it would have to be the badger – such an adaptable, determined mammal, with fascinating social behaviours.

What is your favourite thing to do outside of work?

Walking the dogs on a frosty day (looking for mammal signs!).

Can you tell readers something random about yourself?

Go to YouTube and search 'Big Breakfast Badger Gary Barlow' and you'll see an incredibly young Gary Barlow interviewing me, next to a hastily mocked up badger sett and a very reluctant occupant! The funniest part is that I had absolutely no idea who he was!

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Forthcoming Events

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

■ Conferences
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19 March CIEEM 2024 Spring Conference: Biodiversity Net Gain in Practice Online	20 & 21 March Intermediate QGIS for Ecologists and Environmental Practitioners Ireland	21 March Indicator Plants, Relationships and Habitats – beginners Online	16 April Breeding Bird Surveys and Checks Hereford
16 & 17 April Early Careers Training Programme (First module) Leeds	17 April CIEEM 2024 Irish Conference: Examining the Practical Impacts of Environmental Policy and Legislation on Ireland's Ecology Dublin	18 April Introduction to Habitat Survey and Mapping Ireland	24 April Plant Identification Scotland
24 & 25 April Developing Skills in Ecological Impact Assessment (EcIA) Ireland Dublin, Ireland	25 & 26 April Phase 1 Habitat Survey Scotland	25 & 26 April Plant Identification and Botanical Keys Online	26–29 April Water Vole Ecology and Surveys Online & Gloucestershire
29 April Bat Ecology and Survey Ireland	30 April Bat Impacts and Mitigation Ireland	01 & 02 May Introduction to National Vegetation Classification Scotland	15 & 22 May Introduction to Nature Conservation Legislation in the UK (England) Online
20 May QGIS for Biodiversity Net Gain Online	16 July CIEEM 2024 Summer Conference: Financing the Future: Using Green Finance to Drive Nature's Recovery Online	October TBC CIEEM 2024 Scotland Conference: Restoration Ecology In person, location TBC	27–28 November CIEEM 2024 Autumn Conference: Good Practice in Habitat Restoration Cardiff



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