



Issue 116 | June 2022

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Bulletin of the Chartered Institute of Ecology and Environmental Management

Using Beavers to Boost
Ecosystem Services on
Spains Hall Estate

Marine Nature-based
Solutions: Doing Better
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Editorial

Welcome

Nature-based solutions (NbS) work with nature to address societal problems to the benefit of people and the environment and are the theme of this issue of *In Practice*. NbS are used to address multiple major issues, the key ones being mitigating and adapting to the climate emergency, improving water quality and flood control, enhancing human health and well-being and, of course, tackling biodiversity losses. Enhanced ecosystems can be more resilient to climate change and provide demonstrable economic benefits.

NbS cannot solve societal problems alone, but they do provide additionality and can be much cheaper than standard hard engineering solutions. Novel approaches are emerging such as the Woodland Carbon Code and the Peatland Code, biodiversity and environmental net gain, and Morgan Taylor and colleagues' article (see p. 31 of this issue) proposes new financial drivers. New standards and practices are required for adaptation to climate change as illustrated by Gail Atkinson and colleagues for the new adaptation guide and framework for UK forests (p. 45).

Most of the habitat creation and restoration we undertake as ecologists and environmental managers can be classified as NbS, whether these projects involve reducing urban temperatures, slowing surface water flows and storm surges, sequestering carbon, increasing pollination or buffering sea-level change. Think of ecosystem services and how NbS can help restore, enhance and create habitats to support these crucial functions that benefit everyone, as Rachel Blount and colleagues' article demonstrates (p. 40). NbS can, usually simultaneously, support, improve, restore and extend complex ecosystem functioning, thus helping to tackle the biodiversity crisis.

All habitats have a role to play, as the articles in this issue show. However, they need to be the right solutions in the right places to be effective and to avoid unwanted side effects. This means careful spatial and project planning to deliver multiple benefits. NbS can improve habitats and their species, thus also increasing ecosystem robustness



Recycled plastic piling used to block a gully to rewet blanket peat, Peak District. Photo credit: Penny Anderson.

and quality (see Peter Robson's article on heathland creation, p. 35). However, the evidence base for NbS and their biodiversity and environmental benefits is incomplete. More data are required to inform others and support further application of the overall NbS approach.

Ann Skinner and colleagues (p. 20) and Karen Baxter (p. 15) demonstrate how many different ecosystem functions can benefit significantly from a single approach. Peatland restoration is such an approach that stops or reduces the significant loss of carbon from gullied or drained peat that is undergoing erosion. This applies to both upland or lowland areas, and especially those converted to agricultural land. Revegetating eroding ground and rewetting drying peat significantly reduces carbon losses, helps water quality by reducing dissolved organic carbon content, reduces flooding peaks downstream and is more resilient in the face of climate change, while also supporting active bog and its associated animal life. Joshua Styles and colleagues (p. 11) describe a valuable step towards restoring historic agricultural land derived from peat bog to active lowland peatland.

NbS can also have a range of functions within the maritime environment as described by Colin Scott and Suzanne Armstrong (p.49) and by Katie Medcalfe and colleagues (p. 53). Managed re-alignment creates intertidal habitats on low-lying land while simultaneously protecting adjacent land from flooding and sequestering significant amounts of carbon. There are massive opportunities for re-establishing seagrass beds (these have declined as rapidly as terrestrial hay meadows), which mop up more carbon, trap carbon-laden sediments and provide fish spawning grounds, provided the agents of their destruction

are controlled.

NbS need to be undertaken at scale to make a real difference. They build on the influential *Making Space for Nature* (Lawton 2010) that argues for coherent and resilient blue and green ecological networks extending across landscapes for wildlife to thrive again (see the article by Simon Bates, p. 26). NbS can be used to generate effective and economic ecological solutions in so many situations. Let's get on with developing and applying them, but don't forget to report the outcomes to expand the evidence base and encourage others.

**Penny Anderson CEcol FCIEEM (rtd)
and John Box CEcol CEnv FCIEEM (rtd)**

Members of CIEEM's
Action 2030 working group

Further sources of information


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Conference Dates For Your Calendar!

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For more information visit — www.cieem.net/events

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Cover photo: The mouth of the River Saône at Quiberville-sur-Mer in Normandy, France, from above. A campsite and sewage treatment works are being moved inland to allow the flood-plain of the river to be restored. For more, see page 15 of this issue. Photo credit: Conservatoire du littoral.

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Update to the Code of Conduct

CIEEM's *Code of Professional Conduct* and *Professional Conduct Inquiry Procedures* have been updated and the new versions are now available in the Resource Hub on the website.

Recent webinars

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

- Defra's Nature Green Paper and Environmental Targets
- Becoming a Chartered Ecologist
- An Overview of CIEEM's CPD Tool, MyCareerPath

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

Recent blog posts

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

- Restoring Nature at Scale via Biodiversity Net Gain – by Professor David Hill CBE CEnv FCIEEM and Emma Toovey MCIEEM
- The Right Tree in the Right Place? – by Dr Richard Birch CEcol MCIEEM
- The Fall and Rise of An Urban River – by Francis Hesketh CEnv MCIEEM
- Green Infrastructure and Blue Sky Thinking – by Francis Hesketh CEnv MCIEEM

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

In Practice digital editions

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

Staff changes

In February, **Gemma Monger** joined us as Membership Administrator. In March, **Louis Ormston** left CIEEM after a short time as Professional Development Coordinator (Training).

Krystie Hamilton has moved from Professional Development Coordinator (Conferences) to Professional Development Coordinator (Training), and **Jo Oliver** has moved from Professional Standards Administrator to Professional Development Coordinator (Conferences).

And in May we said goodbye to long-standing Finance Officer **Linda Redman**, who is off on a well-earned retirement.

At the time of writing, we are in the process of recruiting for several positions, including Professional Standards Administrator, Finance Officer, Professional Standards Manager and Head of Professional Practice.

Green Jobs Delivery Group

CIEEM has been invited to be a part of the UK's first ever dedicated group for creating UK green job opportunities, The Green Jobs Delivery Group. The group, co-chaired by Energy Minister Greg Hands, will support the delivery of up to 480,000 skilled green jobs by 2030. We are delighted to be a part of this action-focused group, particularly at a time when our sector is facing a capacity crisis, lacks meaningful diversity and equality of opportunity.

Employment and Salary Survey Published

CIEEM has published its 2022 Employment and Salary Survey for the ecology and environmental management sector. This triennial survey (postponed from 2021 due to Covid) provides a snapshot of how the sector is faring compared to the last survey in 2018. The report is available on our Resource Hub.

CIEEM Conferences 2022

Date	Title	Location
19 July	2022 Summer Conference: Facilitating nature's recovery through environmentally-friendly land management	Online
23–24 November	2022 Autumn Conference: Delivering a Nature Positive, Carbon Negative Future	Edinburgh

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

In Practice Themes and Deadlines

Edition	Theme	Article submission deadline
September 22	Bryophytes and Lichens	n/a
December 22	Non-themed (submissions welcome on any topic)	19 August 22
March 23	Rewilding, Habitat Restoration & Species Reintroductions	18 November 22
June 23	Invertebrates	17 February 23
September 23	Diversity, Accessibility & Capacity in the Sector	19 May 23
December 23	Non-themed (submissions welcome on any topic)	18 August 23

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/>

Defra publishes Nature Recovery Green Paper and draft Environment Act targets

In March, Defra published consultations on proposals for nature recovery and environmental targets. The framework for the latter was set out in the Environment Act 2021. The Nature Recovery Green Paper includes proposals for simplification of the protected sites network, statutory site improvement plans, stronger penalties for wildlife crime and ideas for a new Nature Recovery Network designation. We expect feedback from Defra soon, particularly on targets which must be laid in Parliament by this October. Defra also published a policy paper on action to tackle nutrient pollution.

<https://cieem.net/defra-publishes-underwhelming-nature-green-paper/>

IPCC issues latest warning in new assessment reports

The UN's Intergovernmental Panel on Climate Change (IPCC) has issued its latest assessments of the climate crisis, and the developments in emission reduction and mitigation efforts. The *Impacts, Adaptation and Vulnerability* report finds that around 40% of the world's population is "highly vulnerable" to the impacts of climate change, some losses are already irreversible and ecosystems are reaching the limits of their ability to adapt. The report does offer hope that the worst impacts can be averted if we act quickly. The *Climate Change 2022: Mitigation of Climate Change* report found we are not on track to limit warming to 1.5°C: projected emissions from existing and currently planned fossil fuel infrastructure will lead to warming up to 2°C.

<https://www.ipcc.ch/reports/>

NI Assembly approves new environmental provisions for Northern Ireland

The Environment (2021 Act) (Commencement and Saving Provision) Order (Northern Ireland) 2022 brings into force a range of environmental measures, including statutory duties on DAERA to publish an Environmental Improvement Plan and issue a policy statement on environmental principles, and the extension of the remit of the Office for Environmental Protection to include Northern Ireland. It was approved by the Northern Ireland Assembly on 22 February 2022.

<https://www.daera-ni.gov.uk/news/assembly-approves-new-environmental-provisions-northern-ireland>

Scottish Government publishes vision for sustainable and regenerative farming

Scottish Government has issued a statement setting out its vision for Scotland to become a global leader in sustainable and regenerative agriculture. Scottish Government will work with farmers, crofters and land managers to deliver biodiversity gain and outcomes focused measures which deliver wider benefits through nature restoration, integrating trees on farms, peatland restoration and land management.

<https://www.gov.scot/publications/next-step-delivering-vision-scotland-leader-sustainable-regenerative-farming/documents/>

Welsh Minister for Climate Change confirms deep dive into biodiversity

Minister for Climate Change, Julie James MS, has confirmed in Senedd committee questions that Welsh Government, in conjunction

with Natural Resources Wales, will be conducting a 'deep dive' into the impact on both the climate and the nature emergencies of all spending decisions by the Government. The 'deep dive' began this summer.

<https://record.senedd.wales/Committee/12573#C401594>

EU Parliament adopts environmental objectives until 2030

In March, MEPs endorsed the EU environment programme until 2030, which aims to accelerate the EU's transition to a climate-neutral, clean, circular and well-being economy. The Commission shall monitor, assess and report annually on the progress made by the EU and member states in meeting the priority objectives, which include protecting, preserving and restoring biodiversity.

<https://www.europarl.europa.eu/news/en/press-room/20220304IPR24804/parliament-adopts-eu-environmental-objectives-until-2030>

Landmark UN Environment Assembly adopts key decisions and restores hope on multilateralism

At the recent fifth session of the UN Environment Assembly, Member States adopted 14 resolutions, including to negotiate an international treaty to address plastic pollution and deciding on a multilaterally agreed definition of Nature-based Solutions. Another key resolution adopted calls for strengthening measures to achieve a sustainable, resilient and inclusive post COVID-19 recovery.

<https://www.iucn.org/news/secretariat/202203/landmark-un-environment-assembly-adopts-key-decisions-and-restores-hope-multilateralism>

Ecological Consultancy and the Law: A Case Study with Reference to a Seasonal Bat Swarming Site



Christopher Paul Bell
MCIEEM

Keywords: Bat Conservation Trust, Crown Prosecution Service, Natural England, Wildlife and Countryside Act

Seasonal swarming in late summer and early autumn is a critical component of the life cycle of many temperate bat species, disturbance of which is potentially harmful. The Wildlife and Countryside Act makes it an offence to disturb swarming bats if they are considered to be occupying a place used for shelter or protection, but current

guidance assumes that this applies only to roosts. If so, a single bat roosting under a tile has far greater legal protection from disturbance than the thousands that typically visit seasonal swarming sites.

As consultants, we are often required to interpret protected species legislation, and in doing so can walk a fine line between an over-precautionary approach that may be costly to clients

in both time and resources, and an over-permissive attitude that leaves us open to charges of professional misconduct. I recently faced this dilemma while consulting on a seasonal bat swarming site in a heritage building, in which a plan arose to hold an annual event involving the erection of large temporary structures in the building at the height of the swarming season.

To approve or assess?

I screened the event and advised that it could go ahead without further assessment, but then discovered to my dismay that the structures were present for much longer than I'd anticipated and that the bats' swarming behaviour was noticeably altered, in view of which I advised that a formal ecological assessment would be required before the event was repeated the following year. This advice was based on section 9(4)b of the Wildlife and Countryside Act 1981 (WACA), which in England

and Wales prohibits disturbance of a bat “while it is occupying a structure or place” used for shelter or protection, and on published guidance to the effect that such disturbance is illegal whether or not it is consequential (Natural England and Countryside Council for Wales 2007).

Having reversed what I perceived as a professional error, I thought nothing more of the matter until I received an e-mail from the building’s management, stating that they would not be requiring a formal assessment as they had been advised by Natural England that none was necessary. Knowing that they are not in the habit of providing advice on specific cases, I contacted Natural England to check whether they had made an exception on this occasion, and after making extensive internal enquiries they confirmed that no such advice had been given. I was therefore faced with a difficult choice. Do I walk away from the situation despite my own judgement that the law was likely to be broken when the next event was held, or report an offence against protected species legislation to the police?

Ask the experts

As a compromise, I raised the issue with the Bat Conservation Trust (BCT), which on learning the details of the case agreed with my judgement that a formal assessment was required. However, they declined to open an investigation on the grounds that bats swarming within a site cannot be said to be ‘occupying’ it and so are not covered by WACA 9(4)b. The BCT also cited problems interpreting the meaning of ‘disturbance’, and the fact that despite the oft-repeated counsel that disturbing bats is illegal, no one has ever been prosecuted for doing so.

From my perspective as a consultant, this response raised more questions than it answered. Surely a bat is occupying a built structure when flying within it for an extended period, and not just while roosting? If disturbance can’t be clearly defined, does it mean anything at all, and can laws that cite disturbance have any practical effect? Am I misleading clients when I say they might be prosecuted for disturbance if this has never happened in the 40 years this has been ostensibly illegal?

The BCT also mentioned that since the swarming site is a public building, the likelihood of habituation to disturbance could be cited as a defence. Leaving aside the fact that swarming occurs at night when the building is generally locked and empty, does this mean that if bats are being disturbed on a regular basis the party responsible is effectively immune from prosecution?

Having encountered these quandaries as a result of following their guidance, I thought it constructive to bring Natural England into the discussion, and so I broached the above issues at the 2020 BCT consultant’s forum. The Natural England delegate to the forum advised that he had no standing to comment, but that if the case were logged as a police incident then Natural England would be able to provide advice under their memorandum of understanding (National Wildlife Crime Unit 2015) with the police and Crown Prosecution Service (CPS).

I therefore submitted an incident report to the local police and began corresponding with the area’s lone part-time Wildlife Liaison Officer, requesting that they submit the incident report to Natural England and then transmit any advice received to the regional CPS Wildlife Lawyer for a decision on whether to take the case forward (see Oxford *et al.* 2020). Crucially, the incident report included two key questions raised by the BCT’s stance on the issue: first, should a swarming site be regarded as a place used for shelter or protection, and therefore covered by WACA 9(4)b, and, secondly, is evidence of altered behaviour sufficient to establish disturbance, and how can disturbance be proven more generally?

Natural England advised that obstruction of swarming flights should not be considered a disturbance under WACA 9(4)b since a structure hosting a swarming site is being ‘used’ for shelter or protection by bats only when they are at rest, and not while in flight. This has the same effect as the BCT’s opinion that swarming bats are not ‘occupying’ a site, since it entails that, where bats are concerned, only a roost can be occupied in the sense intended by the Act. So having already encountered doubts about the definitional basis of the BCT’s position, I now added

doubts concerning the biological basis of Natural England’s, since shelter and protection are surely among the selective factors underlying the resort to underground sites or built structures by gatherings of swarming bats, which would otherwise be exposed to both predators and the elements.

Implications

To this I added worries about the practical effect of Natural England’s position, which is to remove unconditional protection of bat swarming sites. This means that disturbance is an offence only if it satisfies the conditional criteria of the Habitat Regulations; that is, that it impairs survival or reproduction, or else affects local distribution and abundance. Given the accumulating evidence that swarming sites are a limiting resource of critical importance to the health of bat populations across wide areas (Parsons *et al.* 2003; Veith *et al.* 2004; Rivers *et al.* 2006; Glover and Altringham 2008; van Schaik *et al.* 2015; Stumpf *et al.* 2017; Nusová *et al.* 2020), this downgrading of their conservation status seemed ill-judged.

Of further concern was the fact that Natural England offered no response to the question of how to establish disturbance, which is confusing given Natural England’s endorsement of the *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM 2018). This document sets out clear criteria for such judgement by establishing a distinction between an ‘impact’, which is defined as an action resulting in a change to an ecological feature, and an ‘effect’, defined as the outcome to an ecological feature from an impact. An action causing a change in flight behaviour of bats within a swarming site over a period of several days is obviously an impact, but the effect is much harder and potentially impossible to determine, which is why WACA 9(4)b is important, since the effect is irrelevant to the commission of an offence.

Evidential hurdles

Following Natural England’s advice, the CPS decided to take no action. However, the reason cited was not the advice but failure to meet a requirement for

evidence from multiple independent surveyors. The evidence had included photographs of the temporary structures in place, as well as quantitative data indicating changed behaviour among the swarming bats, derived from both observation and remote acoustic monitoring, but all had been recorded by me alone. Nevertheless, I thought it worth invoking the CPS 'Victim's Right of Appeal' process to argue for the high quality of the evidence, since English law has never required multiple witnesses.

This proved impossible, however, since the police had not issued the case with a unique reference number, which is assigned when the case file is forwarded to the CPS. In fact, there was no case file, since there had only been phone conversations between the CPS and the police, contrary to CPS policy which emphasises the need for an audit trail when they respond to case-specific police enquiries (Crown Prosecution Service 2018). This is significant, since it had become clear that the police Wildlife Liaison Officer had no specific training and more than 6 months into the process admitted that they still did not understand what crime was being alleged.

Conclusions

There are some obvious lessons to be drawn regarding protected species legislation and the role of consultants in its interpretation. First, since it is a client's responsibility to decide on appropriate action following receipt of advice from a consultant, the latter has no explicit professional obligation to take any further action should the advice not be followed, and cannot be regarded as complicit in any breach of legislation by the client so long as their recommendations to the contrary are on record. Any semblance of guilt by omission can be removed by the simple expedient of reporting the matter to an appropriate conservation body, but if the consultant does choose to submit a police report it may be expedient to arrange a corroborating survey from a third party.

Secondly, it seems clear that seeking clarification on points of law from Natural England via their memorandum of understanding with the police is not a constructive methodology, since communication can only occur at the level of understanding of the police officer handling the case. The net outcome in many, or perhaps most, cases will therefore be to waste police time, not to mention that of Natural England and the consultant themselves. We as consultants are therefore on our own so far as interpretation of the law is concerned, in view of which CIEEM could usefully explore options to provide legal and professional advice to members, perhaps along the lines of the Business Shield service provided to pest controllers by the British Pest Control Association.

Finally, there is a need for a rebalancing of priorities for law enforcement in relation to bats. Every year thousands of owners of modest households are required to commission bat surveys because of the possibility that a few individuals of abundant bat species may be inconvenienced by extension or loft conversion work. Meanwhile swarming sites, which can attract tens of thousands of bats from areas covering thousands of square kilometres and support social and ecological functions that are vital at the population level, are barely recognised by the legal framework and produce bafflement and head scratching from statutory and conservation bodies. There is therefore an urgent need for comprehensive guidance on the treatment and management of swarming sites, whether this derives from CIEEM, the BCT or Natural England, but a good start would be for the latter to revise their current stance and recognise that bats both 'occupy' a structure while swarming within it, and use it for shelter and protection, thereby restoring the legal protection provided by WACA 9(4)b.

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Soil Stripping as a Novel Approach to Raised Bog Restoration: Implications for Habitat Surveyors and Biodiversity Net Gain

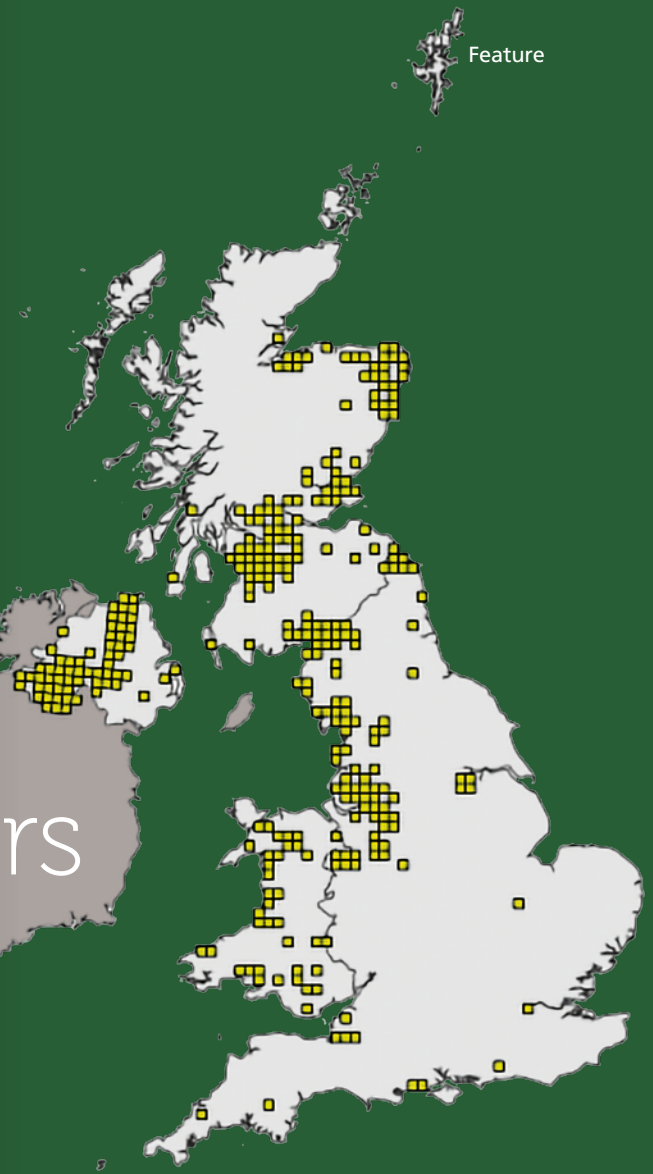
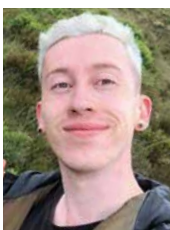


Figure 1. Distribution of raised bog in the UK. Each yellow square is a hectare (10 km x 10 km grid square). Reproduced with permission from the Joint Nature Conservation Committee.



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Keywords: Annex I, peatlands, restoration

Over 99% of English raised bogs have been significantly damaged or degraded in recent times. This article explores how soil stripping is being used as a restorative technique on agricultural land derived from active raised bog

across north west England, and its implications for approaches to habitat survey and Biodiversity Net Gain.

Introduction

Peatlands are incredible. They are our single best terrestrial carbon store, with more carbon held in them than in any other single vegetation type worldwide, while they are also host

to large numbers of specialist higher and lower plants, fungi and fauna (European Union 2016, IUCN 2021). However, despite their high importance in the context of the ongoing climate and biodiversity crises, peatlands are the most at-risk group of habitats in Europe, with 85% of peatlands types threatened to some degree across the continent. This includes raised bog (Figure 1), which is described as Endangered in the European Red List of Habitats following extensive decline

(European Union 2016). Across England, over 99% of our raised bog area has been significantly damaged, attributable to agricultural conversion, afforestation, commercial peat extraction and other major land-use changes (Joint Nature Conservation Committee 2008, Morris *et al.* 2010). Of these, agricultural conversion through drainage and chemical alteration of surface peat through lime and fertiliser application or addition of topsoil has caused the greatest damage, accounting for 40% of the area formerly occupied by pristine raised bog (Morris *et al.* 2010).

Figures released by the Centre for Ecology and Hydrology show that degraded peatlands emit over 20 million tonnes of carbon dioxide equivalents each year, equating to around 4% of the UK's annual greenhouse gas emissions (Evans *et al.* 2017). Improved awareness on climate and biodiversity issues, particularly associated with peatland degradation, have prompted initiatives including the recent Nature for Climate Fund, releasing £50 million for peatland conservation, while the Defra peat strategy and England Peat Action Plan also set out goals to restore UK peatlands. Traditionally, however, peatland restoration strategies for raised bogs are centred on non-agricultural sites, which often include employment of tree and shrub clearance, ditch blocking and bund creation to restore hydrology, sometimes followed by conservation translocations of key species to aid community recovery (Mackin *et al.* 2017).

Where areas of degraded raised bog are restorable, there are many implications to habitat surveyors. The *Interpretation Manual of EU Habitats* provides criteria for the Annex I habitat category H7120 (Degraded raised bogs still capable of natural regeneration) and includes all former areas of raised mire that, through hydrological and other rehabilitation management, are likely to re-establish vegetation with peat-forming capability within 30 years (European Commission 2013). Agricultural sites that might be restored to raised mire are also likely to qualify for priority and irreplaceable habitat status, which are material considerations for planning applications, while also being of significantly higher distinctiveness than arable cropland or modified grassland.

Although the characterisation of degraded raised bog in the field may have implications for development schemes, particularly when that characterisation may compromise a planning application, its presence may also be beneficial, particularly in the application of Biodiversity Net Gain. Where raised bog, a habitat of very high distinctiveness, has been heavily modified and is in poor condition, use of Defra's Biodiversity Metric 3.0 calculation tool shows that restoration of converted agricultural raised bog in poor condition into raised bog in moderate condition is able to deliver significant biodiversity benefits in the form of habitat units, dependent upon the scale of restoration.

This article presents two recent case studies, at two sites in north west England, that demonstrate the effectiveness of soil stripping as a restorative tool for raised bog (see Case studies 1 and 2). This presents a case for soil stripping as a novel approach to raised bog restoration.

Discussion

Although successful recovery of vegetation associated with bogs has now been recorded at a number of sites across the UK, published conservation evidence on the recovery of peat-forming vegetation on raised bog converted for agriculture remains scarce. The overall scarcity of published data presents a significant problem to field surveyors involved in the assessment of sites on deep peat, and for both peatland conservation more widely. At what point is it still possible to restore an agricultural field to functional peatland? When does a potato field or rye-grass pasture become an Annex I habitat of international-level importance?

To first see whether a site is on deep peat, a preliminary investigation of British Geological Society (BGS) data can freely be explored on Geology of Britain Viewer (<https://mapapps.bgs.ac.uk/geologyofbritain/home.html>), which gives detailed data on superficial deposits, including peat. Defra's MAGIC website (<https://magic.defra.gov.uk/MagicMap.aspx>) also shows maps of areas with peat soils, although this is generally less accurate than BGS data (JS, personal observation). To ground truth the desktop data, a soil auger may be used to explore the profile and

ascertain whether peat or other soils are present. Where this is not possible, further peat depth and chemical analysis survey data should be obtained if deleterious impacts from development are likely.

Where agricultural and other sites on deep peat stand to be impacted by schemes, it is essential to consider peatland restorability, which bears significance to ecological assessments. To explore restorability, it is critical to understand existing peat depths and the nutrient status of the underlying peat through peat soil analysis and peat depth survey.

Soil-stripped sites in north west England have all so far been successful with a minimum peat depth of 0.9 m. However, other sites in the region have had peat-forming species successfully recolonise where peat is shallower. This includes Little Woolden Moss in Greater Manchester, where peat depth stands at 0.5 m or less in places, which follows several decades of peat extraction. Average peat depths across much of Chat Moss in Greater Manchester, including agricultural sites, generally vary between 2 and 6 m (Tamburello 2018). This suggests that the overwhelming majority of agricultural land that is over deep peat in this area is likely to be restorable to functional raised bog given appropriate rehabilitation management and, therefore, that these areas are of very high conservation priority.

Whereas a limited range of literature currently exists on the restoration of deep peat on agricultural sites, restoration of raised bog over agricultural areas currently presents a largely unexplored avenue for the application of Biodiversity Net Gain and delivery of improved stocks of natural capital. Novel approaches to raised mire restoration are still being explored, and the outcomes of restorative techniques are being closely monitored across sites. It is hoped that data obtained from novel restorative techniques will be published shortly.

Conclusions

Soil stripping at New Moss Wood, Winmarleigh sheep fields and other, similar sites across north west England have proved to be highly effective in the recovery of species associated with peat formation on active raised mires.



Figure 2. New Moss Wood post turf stripping (September 2020). Photo credit: Lancashire Wildlife Trust.

Case study 1: New Moss Wood, Greater Manchester

New Moss Wood consists of an area of secondary woodland, currently under the ownership of the Woodland Trust. The woodland was planted over former arable agricultural land which overlies a shallow topsoil with an average depth of 0.3 m, with peat deposits below averaging 0.9 m depth. An open, unplanted area consisting of a highly modified grassland dominated by cock's-foot (*Dactylis glomerata*), Yorkshire-fog (*Holcus lanatus*) and cow parsley (*Anthriscus sylvestris*) was selected by Lancashire Wildlife Trust and Natural England for experimental soil stripping in early 2020; the habitat had not been an active raised bog for at least two centuries.

This area, which is 0.4 ha in extent, was stripped of approximately 0.3 m of topsoil in January 2020. Water-retaining bunds were installed using the stripped topsoil, and small-scale translocation of *Sphagnum* mosses, cottongrasses (*Eriophorum vaginatum* and *Eriophorum angustifolium*), cross-leaved heath (*Erica tetralix*) and other appropriate plants took place (Figure 2). The total cost for this work was £25,000, although this cost would have been proportionately less over a greater area.



Figure 3. New Moss Wood with abundant cottongrasses and *Sphagnum* mosses (December 2021). Photo credit: Joshua Styles.

Vegetation monitoring since the time of initial works found substantial increases in colonisation of *Sphagnum* mosses and cottongrasses which now cover most of the site (Figure 3). The site will continue to be monitored through regular hydrological, vegetation and peat depth monitoring by Lancashire Wildlife Trust. In this space of time the habitats have developed from a lowland



raised bog in poor condition to the same habitat in moderate condition. Using the Defra Biodiversity Metric 3.0 this change is capable of delivering up to 3.68 habitat units.

Case study 2: Winmarleigh sheep fields, Lancashire

The Winmarleigh sheep fields is an area extending over 8 ha, converted to improved sheep pasture from raised mire during the 1970s, and lies directly adjacent to the Winmarleigh Moss Site of Special Scientific Interest. The site was heavily drained, regularly limed and a mix of topsoil and artificial fertilisers added to the field at least twice yearly. The field was purchased by Lancashire Wildlife Trust in 2019 with restorative works beginning in January 2021, which came to a total cost of £80,000 and followed a series of surveys. These included a peat depth survey, which found deep peat deposits across the site extending to 2 m. Chemical analysis showed that enriched peat soil, which was the result of agricultural conversion, was confined primarily to the top 10 cm of the profile, with nutrient concentration and pH declining significantly below 30 cm deep.

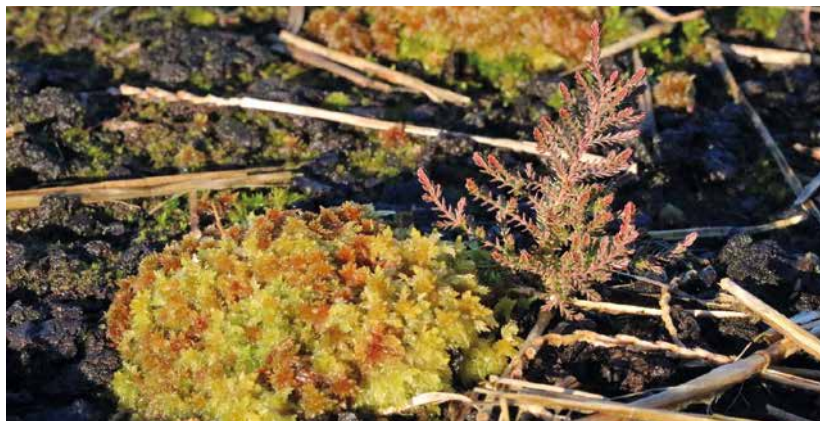


Figure 4. *Sphagnum* moss growth with natural heather regeneration, Winmarleigh sheep fields (December 2021). Photo credit: Joshua Styles.

Enriched topsoil was subsequently stripped to 10 cm depth, exposing bare peat. Following soil stripping, hydrological improvements were made, including irrigation channels and bunds which are intended to maintain optimum water levels. Over 80,000 plug plants of cottongrasses (*E. vaginatum* and *E. angustifolium*), *Sphagnum* and other plants appropriate for the site were planted to aid habitat and community restoration (Figure 4).

Since January 2021, monthly monitoring has shown significant and continued reductions in greenhouse gas emissions, while *Sphagnum* and other bog plants characteristic of local raised bogs have begun to colonise the site, with *Sphagnum* plugs increasing in area by over 500%. In this space of time the habitats have developed from a lowland raised bog in poor condition to the same habitat in moderate condition. Using the Biodiversity Metric 3.0 this change is capable of delivering up to 73.6 habitat units.

The effectiveness of soil stripping in conjunction with other restorative techniques further demonstrates that long-standing and otherwise species-poor agricultural sites have the capacity to qualify for a variety of conservation designations where peat deposits still exist.

Nationally, raised bog restoration continues to be an important nature-based solution that works to contribute to reductions in emissions, improving the state of biodiversity and the well-being of people through the provision of nature-rich green space. Meanwhile, peatland restoration prompted by Biodiversity Net Gain and funding released via the Defra Nature Recovery

Fund and other channels are providing additional drivers for peatland and nature recovery more widely.

Acknowledgements

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Anglo-French Cooperation to Create a Blueprint for Climate Change Adaptation



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Keywords: climate change adaptation, managed realignment

Promoting Adaptation to Changing Coasts (PACCo) is an Anglo-French climate change adaptation project working on managed realignment schemes at two sites: the Lower Otter Restoration Project in Devon and the Basse Saône: 2050 project in Normandy, France.

Teams behind the Promoting Adaptation to Changing Coasts (PACCo) project are thinking big. It is the first time that coastal managed realignment schemes have been coordinated in two countries with the aim of giving greater focus on what may be needed to tackle climate change. The project will create a 'how to' blueprint for others to follow.

Funding for the project

The scheme is led by the Environment Agency, and financed in large part by the European Regional Development Fund's Interreg France (Channel) England fund. The UK site is at Budleigh Salterton in Devon – the Lower Otter Restoration Project – while the French site is at Quiberville-sur-Mer in Normandy – the Basse Saône: 2050 project. After many years of planning, these two schemes joined forces in 2020 when Interreg offered funding towards the total cost of €26 million. Work at both sites will be complete in March 2023.

Why is PACCo needed?

Climate change is threatening to raise local sea levels by more than a metre



Figure 1. The Otter River estuary from above. Photo credit: KOR Communications.

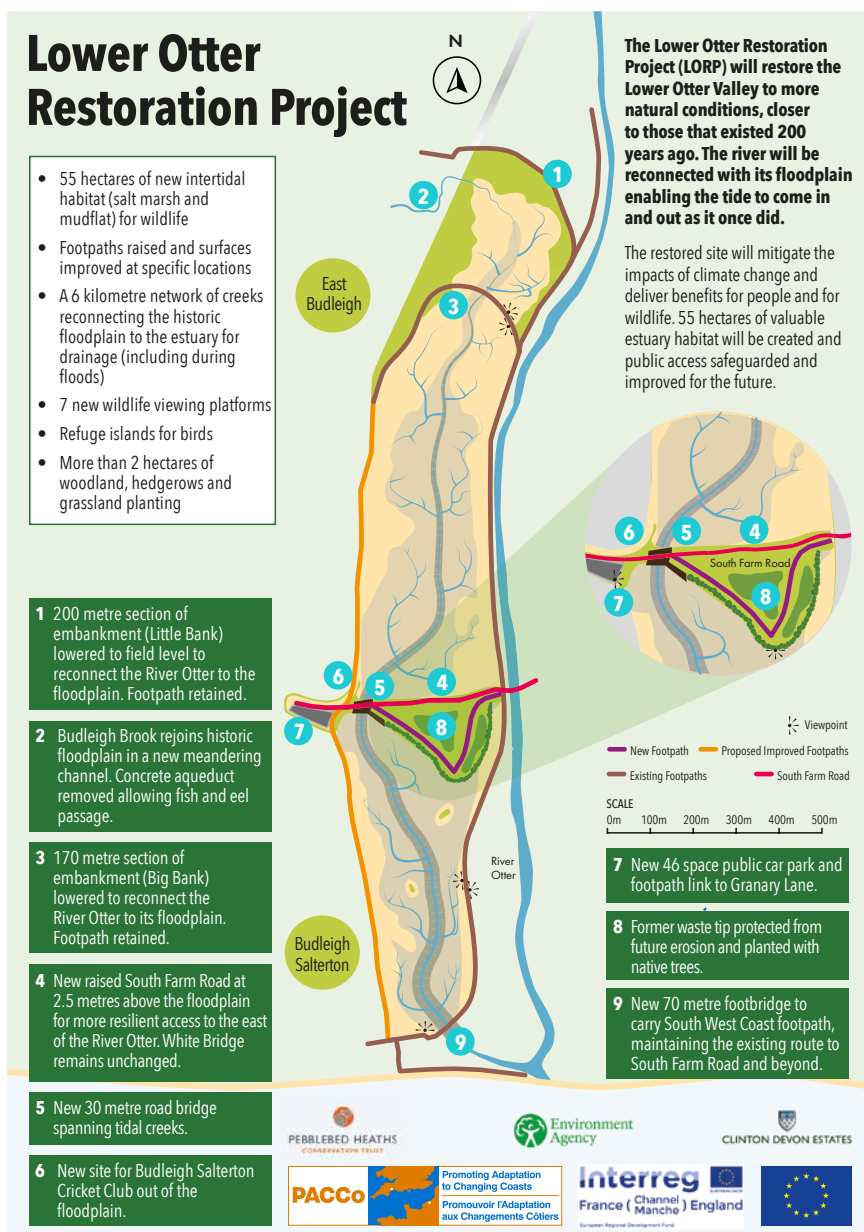


Figure 2. The PACCo Lower Otter Restoration Project in Budleigh Salterton, Devon.

during the next century and both of the PACCo sites are at risk from tidal flooding. In England, the Environment Agency is working in Budleigh Salterton with landowner Clinton Devon Estates whereas in France, the coastal management organisation Conservatoire du littoral is working with the local authority Terroir de Caux in Quiberville. Each partnership has developed solutions to meet their particular challenges and both sites settled on managed realignment schemes as the best way of adapting their valleys to climate change.

Both the lower Otter estuary and Basse Saône area have been subject to historic development that effectively cut the rivers off from their natural flood-plains. On the lower Otter River an embankment was built over 200 years ago reclaiming much of the original estuary for agriculture (see Figure 1), while on the River Saône a network of dykes was scoured out during the 18th century to achieve the same aim (see the cover of this issue). Since then, there has been further development on the original flood-plains:

- In Devon, a council waste tip operated on the land for 50 years up until the 1970s, a road was built across the valley and the local cricket club created its ground close to the mouth of the river with a clubhouse on site.
- In Normandy, a popular campsite was developed, along with a sewage treatment works that can no longer cope with the amount of waste it is taking in. Meanwhile, the River Saône pours into the sea through a concrete outlet pipe.

What will the projects achieve?

The two projects are doing more than just reconnecting the rivers with their original flood-plains. They both include major engineering and construction works.

In the lower Otter valley a road serving housing and commercial properties is currently at risk from tidal flooding. This will be raised, with a new road bridge built over creeks connecting new marshland areas (Figure 2). In addition, a 70 m wide breach will be cut through the existing embankment to allow the sea to reclaim over 50 ha of agricultural

“ Climate change is threatening to raise local sea levels by more than a metre during the next century and both of the PACCo sites are at risk from tidal flooding. ”

land, with a new footbridge maintaining the connection to the popular South West Coast Path that runs through the site. Across the flood-plain a series of creeks are being dug to ensure good drainage once the sea returns to the valley. The Budleigh Brook will be taken out of a concrete aqueduct and reconnected to the flood-plain through a meandering channel. The municipal tip represents an environmental liability and will be secured to prevent pollution leaching into the river. A combined sewer overflow pipe adjacent to a dynamic shingle bar, which is part of the Jurassic Coast World Heritage Site, will also be



Figure 3. In Devon, the new cricket ground with two pitches (right centre) and creeks (left) that were created during the project. Photo credit: Environment Agency.

diverted to a more sustainable location underground while Budleigh Salterton Cricket Club will be moved to a nearby higher location with no flood risk (see Figure 3).

In Quiberville, the campsite is being moved further inland (see Figure 4). In addition, a new sewage works with capacity to serve nearly nine times the population of the current one is

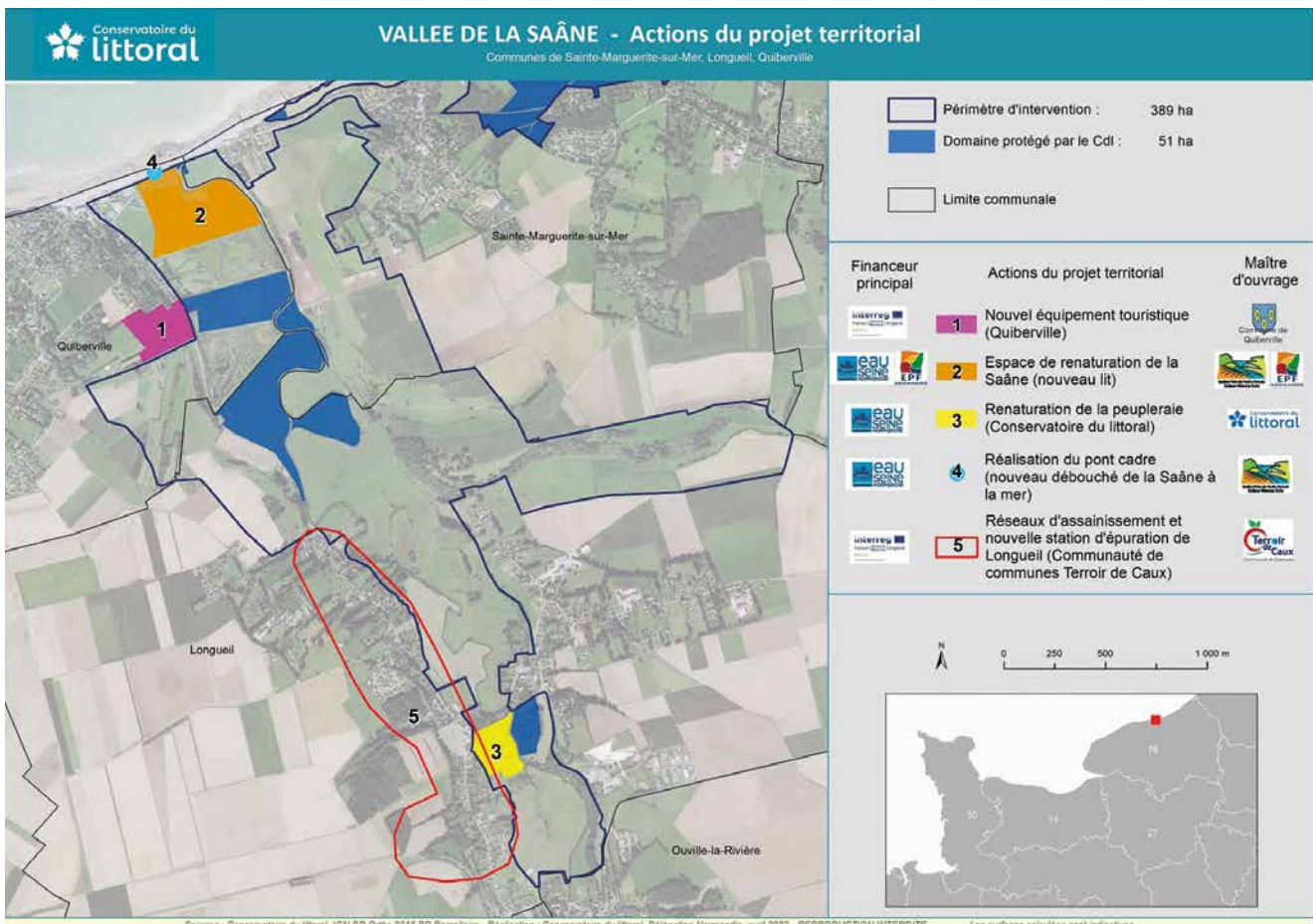


Figure 4. PACCo project in Quiberville-sur-Mer, Normandy, showing the moved campsite (1), recreated flood-plain (2), improved sewage treatment facilities (5) and original point where the River Saâne entered the sea through a concrete outlet pipe river (4).



Figure 5. In Quiberville, a new, much larger sewage works is being built. Photo credit: Conservatoire du littoral.

being built (see Figure 5). This brings improved bathing and environmental water quality in the area. The flood-plain is being recreated on the site of the old campsite.

A year from now, the two sites will look very different from today. Together, some 100 ha of mudflats and salt marshes will be restored, creating new habitats for wildlife and forming carbon sinks to add to the eco credentials of the project. Newly restored areas of salt marsh are estimated to have carbon sequestration rates of up to 3.81 tCO₂ per hectare each year (Stafford *et al.* 2021). The return of estuarine landscapes to the valleys will provide important nursery grounds for marine fish species including gobies (Gobiidae), thin-lipped mullet (*Liza ramada*) and

bass (*Opsariichthys uncirostris*). They will also support a rich marine invertebrate fauna which will in turn attract an abundance of birds, such as curlews (*Numenius arquata*), brent geese (*Branta bernicla*) and sandpipers (Scolopacidae).

“ The two sites will look very different a year from now. Some 100 ha of mudflats and salt marshes will be restored, creating new habitats for wildlife and forming carbon sinks to add to the eco credentials of the project. ”

Even though the schemes are still in development, there are some promising early signs that the sites will be appealing to birds. In autumn 2021 the new creek network developed in the lower Otter valley attracted the largest flock of European white-fronted geese (*Anser albifrons*) seen in Devon for over 30 years as well as significant numbers of green sandpiper (*Tringa ochropus*) and black-tailed godwit (*Limosa limosa*). Further successes will surely come as new tidal habitats develop.

Meeting challenges and boosting ecology

Change is not always welcome, and its necessity and worth is often difficult to communicate. This is true of the

“ The projects are doing more than just reconnecting the rivers with their original flood-plains. Both include major engineering and construction works. ”

lower Otter site, where generations of residents and visitors have enjoyed the familiar pastoral scene of fields, trees and hedgerows from the popular public footpaths. In particular, the removal of trees, hedges and vegetation has prompted concern. However, with the embankment close to failure there are only two scenarios for the Otter valley, with both involving the sea reclaiming agricultural areas whether society wishes to see it or not. One is a managed response to the risk while the second is reacting once a catastrophic breach occurs. Although hedgerows and trees have been removed, ultimately the Lower Otter Restoration Project will provide a net gain in these habitats with new plantings outside of the flood-plain. Any existing wildlife, which has included harvest mice (*Micromys minutus*), hazel dormice (*Muscardinus avellanarius*) and bats (Chiroptera), has been encouraged out of the area to be flooded through phased vegetation clearance at the appropriate season under licence, with a team of ecologists carrying out fingertip searches prior to any machine clearance. The Otter Meadows are also home to rare plants, including the divided sedge (*Carex divisa*). These are being translocated to sites well away from the area that will eventually become a tidal flood-plain.

Meanwhile, in France, although a sewage works might not seem a likely place for wildlife or visitor experiences, there are plans to provide an observation platform so that school parties may learn about the water cycle and the wildlife found on the site.

The mayor of Quiberville, Jean François Le Bloc, admits that he used to view concrete as the way to keep water at bay. He now believes that working with nature is the answer to reducing flood risk and encouraging biodiversity. This nature-based solution approach is also

being adopted by the Environment Agency when it seeks to reduce flood risk with the use of leaky dams in streams, for example. Leaky dams are increasingly used to slow water flows, mirroring the action of beavers.

The case for realignment

Why do realignment schemes matter? The historic development work along the lower Otter and the Saône – and other estuarine areas – have reaped economic and societal benefits over the centuries, but those benefits have come at a cost with natural estuarine habitats lost, rivers disconnected from their flood-plains and natural processes impacted. In addition, societal infrastructure in areas of high flood risk presents a very significant risk. With rising sea levels, the threat of flooding will become ever more likely. The Quiberville campsite area has flooded on a number of occasions, with the area especially badly hit in 1999, as have the agricultural fields, cricket club, road and municipal tip at Budleigh Salterton. In 2018 and 2021 the existing embankment was close to being breached; sea ingress into the valley is inevitable. By accepting this and managing the process it is possible to maximise societal and wildlife benefits while minimising the risks.

Legacy of the project

There are coastal communities throughout the world facing similar challenges to the Saône and Otter valleys. A key element of the PACCo project is the creation of a 'how to' guide that can be used to decide whether adaptation is appropriate in a specific coastal area and, if so, how to proceed. Over 70 places in southern England and northern France might benefit from considering a managed realignment approach.

“The legacy of the projects in the Saône and Otter valleys will be very visible and long-lasting,” said Dr Lydia Burgess-Gamble, Environment Agency lead for PACCo. “For other communities, not only in those 70 places, but anywhere in the world, the PACCo legacy will be an online blueprint, covering everything from the practicalities of managed realignment schemes, to finding finance and the necessary

communications and engagement, that will help them assess whether this is the right approach for them.”

The threats of climate change to coastal communities, including sea level rise, are very real. Adaptation can be complex and costly, involving intricate problem solving and is not always immediately welcomed by the local population. Two estuaries that for generations have been lush and green will be transformed into valuable intertidal habitats. Without either of these proactive projects the land will, at some point, return to marshland, but in an uncontrolled manner that could have negative consequences for people and wildlife. This is because the sea will simply reclaim the land it once covered. By managing the realignment in a controlled way, the changes will be sustainable, creating a new landscape for future generations to use and enjoy.

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Flood-plain Meadows: An Entirely Sustainable Nature-based Solution that is Centuries Old

Figure 1. Flood-plain meadows support a vibrant plant community with up to 40 species of plants/m², including rare and uncommon species such as snakeshead fritillary (*Fritillaria meleagris*), narrow-leaved water-dropwort (*Oenanthe silaifolia*) and great burnet (*Sanguisorba officinalis*). Photo credit: Mike Dodd.



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3000 ha in England and Wales. Their loss has had wide-ranging consequences, exacerbating the impacts of climate change and removing substantial carbon reserves and an important buffer for rivers against diffuse agricultural pollution. This article explains why flood-plain meadows are a particularly elegant nature-

Keywords: climate change, ecosystem services, NBS, nature recovery network

Widespread in river valleys, species-rich flood-plain meadows were overwhelmingly converted to intensive agriculture or urban development during the 20th century, leaving just

based solution to the climate and biodiversity crises, and details how we can work together to restore them as a core component of an effective nature recovery network that also sustains productive regenerative agriculture.

Flood-plain meadows and the Partnership

Flood-plains of high nature value that support habitats such as species-rich hay meadows are a vital element of UK natural capital. Unmodified, they support a healthy freshwater environment and provide many goods and services, helping to mitigate flood risk and drought, store carbon, reduce sediment and nutrient loadings in rivers, conserve biodiversity and cultural heritage, support pollinating insects and provide inspirational places for people.

Flood-plain meadows were highly prized for centuries because river

sediments deposited during floods provided natural fertiliser and stimulating early grass growth. The diverse grasses and herbs rendered the hay of particularly high nutritional quality, vital as winter feed for livestock on which transport, agriculture and local communities were dependent.

The Floodplain Meadows Partnership (FMP; Rothero *et al.* 2021) was established in 2006 by the Open University in association with statutory agencies and non-governmental organisations. The FMP focuses on turning research into best practice management advice, influencing policy and raising awareness through advocacy. Key environmental issues are investigated through long-term experiments and observation. The resulting information is disseminated through training, workshops, publications and conferences. The Partnership promotes the recovery of at least 70,000 ha of species-rich flood-plain meadow for multiple benefits; its website details restoration, creation and management techniques.

A rare habitat

Once occurring at a landscape scale, the meadow foxtail/great burnet (*Alopecurus pratensis/Sanguisorba officinalis*) flood-plain-meadow plant community (National Vegetation Classification MG4; Rodwell 1992) is now extremely rare and mostly found in small sites of <10 ha. Stands are largely restricted to lowland river flood-plains in England, where little more than 1500 ha remains (Holmes *et al.* 2005), with less than 10 ha recorded in Wales (Figure 2).

Where summer water tables are higher, for example on groundwater-fed systems, MG4 is replaced by crested dog's tail/marsh marigold (*Cynosurus cristatus/Caltha palustris*) grassland (MG8). Many sites support a mosaic of other wet grassland plant communities.

As dynamic semi-natural systems, species-rich flood-plain meadows lose their biological diversity through application of agrochemicals, lack of cutting and/or prolonged waterlogging caused by neglect of surface drainage infrastructure. All remaining examples of ancient flood-plain meadows and successfully restored sites should therefore be conserved and managed to ensure they are in the best possible condition and can provide sources of seed for the future.

Unintended consequences of loss

Extensively altered by river engineering and land drainage, at least 42% all flood-plains in England have been separated from their river (Maltby *et al.* 2011), no longer able to store, clean and distribute water across the landscape. The impacts are becoming increasingly apparent as climate change bites – with winter rainfall and flooding predicted to increase, and reduced summer rainfall leading to drought. A step change in the way flood-plains are managed is urgently needed to help society adapt and become more resilient to climatic extremes. Just 14% of English rivers currently meet the criteria for good ecological status (Bevan 2020), primarily because of physical alterations and diffuse pollution from agriculture. Nearly 70% of flood-plain land is intensively managed (Heritage and Entwistle 2017) whereas semi-natural habitats such as flower-rich meadows

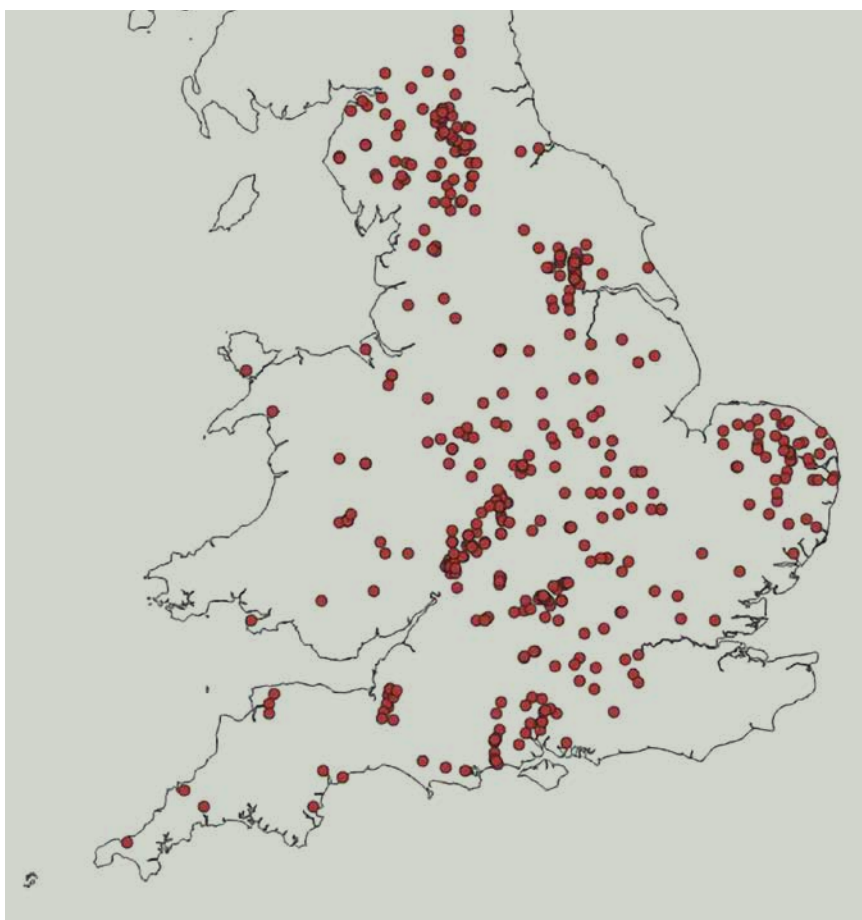


Figure 2. Known flood-plain meadows in England and Wales.

and wet woodland occupy a mere 11%. The loss of these protective flood-plain habitats makes the Government's 25-year Environment Plan target for 75% of waters to be close to their natural state extremely difficult to achieve.

The benefits of flood-plain meadows today

Flood-plain meadows, developed during an age when soil fertility was difficult to build and maintain, were considered to be the most valuable agricultural land. Some might argue that, despite their beauty, diversity and intrinsic value, they are essentially an historical anachronism with little role to play in modern day socio-economics. However, there is growing recognition of the contribution flood-plain meadows can make to both the climate and biodiversity crises, and increasing evidence for the many benefits they provide. A review concluded that the overall benefits provided by seasonally inundated flood-plain meadows are greater than those provided by land in intensive agriculture (Lawson *et al.* 2018).

Carbon storage

Regular replenishment during floods ensures flood-plain soils are constantly accreting and maintain their fertility, in stark contrast to the widespread compaction and erosion found in most lowland agricultural landscapes. Three to five times more carbon is stored in soils than in vegetation such as trees (Anderson 2021). The deep rooting strategies of meadow plants (Figure 3) enhance the ability of flood-plain soils to sequester and securely store significant quantities of carbon throughout the soil profile.

Organic carbon within the top 10 cm of soil at North Meadow in Wiltshire was recorded as 109 tC·ha⁻¹ (Lawson *et al.* 2018), a much higher value than reported for neutral grasslands in Gregg *et al.* (2021). Recently published research (Yang *et al.* 2019) showed that higher species richness increases the sequestration rate in grasslands. Carbon sequestration in a newly restored flood-plain meadow occurs more rapidly and over a much larger scale than is likely to be achieved through tree planting (Figure 4) and the land can continue to be farmed, which

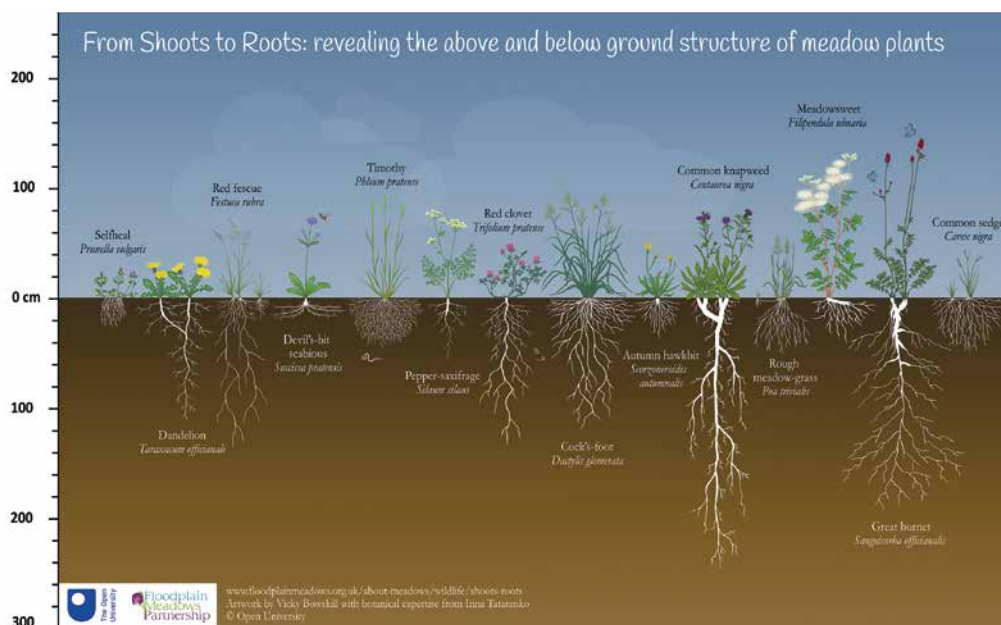


Figure 3. Rooting depth of meadow plant species reflects the depth of carbon distribution down the soil profile. Reproduced from Bowskill and Tatarenko (2020) under CC BY-NC-SA 2.0 UK. © Open University.

many landowners would prefer. Newly planted trees can actually liberate carbon through soil disturbance and may not begin to sequester net carbon for 10–30 years (Anderson 2021). These facts are at odds with the current widespread focus on tree planting rather than grassland restoration.

Natural flood management and aquifer recharge

The increased likelihood of extreme events makes it vital that the ability of flood-plains to slow, store and filter floodwater is restored so they can play a critical role in natural flood management. The enormous potential

for river and flood-plain meadow restoration as nature-based solutions to both floods and drought is recognised in the *Working with Natural Processes* documents (Environment Agency 2021), but rarely utilised. Flood-plain soils tend to be highly permeable, often with underlying deposits of sand and gravel, allowing water to replenish the aquifers below and support low summer river flows, buffering rivers against drought.

Conversely, because seasonally inundated flood-plain soils are very vulnerable to compaction when wet, and to erosion when left bare over winter, arable crops such as maize are particularly damaging in flood-plains.

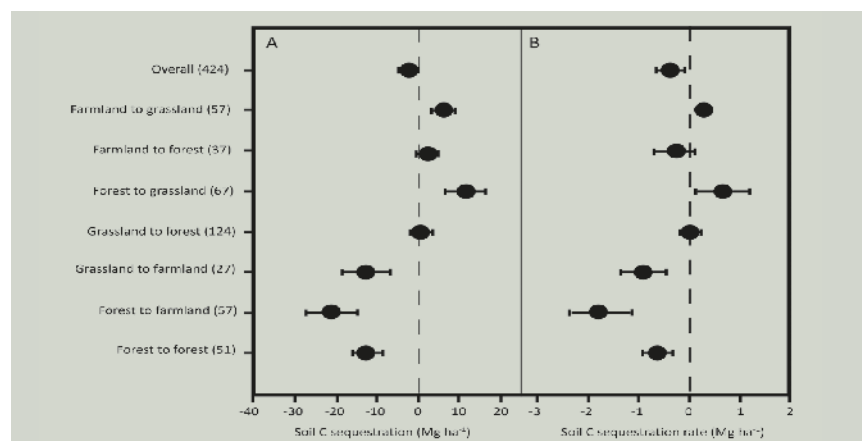


Figure 4. The effects of land-use change on soil carbon sequestration (A) and soil carbon sequestration rate (B) from a meta-analysis of independent studies, which considered change over a range of timescales, in many cases for >30 years. Circles with error bars denote overall mean values and 95% confidence intervals, with numbers of observations in parentheses. Reproduced from Deng *et al.* (2016) under CC BY 4.0 with permission from Elsevier.

“ Restoring flood-plain meadows, for example by replacing arable crops, can directly reduce inputs of pollution in the form of suspended sediment and excess nutrients that arise from intensive agriculture. ”

Water quality benefits

Widespread diffuse pollution from intensive agriculture results in many rivers having artificially high levels of suspended sediment and excess nutrients. Restoring flood-plain meadows, for example by replacing arable crops, can directly reduce inputs of both. Up to 40 t of sediment per hectare were deposited after the 2007 summer floods on 10 UK flood-plain meadow sites across five catchments. The deposition of nutrients on flood-plain meadows across England was also significant, varying from 2 to 270 kg·ha⁻¹ for potassium and 1–32 kg·ha⁻¹ of phosphorus (Rothero *et al.* 2016).

The ability of flood-plain meadows to trap sediments and export nutrients such as phosphorus through the annual hay cut is vitally important to the restoration of good ecological status to rivers. A single hectare of meadow can export 5 kg of elemental phosphorus from a river system every year, highlighting their potential as a nature-based solution to eutrophication (Rothero *et al.* 2016).

Sustainable agriculture

Restoration of species-rich flood-plain meadows at a landscape scale could help in the drive to achieve net zero, support the green economy and provide jobs by extending a naturally regenerative agricultural system that requires no chemical inputs yet recovers well after floods and remains productive during droughts. The animals that graze such meadows and consume the hay require less imported feed, have better nutrition and therefore produce healthier meat for human consumption (Shellswell 2017).

Biodiversity

The biodiversity of flood-plain meadows has been well documented (Rothero *et al.* 2016; Figure 1). They support a wide range of flowering plants and invertebrates, providing vital nectar for significant populations of pollinating insects. They are important for small mammals, wading birds, amphibians and reptiles, and their abundant natural predators may help to combat the threat of new pest species as the climate warms.

Other values

Flood-plain meadows are iconic landscapes of significant historic, cultural and aesthetic importance, often close to towns and cities (Figure 5). Well used and much loved, they are a vital resource for improving physical and mental health and well-being through quiet recreation and contact with nature. This was highlighted during the current pandemic and in the Partnership's recent arts and crafts competition, a particularly powerful



Figure 5. Oxford meadows in flood. Photo credit: Mike Dodd.

way for engaging with local communities. View some of the diverse entries at <https://tinyurl.com/y5zdpzt>.

Working together to promote, co-design and co-fund restoration schemes

Flood-plains occupy around 5% of the UK (652,000 ha), offering huge opportunities for conservation professionals to restore a functioning mosaic of wetland habitats. Flood-plain meadows are cost-effective to restore using green hay and low cost to maintain, providing productive grassland that protects and enhances soil and buffers watercourses. A substantial increase in extent is needed as part of the UK's strategy to restore resilient landscapes.

Many organisations and individuals have a part to play. Wide-ranging policy mechanisms and funding opportunities include:

- reduction of greenhouse gas emissions and natural disasters
- reduction of diffuse pollution
- more sustainable, regenerative agriculture: working towards net zero
- nature recovery network and providing Biodiversity Net Gain through development.

“ Working effectively together, and through strategic plans such as Local Nature Recovery Strategies, is vital to ensure the right habitats are restored or created in the best places. ”

Species-rich flood-plain meadows can help to achieve all these objectives at the same time. The new Environmental Land Management Scheme will provide the main source of funding for habitat restoration. The extent to which this will support multiple farmers in discrete landscapes like flood-plains is not yet clear. Groups of farmers with flood-plain land should be encouraged to take up appropriate Sustainable Farming Initiative measures, Local Nature Recovery options, and long-term land use change through the Landscape Recovery scheme. Farmer facilitation groups can help focus restoration on discrete areas and specific habitats; where backed by funding and a long-term commitment, an increase in flood-plain meadows could bring about sustainable and measurable change.

Working effectively together, and through strategic plans such as Local Nature Recovery Strategies (LNRS), is

vital to ensure the right habitats are restored or created in the best places. Achieving the optimum balance will require careful planning to avoid conflicts between, for example, food production, government tree planting targets and the drive to establish more riparian woodland.

Biodiversity off-setting, carbon and nutrient trading are new and largely unregulated markets. The data used are not comprehensive, partly because of the lack of empirical evidence of values for different habitats and current schemes do not adequately reflect the long-term contribution that flood-plain meadows can make (Figure 6).

What you can do to help

All conservation professionals can look for opportunities to restore functional flood-plain habitats, identifying rivers and their flood-plains as a core component of LNRS or restoring them as Biodiversity Net Gain associated with development. Working with farming cluster groups and catchment management partnerships is another very effective way of developing projects that deliver change.

The FMP is keen to work with partners on local projects and liaise with farmer



Figure 6. The restoration of flood-plain meadows at a landscape scale is far more effective than using thin riparian strips (Sawatzky and Fahrig 2019). Photo credit: Emma Rothero.

groups and land managers working in flood-plains. Local groups are supported with guidance and training, helping them investigate flood-plain history and undertake long-term monitoring, management and restoration using a range of methods. Local advice can be provided through FMP Ambassadors, a network of experienced practitioners and volunteers available to support projects and share advice in their local area (see *Where to find out more*).

Conclusions

Land use in flood-plains needs to be optimised so they can once again slow, store and filter the flow of water from the land. Functioning flood-plain meadows are a cost-effective nature-based solution that can help reduce flood risk and diffuse pollution, halt and reverse the loss of biodiversity, store carbon securely at volume and significantly benefit local communities. As flood-plains occupy just 5% of the UK's land area, targeted investment in restoration would give integrated outcomes and massive financial savings and gains for society as a whole. We know what to do, where and how to do it: now we need to ensure the various targets, strategies and funding mechanisms to enable our skilled professionals and land managers to restore and re-create this amazing and supremely pragmatic land use at a landscape scale.

Where to find out more

The FMP website (www.floodplainmeadows.org.uk) gives access to the handbook, research outputs, newsletters and details of the Ambassador scheme.

YouTube recordings from the 2021 conference are available at: www.youtube.com/watch?v=UPHWdNC AAWI&list=PLQdkll7Mtm 6N9hZWGuGZ xnmTNTMVw24UN &index=1

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Clyst Canopy: A Local Test of CIEEM Carbon-offsetting Principles

Figure 1. Aerial view of the Clyst Valley 2019 with Cranbrook top, Ashclyst Forest top right, Percy Wakley Woodland Trust middle left and the Whimble orchards lower right. Photo credit: Still Imaging.



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Keywords: carbon offset, habitat management, woodland

East Devon District Council has an ambitious target for tree cover in the Clyst Valley, just east of Exeter, Devon. A grant has been secured through the Natural Environment Investment Readiness Fund to establish whether private investment can be stacked alongside Woodland Carbon and Biodiversity Net Gain

credits to reach a financial tipping point and persuade landowners to convert from crops and livestock to trees. In this article I explore whether this can be achieved while upholding the CIEEM carbon-offsetting principles.

Local context

Exeter and the 'west end' of East Devon is experiencing considerable growth. Working across boundaries,

local authorities generated a Green Infrastructure strategy which first set out the concept of a Regional Park, a major green/blue space centred on the flood-plain and river of the Clyst (Figure 1). East Devon's Local Plan safeguards land for this park that is equivalent to half the size of Exeter.

All the land is in private ownership, so landowners must be persuaded to change land use practices, leading to "more, bigger, better and joined up" priority habitat as advocated in *Making Space for Nature* (Lawton *et al.* 2010). The 25 year Clyst Valley Regional Park master plan guides the work of partners and won the 2021 south west regional Royal Town Planning Institute award for planning excellence.

The Clyst Valley is characterised by much pastoral land grazed predominantly by dairy cattle. The river itself is little more than a stream for most of its length, but floods on to extensive plains south of Broadclyst before entering the Exe

Estuary Special Protection Area at Topsham. Woodland cover presently stands at 9%, well below the UK average of 12%. The most substantial block is Ashclyst Forest, created in the 19th century. Much of the National Trust Killerton estate is within the Regional Park and supports an impressive 1200 ancient and veteran trees in parklands, fields and hedgerows.

Projects underway

Drawing on Green Recovery Funds, the National Trust has an exciting programme of habitat creation and restoration underway: 18 ha of woodland and 40 ha of wood pasture creation, recreating 4 km of lost hedges, establishing 5 ha of agroforestry and river restoration on the River Culm (the latter is funded through Interreg). Using Heritage Lottery funds, between 2017 and 2019, East Devon District Council (EDDC) ran its Great Trees project, resulting in 1.5 ha of new woodland planting, 5 ha of parkland restoration and the creation of two new orchards and 100 m of new hedgerow. More than 300 trees were added to the Ancient Tree Inventory by volunteers, including one oak estimated



Figure 2. Volunteers learning how to record ancient and veteran trees for the Woodland Trust's inventory. Photo credit: Jenny Steer.

to be 700 years old, situated on an old parish road (Figure 2).

However, it was after watching the last episode of *A Perfect Planet*, Sir David Attenborough's latest BBC film, that the author decided to re-treble efforts to tackle the twin climate and nature emergency. Among partners there was agreement that an ambitious long-term

target for 30% tree cover in the Clyst Valley was achievable. We are beginning to hear a softening of attitude towards nature conservation from some dairy farmers. In large part this is due to Arla Food's policy that 10% of land on farms supplying milk to its cooperative should be managed for biodiversity.



Figure 3. The upper Clyst valley landscape at Whimble, with traditional orchards and hedgerow trees in between pastoral meadows. Photo credit: Simon Bates.

Clyst Canopy: a project to deliver 30% tree cover

EDDC led a successful bid to the Natural Environment Investment Readiness Fund, a programme designed to scale up private investment in nature. Our goal is to explore whether an Environmental Impact Bond (EIB) can deliver green infrastructure. An EIB is a mechanism for raising up-front capital that provides a financial, social *and environmental* return on investment. In our project, we're mostly interested in creation of riparian woodland habitat, the associated improvements in water quality and the demonstrable health benefits accruing from public access. However, our first milestone is to calculate the revenue that would be required to persuade farmers to convert land to trees, the so-called tipping point. Can this be achieved by blending cash from publicly funded grant schemes with private finance from Woodland Carbon and Biodiversity Net Gain credits, and additional capital for public goods?

The CIEEM principles for carbon offsetting

The CIEEM principles for carbon offsetting were developed to guide CIEEM's own selection of offsetting projects and to take account of PAS 2060 (the international standard for the quantification, reduction and offsetting of greenhouse gas emissions), the Oxford Offsetting Principles and the recent Environment Agency review of offsetting approaches. How does the Clyst Canopy project potentially stack up against all of the CIEEM principles?

Principle 1: Additional – it is fundamental that offsetting funds do not pay for work that would have happened anyway

There is no problem here: the land is in private hands and without our intervention is likely to remain in productive agricultural enterprises. However, in order to claim a carbon offset credit it is essential to demonstrate that the greenhouse gas reductions would *not* have occurred in the absence of a market for offset credits (see www.offsetguide.org/high-quality-offsets/additionality/). Specifically, for the Woodland Carbon Code (WCC), at least 15% of the project costs must comprise Woodland Carbon Units.

“ By focusing woodland creation in the riparian and flood-plain zone we should see an improvement in water quality, as suspended sediment is prevented from reaching and causing pollution of the watercourses. ”

Principle 2: Verifiable – verification and certification of the CO₂ offsetting in a transparent and accountable process

The WCC is the voluntary standard for UK woodland creation projects and is accredited by the International Carbon Reduction and Offset Alliance (ICROA). Independent validation and verification to this standard provides assurance and clarity about the carbon savings of these sustainably managed woodlands where there is a permanent land-use change to woodland. A Woodland Carbon Unit is a tonne of CO₂ that has been sequestered in a WCC-verified woodland.

Principle 3: Remove CO₂ from the atmosphere – nature-based solutions that create new habitats and restore existing habitats and ecosystems that will help to address the biodiversity crisis and deliver ecosystem services

The 30% canopy goal is to be achieved through (1) ensuring our existing old growth trees are in sustainable management, (2) new woodland planting and natural regeneration, (3) wood pasture/parkland restoration, (4) shelterbelt/hedges and (5) agro-forestry.

Clyst means 'clear water' in Old English, but sadly the River Clyst often runs red with soil from the catchment. The Environment Agency has assessed that water bodies within the catchment are currently failing to meet Good Ecological Status/Potential under the Water Environment (WFD) Regulations 2017. The whole of the catchment is covered by a Nitrate Vulnerable Zone because the permeable soils do not protect the underlying aquifer from nitrate pollution. By focusing woodland creation in the riparian and flood-plain zone we should see an improvement in water quality, as suspended sediment is prevented from reaching and

causing pollution of the watercourses. Woodland buffer strips need to be a minimum of 12 m wide (Environment Agency 2020). Once settled, the soil-associated fungi and bacteria help to safely lock up nitrates and phosphate, agricultural chemicals and hydrocarbons, thereby stopping them entering the watercourse.

Principle 4: Permanent – the CO₂ removed from the atmosphere should not be released in the future except through natural processes

Although our priority is to deliver new broadleaved woodland through natural regeneration, much will need to be managed. Do we have a problem here?

Harvesting timber is essential in the fight to reduce our greenhouse gas emissions. The UK 6th Carbon budget highlights that twice as much land would need to be afforested if we do not use the timber to replace carbon-heavy building materials. Timber could be in use for generations, ensuring that the carbon is locked up more permanently than if it is left to decay. Faster-growing species sequester carbon sooner, and time is a luxury we no longer have.

Our most valuable ancient woodlands have been managed, and lack of management is a cause of condition failures, giving rise to dense shade, poor herb layers and inadequate recruitment of trees and shrubs. Some habitats have a long history of regular and routine management by humans, often with domestic animals, for example woodlands, hedges, grasslands, heathlands, reed swamps and ponds. Such habitat management is as much a natural process that disrupts part of an ecosystem as a major storm creating a swathe of felled trees in a woodland (such as the great storm of 1987), a major flood covering riverine meadows in silts, a frontal sand dune system being remodelled by a severe storm or an infestation by an insect such as heather beetle or a disease like ash dieback.

The intention of this principle is to exclude projects that would result in a permanent loss of sequestered carbon, for example the conversion of permanent grassland to arable or built development. The intention is not to exclude those habitats that are

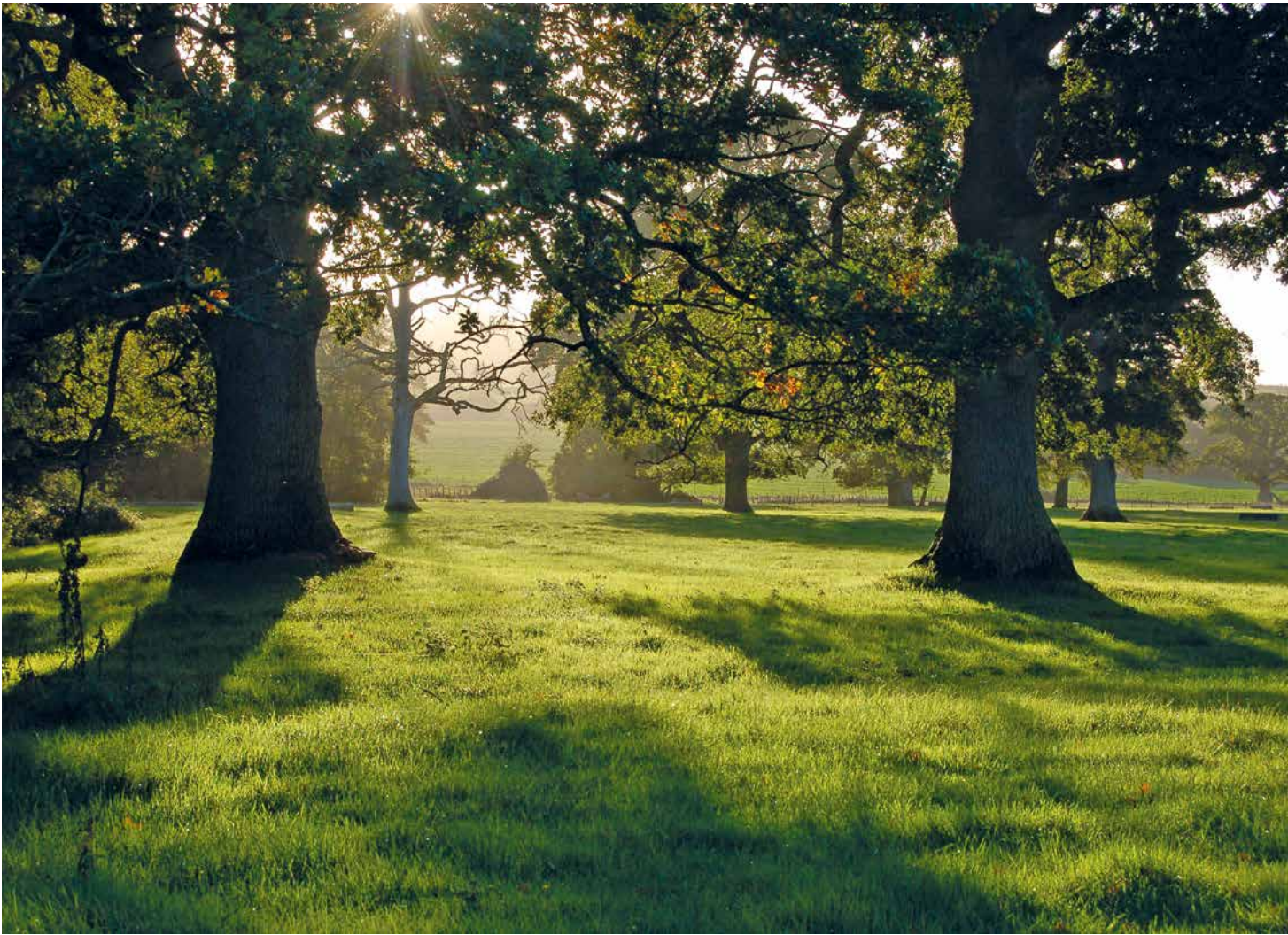


Figure 4. A shadow of its former self: parkland at Poltimore is now being restored. Photo credit: Simon Bates.

managed in ways where sequestered carbon is temporarily converted to CO₂ and lost from the habitat. The WCC is very conservative in this respect. For example, soil carbon sequestration can only be claimed for projects on a mineral soil where the previous land use was arable or rotational grass and the woodland will be managed as minimum intervention.

Therefore, I would like to propose a change to this principle as follows: Permanent – the CO₂ removed from the atmosphere should not be released in the future except through natural processes *and habitat management*.

Principle 5: Undertaken in real time – CO₂ emissions should be offset simultaneously with their generation or over a defined short period of time

The principle of simultaneous offsetting is more demanding. New

CO₂ emissions will accumulate in the atmosphere and nature-based schemes should be removing CO₂ from the atmosphere at the same time and at the same rate as it is being added by the operations and activities of the organisation seeking the offset.

John Box has likened the present global situation to an overflowing bath, with water as a metaphor for CO₂ (Box, 2021). The bath is full and the overflow pipes (the natural sinks of vegetation and the oceanic environment) are overwhelmed. The house is collapsing under the weight of water. The taps need to be turned down and the overflow pipes widened!

It would be ideal for us to tie specific investors to specific woodland creation schemes. In fact, we're hoping that companies will pay more for 'Clyst carbon' precisely because they can see the project from their window! If that investor demonstrated a verifiable

programme of emissions reduction, as a company, then in a sense offset would proceed hand in hand with reduction. Carbon sequestered under a WCC project is calculated in 5 year intervals and varies between time periods, with less sequestered in the early years of the overall 100 year timespan. However, as long as the carbon is emitted in the 5 year assessment period, then it can be offset by woodland carbon.

Principle 6: Based locally – offsetting schemes should ideally be based in Britain or the island of Ireland

Again, there is no problem here. Indeed, verified using the WCC we will market Clyst carbon to Exeter-based businesses aiming to offset their carbon. We will aim for a £5 uplift on the average price of UK Woodland Carbon Units. This could yield revenue of £3.15 million in the next 25 years. We hope investors agree that woodland carbon is attractively under-priced at the moment.

“ The next steps are to calculate the financial, social and environmental tipping points needed to persuade farmers to create more habitat featuring trees. ”

Principle 7: Avoid negative impacts – offsetting schemes should have a very low risk of creating unintended consequences for people or the environment

We are absolutely alive to the recent issues where existing non-woodland habitat has been damaged by tree planting caused by an over-reliance on remotely analysed habitat data. WCC projects must conform to the UK Forestry Standard and compliance is checked at validation and verification. EDDC has recently appointed a district ecologist with experience in habitat identification and assessment.

Every potential woodland creation site that comes forward, regardless of size, will be surveyed on the ground by an ecologist that meets the competency level of ‘accomplished’ for habitat identification and evaluation (CIEEM 2021). Field survey methods and reporting would follow the *Guidelines for Preliminary Ecological Appraisal* (CIEEM 2017). The aim would be to generate a habitat map to UK Habitat Classification Level 5 (see www.ukhab.org.uk). This would then inform which sites are suitable for natural regeneration towards broadleaved scrub and woodland and/or planting to woodland, parkland, orchard or other habitat with trees. It would also inform where non-tree habitat restoration or creation should take priority.

The greater challenge is likely to come from the farming community. With our Grade 1 and 2 agricultural soils, many argue that food production on the doorstep of a growing population should take precedent, especially given disruptions in global food trade as a result of the war in Ukraine. We

presently import about 40% of our food and 80% of our timber. We believe it is feasible to treble the tree canopy without reducing home food production by targeting woodland creation on flood-plains in particular, bringing a host of other environmental, social and economic benefits.

Conclusions

Our work looking in detail at 10 farms representative of the range found in the Clyst Valley has started to illuminate some of the challenges we will need to overcome. We’ve learned that Biodiversity Metric 3.0 does not favour conversion of flood-plain grazing marsh to woodland, even if that marsh is actually improved grassland with poor botanical value. This is principally due to the fact that Natural England has removed the ‘accelerated succession’ factor for woodland. In my opinion this is a mistake: early succession woodland supports greater insect biodiversity and abundance, which has benefits for wildlife further up the food chain.

The next steps in this project are to calculate the tipping points that we need to exceed to persuade farmers to create more habitat featuring trees. These tipping points are both financial/social, for example attitudes to risk and to the value of trees, and environmental. Delivering woodland creation in early 2023, ideally on an intensively managed farm, may be crucial in winning support from other farmers and also potential investors.

The CIEEM offsetting principles are essential to ensure that, at this important time, projects demonstrably and robustly alleviate both the nature and climate emergencies. I have tested them against our local Clyst Canopy project, and vice versa. I suggest one modification to the principle of permanency. The principles have helped me to identify risks and weaknesses in our project before we get stuck into delivery. I recommend that CIEEM members use them routinely in their project management.

Acknowledgements

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Novel Financial Drivers to Encourage Climate Resilience Through Biodiversity Gain



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Keywords: ecosystem services, environmental net gain, ESG, TCFD, TNFD

There are a range of existing mechanisms that we as ecologists can use to encourage gains for both biodiversity and climate resilience, which lie outside of the familiar policy and legislative framework. This article discusses some of these mechanisms, arguing that we can and should be broadening the tools we use to drive nature-based climate resilience in the UK.

Framing nature in a changing landscape

Let us start with two conflicting facts: nature underpins our economies, livelihoods, health and happiness, but societal demands upon nature far exceed its ability to sustain our current levels of consumption. These statements form the basis of the landmark publication, *The Economics of Biodiversity: The Dasgupta Review*

(Dasgupta 2021). Commissioned by HM Treasury, the report addresses our broken system of economics head on, through the lens of natural capital. Although the review does not present anything we, as environmental professionals, were not already aware of, its significance lies with the mainstreaming of this understanding in a different discipline; an ecosystem-led approach presented by an economist in the language of economics.

The review proposes three key transitions that will allow our economic system to better incorporate and support nature's recovery. These are centred around reducing consumption of natural goods and working better within nature's means, changing our current measures of economic success and enabling systemic and institutional changes, particularly regarding finance and education. These are broad, interconnected transitions and addressing each point will mean vastly different things for different individuals, industries and governments. While we all have a role to play, understanding these respective roles in the face of such large-scale challenges can be difficult.

As ecologists, our work with the construction industry and increasingly with new sectors such as professional

services, fund managers and investors, can further embed biodiversity in building practices and across strategic decision-making. These efforts are increasingly supported by the emergence of quantitative metrics for measuring biodiversity and its wider functions, such as Biodiversity Net Gain (BNG; see Box 1) and Environmental Net Gain (ENG; see Box 2) in the UK.

Box 1 What is BNG?

BNG is an emerging planning requirement that aims to ensure that developments have a net positive impact on biodiversity overall, by minimising any negative impacts, restoring existing areas or offsetting (HM Government 2018). To achieve net gain, the biodiversity value attributable to the development must exceed the pre-development value by 10%, according to Defra's Biodiversity Metric 3.0 (HM Government 2021).

Changing measures of economic success

While much of the Dasgupta review focuses on the (mis)use of gross domestic product as a measure of

Box 2 What is ENG?

ENG builds upon the UK government's ambition to leave the environment in a 'better state' for the next generation (HM Government 2018). To realise this vision, environmental improvements are to be ensured within all forms of development regarding both new and existing buildings and wider infrastructures. ENG therefore expands upon existing BNG principles to take into consideration the function of wider ecosystem services, such as flood protection, recreation and improved water and air quality (EIC 2019).

economic progress at a global scale, here we draw on it to consider ways in which industry can contribute to this transition at an organisational level. The first step is to encourage accurate natural capital accounting (NCA). NCA is not a new concept; indeed, natural capital valuation and ecological economics have been common ideas in conservation literature since the 1990s and anyone versed in Environmental, Social and Governance (ESG) reporting (see Box 3) will be familiar with the idea (Obst 2015).

Box 3 ESG in a changing climate

ESG reports capture a company's impact on and contribution to the environment and society. They are increasingly required by investors, stakeholders, insurers and banks to evidence how a company considers the risk and opportunities associated with themes such as climate resilience. Quantitative disclosures using accepted metrics are included within annual reports alongside qualitative discussion. There are a range of methodologies which can be followed, with some institutions expecting bespoke approaches to how disclosures are measured and reported. Biodiversity has typically been a qualitative element in these reports, if mentioned at all, although this is beginning to change with the development of BNG and ENG metrics in the UK.

NCA can calculate the stock or flow of nature and/or its ecosystem services in either physical or monetary terms; that is, the quantity of natural assets or their price. However, just sticking a static financial value on nature does not automatically transform it into an attractive investment opportunity. Typically, biodiversity and ecosystem services have not been accounted for on a company's books. This means that the negative impacts of operations on nature go largely unpunished, but also that any natural capital benefits and values also go unrecorded.

Whereas NCA has been considered in relation to sustainability appraisals (Hooper and Austen 2020), it has not yet been applied to BNG and ENG. Using BNG and ENG to undertake NCA presents an established framework through which ecologists can baseline existing natural capital and measure improvements over time. Although the UK Government recommends enabling a 'natural capital approach' (Defra 2021), NCA is not a formal planning requirement. Utilising emerging (and increasingly mandated) BNG/ENG metrics to produce natural capital accounts therefore provides ecologists with an increasingly strong footing for their development.

Approaching NCA with a BNG/ENG lens could enable a developer to, for example, assess the quality and value of a development's natural capital stock (i.e. the biodiversity units present), as well as ecosystem service flow, be that on an individual building, multiple buildings or across the infrastructures of a larger site (referred to here as 'built assets'). This could be achieved by utilising Defra's Biodiversity Metric 3.0 and the Environmental Benefits from Nature (EBN) tool to establish a biodiversity baseline for a site and plan for ecosystem service change and function. By

accounting for this, it is possible for organisations to make more informed decisions, which evaluate potential impacts of policy or management changes upon the resilience of those built assets (or wider portfolio of built assets) to the increasing impacts of climate change. This can be summarised concisely to a client as:

1. conserve and enhance biodiversity
2. retain and improve ecosystem service delivery
3. increase natural capital stock
4. derive tangible benefit from improved asset performance (in terms of its resilience) against physical climate risks.

By framing evidence-based accounts of biodiversity and ecosystem services as contributing positively to the climate resilience of an organisation's operations and asset portfolio, ecologists can leverage their consideration against corporate ESG benefits or, more recently, the Task Force on Climate-related Financial Disclosures' (TCFD) recommendations (see Boxes 4 and 5; TCFD 2017).

By adopting this novel approach, we can encourage our clients to fund improvements to climate resilience via investments in the quantity and quality of biodiversity that can be delivered by utilising nature-based solutions such as those shown in Figure 1. Figure 2 defines this approach, demonstrating the links between drivers, adaptation measures and metrics to enhance corporate climate resilience through the protection and enhancement of biodiversity. By tapping into these ESG, TCFD and TNFD incentives, ecologists can utilise mechanisms that are already being used to encourage wider sustainability topics (such as net zero carbon or social value), but instead lead with a biodiversity focus.

Box 4 What is the TCFD?

The TCFD provides structure and impetus for companies to identify and quantify the tangible climate-related risk to the assets they run and/or invest in. The need for climate risk disclosures to be undertaken, in line with TCFD recommendations, is likely to be mandated in the UK by 2023. In this context, it is possible to link biodiversity benefits to improvements in the climate resilience of a built asset (or portfolio of built assets) via the use of nature-based solutions, all of which can be captured within TCFD reporting. A Task Force on Nature-related Financial Disclosures (TNFD) is also being developed and shared its beta framework for organisational reporting on nature-related risks in March 2022 (see Box 5).

Box 5 What is the TNFD?

The Task Force on Nature-related Financial Disclosures (TNFD) is developing a set of disclosure recommendations for nature-related risks and opportunities that maximises consistency in language and approach with the TCFD's guidance (TNFD 2022). The rationale underpinning the TNFD, much like that of the TCFD, is that transparency of information through disclosures facilitates better risk and capital allocation decisions by corporates, investors and lenders. This will in turn enhance understandings of the nature-related dependencies and nature impacts that materially shape enterprise risks and opportunities and their financial implications. The intention is that this will channel finance away from nature-negative outcomes towards nature-positive solutions, opportunities and business models, which ultimately support financial stability. The TNFD recently released its first beta framework for consultation, which provides clarity on its purpose, scope, terminology and function. The final recommendations are scheduled to be published in September 2023.

As ecologists, we can look at corporate climate resilience through the lens of the emerging BNG and ENG (or ecosystem service valuation) concepts. Crucially, both approaches allow us to quantify changes (usually through proxy measures) in the ecological performance of a built asset. It is these predicted or actual changes that can be measured and leveraged to evidence the mutual benefit of net gains to developers, asset managers and nature itself.

When using these metrics, avoiding an over-reliance on the numbers is essential. Always apply nuance and a level of qualitative expertise regarding what the best ecological outcomes may be in each context. This suggested approach does veer away from classic NCA, which ultimately gives financial value to a biodiversity asset. However, we do so recognising the range of mixed and contested views on this issue across the CIEEM membership.

If used in line with best practice and with the intention of, first and foremost,



Figure 1. IGNITION Nature-based Solutions Living Lab at the University of Salford, with a green roof and a green wall. Photo credit: The IGNITION Project.

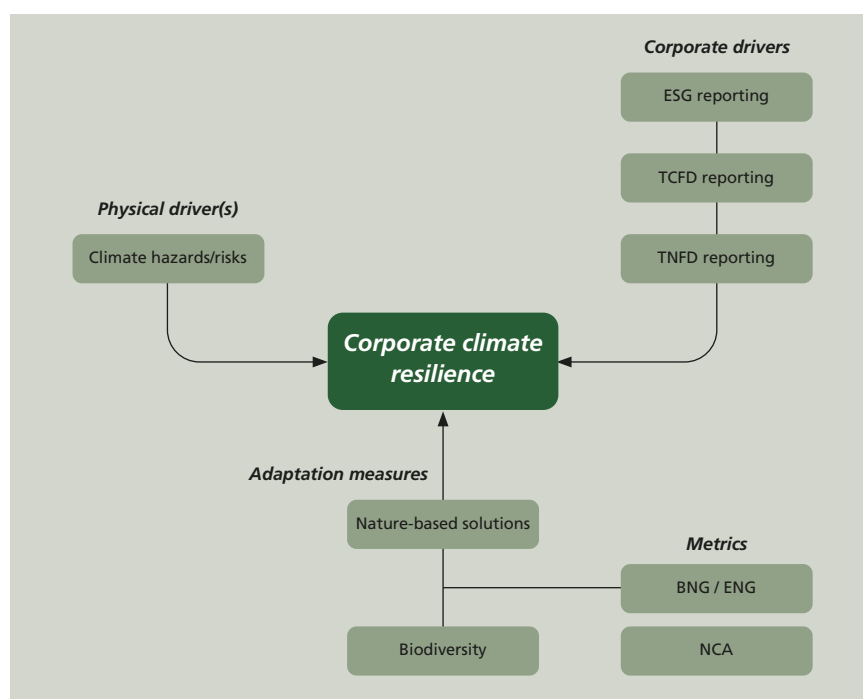


Figure 2. Framing biodiversity-led corporate climate resilience.

delivering a benefit for nature, this BNG/ENG template for identifying, optimising, measuring and reporting direct and indirect benefits could be applicable to any organisation with landholdings or built assets. This could be particularly relevant and valuable for those that have a requirement for ESG reporting but no other existing driver to encourage gains for nature.

A template for moving forward

Accounting for biodiversity in this way is only the first step. Significant cultural changes are still needed if we are to curate and embed a more holistic appreciation of its value across the built environment value chain. However, integrating biodiversity/ climate resilience co-benefits within financial decision making (via ESG, TCFD and TNFD reporting) could incentivise such significant institutional changes. Shareholder reports should have as much of a focus on biodiversity and associated carbon accounting as financial performance, embedding BNG/ENG as core key performance indicators.

To bring an understanding of biodiversity's importance into the mainstream, a simultaneous mainstreaming of investment in biodiversity and natural capital is required. Recent actions, such as Defra's Natural Environment Investment Readiness Fund (NEIRF) grants (Defra Press Office 2021) and the TNFD (TNFD 2021) are encouraging signs, hinting at a future in which private investment favours projects that evidence integrated biodiversity and climate resilience.

This turning tide is visible in the example from Great Portland Estates (see Box 6), which shows a large developer/investor beginning to strategically plan, deliver and report on biodiversity-led corporate climate resilience.

Concluding remarks

Our toolset and ability to accurately assess the value of biodiversity, natural capital and ecosystem services, in both real and financial terms, is ever increasing. The insights this provides should be placed at the forefront of considerations around development viability and portfolio management, which we as ecologists can encourage, opening a brand new sector to engage and work with.

Box 6 Great Portland Estates' environmental net gain strategy

Great Portland Estates (GPE; www.greengage-env.com/case-studies/great-portland-estates-bng-and-embodied-carbon/) is a FTSE 250 property investment and development company that owns a £2.5 billion portfolio of London real estate. GPE have committed to deliver an ENG strategy across key assets in its London portfolio. Baseline conditions at each property were assessed for their biodiversity value and ecosystem service output and a strategy to enhance each site to deliver measurable environmental benefits was prepared. Through the proposed interventions, significant uplifts in biodiversity value and ecosystem service delivery have been targeted, including improved habitat connectivity, water management/regulation and air quality. Consequentially, GPE were able to develop and deliver on a range of ESG-linked key performance indicators that improve the environmental performance and climate resilience of its London assets.

We need not be entirely beholden to BNG/ENG as a mitigative or compensatory tool in new development. We should also be seeking to catalyse change in different markets through novel mechanisms where we can focus on the gains alone. The example from GPE (Box 6) demonstrates both the feasibility of this approach in practice and the capacity for it to drive the crucial retrofitting of nature-based solutions on existing built assets.

In summary, we have outlined how ecologists can begin to use these novel drivers more broadly, building on the advances made by metrics to leverage positive outcomes for nature that are then embedded within strategic decision-making and can be disclosed against ESG, TCFD and TNFD reporting frameworks. As these disclosures continue to mature and are increasingly being mandated, ecologists can therefore position themselves at the forefront of this emerging market.

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Challenges of Habitat Creation: A Case Study of Lowland Heath



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Keywords: Dorset heath, habitat creation, lowland heath, net gain, nature-based solutions

Policy drivers to deliver net gain combined with the increased focus on nature-based solutions are likely to result in a proliferation of habitat creation schemes, which contrast with habitat restoration in terms of difficulty and certainty of success. Creating habitat has numerous challenges and the paucity of existing

literature and knowledge generate significant uncertainty as to how to deliver successful schemes. The existing development process tends to focus on surveys and assessment, with mitigation or enhancement often added at the final stages before submission. Schemes involving habitat creation may require longer

periods of preliminary work to sufficiently inform the proposals. Here a case study is provided of lowland heath creation along with the challenges, experimental trials and monitoring over a 7-year period.

Introduction

Starting with an almost blank canvas, creating a specific target habitat is fraught with uncertainty since there are many factors to consider. With the advent of Biodiversity Net Gain and the twin drivers of the climate and biodiversity crises, attempts to create habitats are likely to become more common as we seek to implement nature-based solutions. Here, a case study is presented of lowland heath creation, dominated by a mix of Dorset heath (*Erica ciliaris*), bell heather (*Erica*

cinerea), heather (*Calluna vulgaris*) and western gorse (*Ulex gallii*), as a microcosm of the issues typically faced when attempting to deliver such schemes in a development context.

This habitat creation project is based at Carland Cross wind farm in Cornwall, where the repowering of an old wind farm in 2012 with 11 more modern turbines included a commitment to deliver 2.4 ha of lowland heath creation. There was no loss of lowland heath since the development was entirely located in arable fields, but the existence of the Newlyn Downs Site of Special Scientific Interest/Special Area of Conservation (SSSI/SAC) adjacent to the wind farm provided an opportunity to deliver enhancement for biodiversity as part of the development.

Where to start?

The Environmental Statement had intended the lowland heath to be created in small parcels of redundant arable field close to wind turbines, the logic being that the layout of tracks and foundations left some areas too small to be cropped and therefore that they should be used for habitat creation. While it is laudable in theory to make use of land with no economic purpose, in practice these areas were discounted because the legacy of fertilisation and improvement for arable use did not lend them well to creating lowland heath: the risk of failure was considered to be too high. They were also small, fragmented and not joined to Newlyn Downs, so the gains for biodiversity were also likely to be more limited.

After discussions with the landowner, a candidate area of semi-improved grassland pasture was identified adjacent to Newlyn Downs which had received no inputs for over 15 years and was part of a higher-level stewardship (HLS) grazing agreement. This seemed to offer a higher probability of success and since it was contiguous with Newlyn Downs it provided better connectivity for wider biodiversity gains in the longer term.

Experimental trials

Comparative soil testing between the candidate area and Newlyn Downs indicated that while nutrient concentrations were similar, the pH

values were markedly different. As expected, Newlyn Downs had acidic pH values of 3–4 whereas the candidate area was neutral at pH 7. This presented a problem: would species from Newlyn Downs germinate and grow in the candidate area with a neutral pH, and could competition from grassland species be avoided? A literature review of previous published attempts to create lowland heath included measures to reduce pH by adding sulphur-derived compounds (Green *et al.* 2006, Hawley *et al.* 2008). The project was faced with a dilemma, because none of the previous examples found had been particularly successful in creating lowland heath (Walker *et al.* 2004) and importing inorganic compounds to reduce pH could also create other unintended consequences for plant growth and survival.

In addition to the pH levels, the soil structures were also notably different. Newlyn Downs has well developed podzols with clear stratigraphy of layers, whereas the candidate area soils had been homogenised due to historical ploughing. As such, it was decided that even if pH levels could be altered there was potential for unintended changes from adding inorganic compounds, and there was still no way to recreate

the soil structure. There was no way to be certain of the outcome, so we conducted some experimental trials to investigate. Although trials add several years to the restoration programme, it is considered preferable to do this and improve the chances of an overall successful outcome before committing large quantities of time and money.

A replicated block/plot experiment was designed to test the response of a subset of potential treatments previously tested by Pywell *et al.* (1995). The treatments were applied as two factors:

1. to the existing turf as: no treatment (control), turf removal to a soil depth of approximately 5 cm (scalping) or glyphosate herbicide application.
2. by addition of 40 litres of seed/brash cut and harvested under a SSSI licence from Newlyn Downs, or no addition of seed/brash (control).

Since there were three levels of turf treatment and two levels of seed/brash treatment this resulted in six possible combinations of treatments to be implemented. As such, the resulting experimental design comprised 12 replicated blocks, each of which contained six 1 m × 1 m plots to which a combination of each treatment was randomly assigned (Figure 1).



Figure 1. A single block of six experimental plots of lowland heath creation, each with a different combination of treatments applied. Photo credit: Peter Robson.

The trial was implemented in January 2014 and inspected in May and again in October of the same year to assess initial responses. Germination of seed was absent on every plot except those which had been scalped and had seed added. Even on those plots, germination rates were low, with only 12 plants in total visible after the first growing season. One concern was the timing of seed collection occurring January due to unforeseen delays, when it is known that most dwarf shrub seed ripens and is released in the late autumn. As such, additional seed was harvested from Newlyn Downs in late October 2014 and added to six of the 12 scalped plots which had had seed previously added, adding a further dimension to the initial experimental design.

Trial results

The trials were monitored at the end of the growing season in 2015 and 2016, each time by counting the number of individual dwarf shrub species which had germinated in each plot. Only scalped plots with added seed had any dwarf shrub species present, and plots which had additional seed added in October 2014 had significantly greater abundance (Figure 2).

Plots which had the turf removed (scalped) and seed added in October had demonstrated the best response,

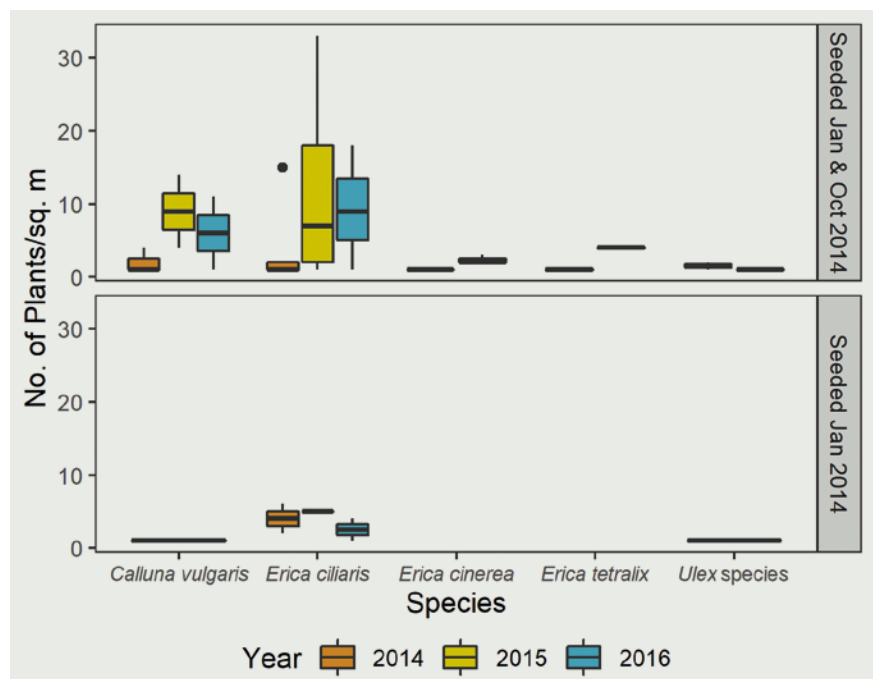


Figure 2. Box plot showing the distribution of dwarf shrub species density between plots from the experimental trials.

and the plants had survived for two or three growing seasons, suggesting that conditions were likely to be sufficiently suitable for establishment.

Lowland heath creation

With these results we had sufficient confidence to scale up the habitat creation to the full 2.4 ha area. The ground was prepared by shallow ploughing to invert the grass turf

then harrowed and rolled to provide a smooth bare earth surface. Seed and brash was collected under licence from the adjacent Newlyn Downs using a tractor-driven forage harvester and blown into a spreader trailer. The spreader trailer then broadcast the harvested material onto the prepared bare earth surface, achieving a depth of 20–60 mm (Figure 3).



Figure 3. Spreading harvested seed/brash onto the prepared bare soil surface. Photo credit: Peter Robson.

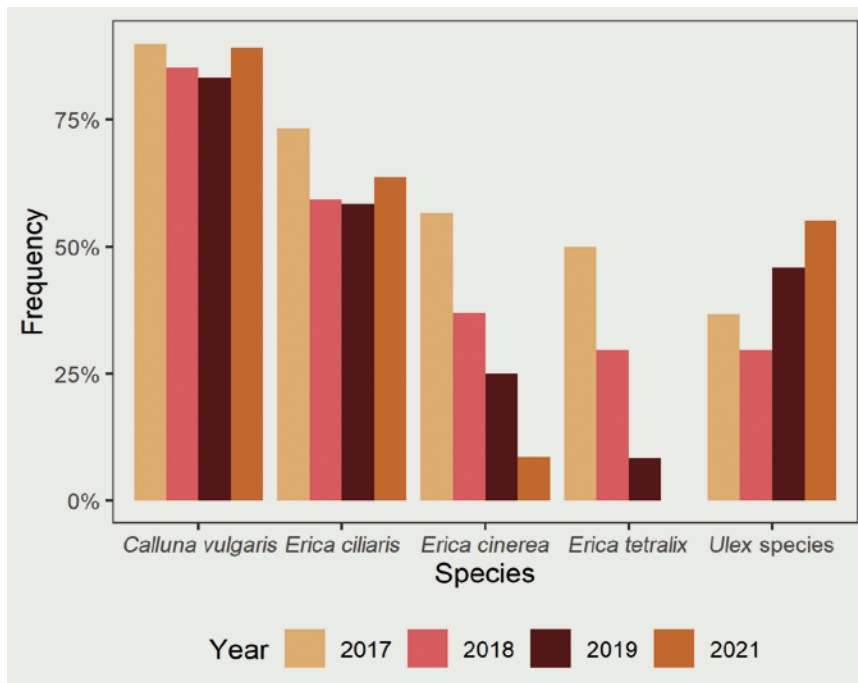


Figure 4. Frequency of key dwarf shrub species within a 1 m² quadrat.

Once the work was implemented a new monitoring strategy was needed to determine whether the habitat creation was successful. An obvious reference was Newlyn Downs, but simply targeting a particular climax vegetation type is too long term for a project such as habitat creation. It may take years or even decades to reach such a point; the early periods of habitat creation require quantitative metrics which give clear, unambiguous evidence of trajectories.

Since the seed was primarily sourced from dwarf shrubs (Figure 2), and it was considered likely that the establishment of dwarf shrubs was key to creating the conditions for other species to become established, the focus was on dwarf shrubs. We expected germination of seed to result in a large number of individual plants, although some of them would not survive. Since initially plants would be extremely small, attempting to measure cover as a metric for abundance was rejected. A hybrid approach was adopted whereby individual plants were counted to obtain densities in the first 4 years, and as plants increased in stature sufficient to make discerning individual plants impossible abundance was measured using frequencies. Canopy height above ground level of heather (*C. vulgaris*) was also recorded to estimate growth (heather was selected since it is palatable to herbivores). Measurements

were taken from a systematic grid of $n=30$ sample units comprising nested radial quadrats of radius 25, 50 and 100 cm. The nested quadrat approach enables species with differing abundance to be assessed at an appropriate size of sampling unit, with rarer and commoner species using larger and smaller quadrat sizes respectively.

The results are encouraging so far (Figure 4). Germination and initial densities were above those recorded from the trials, indicating the seed was successfully harvested and the surface preparation was suitable. Significant ground disturbance by cattle was noticed in 2017 along with reductions in most of the key metrics, so measures were taken to exclude cattle entirely until the habitat is better established.

However, the results are not uniformly positive. In particular, bell heather (*E. cinerea*) is a frequent component of Newlyn Downs and also germinated well in both the trials and main restoration work. But, after just a few years it is clearly in decline and the reasons for this are not clear. While patches of apparently healthy plants are visible on the ground its overall frequency has reduced, possibly due a requirement for more specific soil conditions. A similar pattern is evident for cross-leaved heath (*Erica tetralix*), which is much less frequent within Newlyn Downs and

requires wetter conditions not present in the establishment area. As such, the decline in cross-leaved heath is not surprising and less of a concern.

The main potential risk to the success of the project at this stage is considered to be competition from non-heathland species, particularly bramble (*Rubus fruticosus*), which is a constant across the site, and dense stands of soft rush (*Juncus effusus*) in the damper areas. It is hoped that as the stature of the dwarf shrub species increases they will be less prone to competition, and the reintroduction of summer grazing by cattle in the future will help reduce the cover of grassland species (Figure 5). It may take several years, or even decades, until we are able to fully validate whether the creation of lowland heath habitat was truly successful.

Conclusions

As habitat creation becomes more widespread as a result of new policy drivers, the paucity of existing knowledge available to implement such schemes suggests that ecologists will be faced with significant uncertainty as to how to deliver these projects. For net gain to be effective, and nature-based solutions to indeed be solutions, greater attention is required regarding site selection, the techniques to be used and long-term quantitative monitoring with appropriate levels of precision to infer conclusions. Development timescales often do not lend themselves to taking a considered approach to site investigation, experimental trials and phased implementation but we consider this approach to be entirely necessary when uncertainties are high. As such, rather than specifying habitat mitigation/enhancement measures at the end of ecological assessment process there is considerable value in commencing this work in parallel with surveys and assessments to better inform the proposals.

“ Germination and initial densities were above those recorded from the trials, indicating the seed was successfully harvested and the surface preparation was suitable. ”



Figure 5. Photo taken September 2021 showing abundant cover of dwarf shrubs and competition from grasses and bramble. Photo credit: Peter Robson.

Another challenge is the typically long duration of habitat creation projects allied with the lack of continuity of involved staff. This requires relevant documentation and data to be coordinated, centralised and managed for long periods of time and consideration is required as to who holds this information, how it is secured and how it is accessed.

We would also advocate for greater enforcement of long-term mitigation/enhancement measures, since all too often the planning authorities attach lower priority to obligations post-consent or are simply not sufficiently resourced to audit and enforce commitments and obligations that require long time periods following consent to deliver. Without this, promises and commitments may not transpire on the ground.

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Spains Hall Estate:

Beaver-ing Away to Boost the Delivery of Ecosystem Services

Beaver (*Castor fiber*) at Spains Hall Estate. Photo credit: Russell Savory.



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Keywords: beavers, Biodiversity Net Gain, ecosystem services, land management, natural capital, nature-based solutions

There is a growing awareness of the benefits that functioning ecosystems provide us with and that nature-based solutions will be crucial in tackling the climate emergency and biodiversity crisis. A nationwide change in how we use our

land is needed and there are many forward-thinking landowners who are now altering the management of their landholdings with this in mind. This article highlights the land management changes that are ongoing at Spains Hall Estate in Essex and details how these changes are predicted to enhance the delivery of ecosystem services and provide a boost for people and nature.

Introduction

Not only is biodiversity increasingly being seen as having an intrinsic value, awareness is also growing of the further benefits that functioning ecosystems can provide, including solutions to human-caused issues that are often referred to as nature-based solutions. The climate emergency and biodiversity crisis are finally being widely recognised and we are seeing increasing evidence and acknowledgement that nature-based solutions will be key in addressing these problems while providing numerous additional benefits.

Many forward-thinking landowners and organisations are showing an interest in nature-based solutions and exploring how they can manage their land to increase biodiversity and the provision of ecosystem services. Diversifying land use benefits nature and society and has the potential to provide a variety of income streams and economic benefits for landowners.

As ecological and environmental practitioners, many of us are now talking about topics such as ecosystem

services, nature-based solutions and associated changes in land management. However, it is only by working actively on these topics in the field that an understanding develops of both the depth of the opportunities available and the complexities surrounding them. It is a privilege to work on client-led nature-positive projects that are undertaken with biodiversity enhancement and ecosystem restoration as the core objectives. Such work is new to many of us and requires effective collaboration and novel ways of thinking.

Spains Hall Estate

Spains Hall Estate in Essex has been in the same family for 260 years and is now in the process of diversifying from predominantly arable crop production. The work there involves various land management changes, including a transition to agroforestry, the introduction of natural flood management (NFM) measures such as enclosed beaver reintroductions (see Figure 1) and woodland creation.

The core objective of the work is to enhance ecosystem services delivery across the 832 ha landholding, which until recently supported 660 ha of arable land, with the remaining land predominantly comprising existing deciduous woodland and grassland habitats. Numerous partners have collaborated with Spains Hall Estate on this work, including the Environment Agency, Essex and Suffolk Rivers Trust, Essex Wildlife Trust and Atkins. Here we present the main land use changes being implemented and the impacts that these changes are having or are predicted to have in the future.

Land use changes and objectives

Natural flood management

The initial land use changes undertaken were part of the delivery of a NFM scheme aiming to reduce the risk of flooding to Finchingfield, a village located downstream of the Estate. The centre of the village has previously been subjected to floods, with the Environment Agency

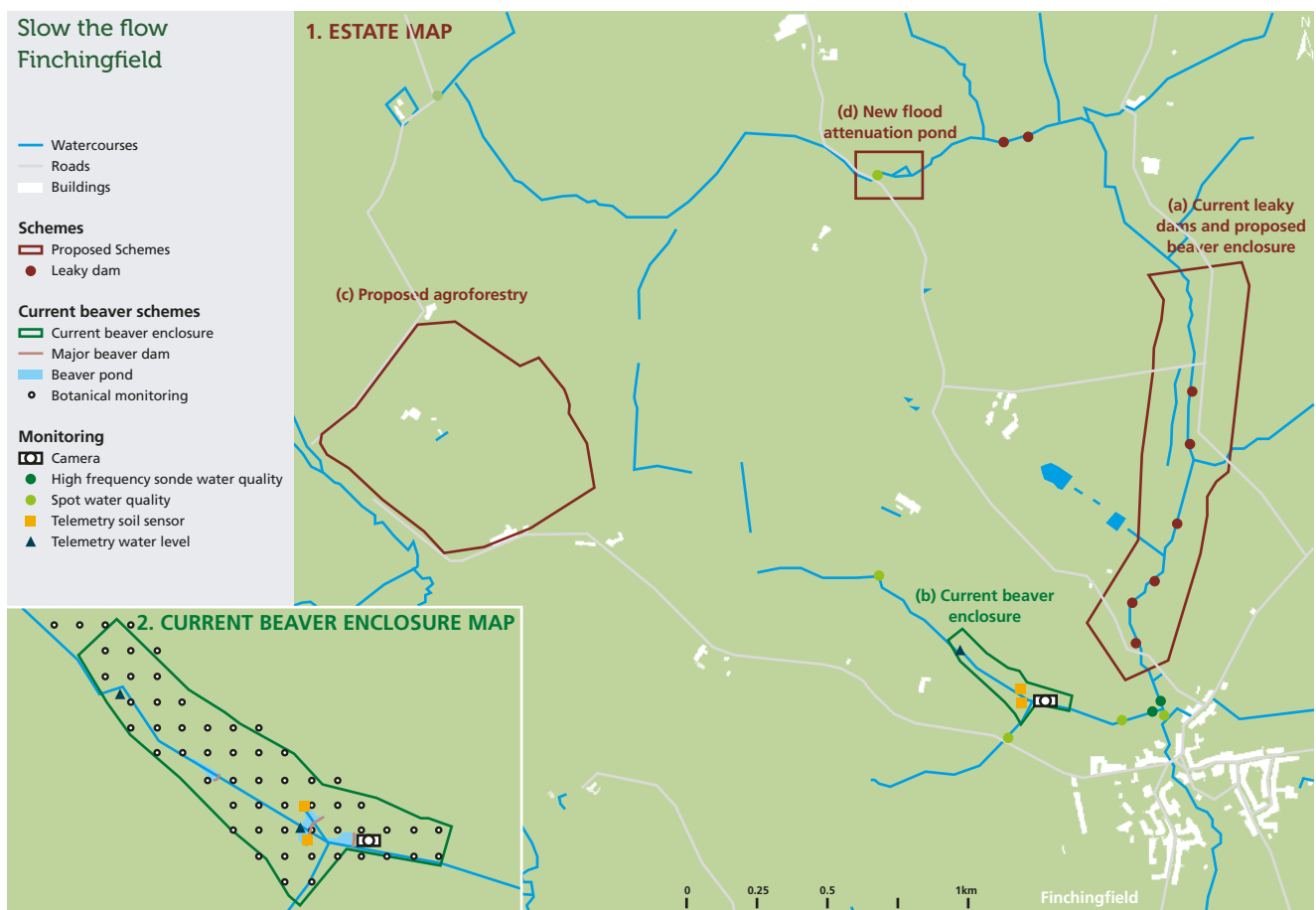


Figure 1. Map of proposed and implemented land use changes at Spains Hall Estate.

estimating that 12 residential houses, six other properties and two local roads, including the main road through the village, are at risk of flooding.

The NFM interventions included two very different measures. The first was the installation of eight leaky dams upstream of the village on Finchingfield Brook in 2019, with the aim of slowing the flow and inundating land on the Estate during periods of high flow, storing water on this land to reduce downstream flood risk (Figure 2). Leaky dams are stacks of wood designed to hold back water after heavy rain – essentially artificial beaver dams – and divert the water onto riverside flood meadows and fields rather than to downstream properties and roads.

The second NFM intervention was the licensed release of a pair of Eurasian beavers (*Castor fiber*) in 2019. The beavers were released into a 4 ha fenced enclosure on the Estate that comprised woodland and a small stream, a strand of Finchingfield Brook. After being absent from Essex for over 400 years, these ecosystem engineers have now been given free rein to fell trees, build dams and create a biodiverse wetland landscape within their enclosure (Figure 3). Over 20 dams have already been created and two beavers have now become a family of six. Already, kingfishers (*Alcedo atthis*), water voles (*Arvicola amphibius*) and water shrews (*Neomys fodiens*) have re-colonised the area due to the wetland habitat created. Beaver reintroductions elsewhere have provided an abundance of evidence that the presence of beavers can result in improved water quality, enhanced biodiversity and, of particular importance for this scheme, reduced flooding downstream (Brazier *et al.* 2021).

In addition to the above, there are more NFM interventions in the pipeline in 2022, including a new 40 ha beaver wetland, which would involve the release of two new beaver pairs into strategically located enclosures, and the creation of multiple attenuation ponds to further interrupt and re-route runoff pathways and store excess run-off.

Agroforestry

Starting in 2022, the Estate is also converting large areas of traditional farmland to agroforestry. Agroforestry



Figure 2. Leaky dam holding back the flow on Finchingfield Brook. Photo credit: Spains Hall Estate.

integrates trees and shrubs into agricultural systems, typically by planting rows of trees through crop fields (known as silvoarable; *silva* is Latin for woodland), often also called alley cropping, or by incorporating trees and shrubs into pasture fields that are grazed by livestock (silvopasture), which provides livestock with additional fodder and shelter. Agroforestry is common in some parts of Europe, particularly Portugal and Spain (where livestock graze and feast on acorns beneath

oak trees in the *dehesa*; Mottershead and Maréchal, 2017), but is not widely practised in the UK. However, it is currently garnering attention as an effective nature-based solution that has the potential to increase carbon sequestration and biodiversity and decrease soil erosion and flood risk without compromising food production (Kay *et al.* 2019). There are plans for the Estate to ultimately support over 300 ha of agroforestry, a significant proportion of the total landholding.



Figure 3. Aerial image of the beaver-created wetland at Spains Hall Estate. Photo credit: Spains Hall Estate.

Land use change impacts

Data collection and monitoring

At the heart of the scheme is the collection of evidence and data, most of which is deliberately made open source by the Estate, to assess the effectiveness of interventions and build an evidence base to aid future works and assist other landowners and organisations who are interested in implementing similar land management changes. For example, for the implemented NFM measures this has included the installation of water quality sondes (unattended underwater probes that automatically gather and transmit data from their location), regular collection of nutrient and pesticide samples, the installation of loggers to monitor weather, water level and soil moisture, botanical monitoring grids and hydraulic flood modelling. Data collection is ongoing, with a solid baseline gathered, regular monitoring planned and the implementation of further data collection techniques in the pipeline.

Flood alleviation

In the meantime, there is anecdotal evidence from Finchingfield residents that the NFM management interventions may already be working. Recent rainfall events that locals considered would typically lead to flooding in the village have not done so, likely due to the improved storing of water on the upstream Estate. The beavers have been playing their part in this upstream storage of water by dramatically altering the landscape of their enclosure, storing large areas of standing water behind the many dams they have created (Figure 4). It is expected that the risk of properties and local roads flooding will reduce further as the NFM measures establish and further measures, including new beaver releases and the creation of attenuation ponds, are implemented.

Natural capital assessment

In aid of enabling the Estate to shape future plans and projects, provide better visibility of the potential for environmental markets and to help build a business case for sustainability, Atkins was commissioned to produce a natural capital account of the land management changes and interventions across the site. There



Figure 4. Large beaver dam at Spains Hall Estate. Photo credit: Atkins.

are various natural capital tools available, including Natural England's Environmental Benefits of Nature Tool (Natural England 2021), which gives a valuable indication of the direction of changes in ecosystem service provision that may arise from land use change and can flag areas for more detailed consideration. In this case it was determined that quantification of the changes was important, particularly as a primary aim of the assessment was to provide the Estate with the information required to make long-term land use decisions. Therefore, Atkins used their bespoke Natural Capital Studio tool, which can provide such quantification. The tool uses data on actual and predicted land cover prior to and following management changes to estimate the potential changes in 15 ecosystem services, and applies existing valuation evidence to assess the value in monetary terms. In this case, local site-specific data and the application of bespoke approaches were implemented to extend and expand the standard analysis.

Ecosystem services

The natural capital assessment demonstrated the potential benefits that the implemented and proposed land use changes could provide, forecasting that the land use changes across the Estate will result in a significant net increase in annual

ecosystem service provision. The largest predicted benefits are those associated with biodiversity, air quality and carbon sequestration. Flood attenuation, soil and erosion risk, and pollination potential also saw increases, with social benefits relating to recreation, health impacts and educational opportunities also found to be significant. Illustrative figures indicate the scale of environmental gains that are achievable, which include predictions that there could be an annual net carbon benefit of 294 tonnes (through sequestration and a reduction in CO₂ emissions), that an estimated 264 kg of phosphate and 20 tonnes of nitrogen could be kept out of watercourses each year, and that there could be a net increase in over 330 biodiversity units. The main land use change driving these ecosystem service gains is predicted to be the increasing tree cover through woodland creation and agroforestry, although benefits relating to the NFM measures were also apparent.

“ Recent rainfall events that locals considered may lead to flooding in the village have not done so, likely due to the improved storing of water on the upstream Estate. ”

Future funding streams

Financially, despite an obvious reduction in food production on the Estate due to the diversification of land use from predominantly arable agriculture, a substantial increase in the overall annual monetary value of ecosystem services was predicted. Although the markets for ecosystem services are largely in their infancy, in the near future land use changes such as those seen at Spains Hall Estate could be funded by various streams. For example, the increase in biodiversity and carbon sequestration has the potential to provide credits to offset the impacts of off-site developments that would otherwise cause net detriment to the environment. In fact, the biodiversity benefits predicted in the natural capital assessment played a significant part in the Estate's successful application to be part of the Natural England Biodiversity Net Gain credit pilot, which will support the design of a credits scheme and aid in developing credit investment pipelines and payment structures to fund ecosystem service provision.

While the exploration of such market opportunities is ongoing, the land management changes are already allowing the Estate to diversify its income, with the creation of habitats and the reintroduction of beavers boosting income from tourism, allowing the Estate to run tours and wildlife photography courses and increasing the popularity of offerings such as holiday cottages and camping as a result.

Wider benefits

It is worth noting that many of the benefits resulting from the scheme will extend beyond the landholding's boundaries. In addition to the flood alleviation benefits for the residents of Finchingfield, other benefits for the wider community are also predicted, including those relating to water quality, recreation and health. Furthermore, the approach adopted by the Estate is already acting as an educational springboard, encouraging other landowners and organisations locally, regionally and nationally to adopt similarly ambitious changes to their land management.

Conclusion

Spains Hall Estate is an excellent example of how the management of

landholdings can diversify to enhance the provision of ecosystem services and provide sustainable benefits for landowners, the local community, the wider public and biodiversity. The Estate is fast becoming a blueprint for the successful implementation of nature-based solutions and is increasing its value as an educational and scientific resource by providing a platform for scientific research and monitoring of these changes, along with demonstrating the outcomes of the land management changes to other landowners and organisations.

However, it is still appreciated that it can be an enormous challenge for landowners to make long-term decisions on land use, particularly in such uncertain times and with many of the markets for ecosystem services still in their infancy. It is hoped that the ongoing biodiversity credit pilot scheme that the Estate is involved in will aid in developing credit investment pipelines, leading to clearer financial opportunities for landowners who are keen to implement land use changes that benefit biodiversity and people.

It is also considered that there is a difficult balance in optimising the delivery of multiple environmental benefits from one landholding while minimising conflicts. There are risks in thinking about and trying to address such environmental benefits in isolation, for example if decision making focuses on carbon sequestration alone then this could negatively impact biodiversity, perhaps by planting tree species with high carbon sequestration potential but low biodiversity value and destroying a previously wildlife-rich habitat as a result. There is a fine balance to strike and for this to work best it will need to involve ecological and environmental practitioners at every step, with specialists in various fields coming together to share knowledge and collaborate, build relationships and take the time to develop an understanding of nature-based solutions.

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The New UK Forestry Standard Practice Guide

Adapting Forest and Woodland Management to the Changing Climate



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Keywords: adaptation, climate change, forestry, trees, woodland

Our important forest and woodland habitats are experiencing increasingly rapid climate change which is accelerating the need to build resilience. How can we facilitate the necessary shift in practice and address barriers to change to help protect and sustainably manage our future forests and woodland? This article discusses the challenges facing the forestry sector and how our growing scientific understanding of adaptation measures needs to translate into practical guidance. We introduce the new UK Forestry Standard Practice Guide, which includes a five-step Adaptation Framework to help forest and woodland managers assess risks and select appropriate adaptation measures.

Introduction

The changing climate is affecting our trees, forests and woodlands; how they grow, survive and the suitability of certain tree species for different parts of the UK. This, in turn, is affecting their vulnerability to climate risks and potential to provide important ecosystem services including carbon sequestration, wildlife habitat, flood risk reduction, timber production and recreational space. For such services to

continue, it is essential to take action to adapt existing woodlands to the changing climate, and to plan new woodlands appropriately. Research into how owners and managers are responding to environmental change has shown that owners commonly say that they plan to build adaptive practice into their decision-making (Ambrose-Oji *et al.* 2018). However, according to the British Woodlands Survey, uptake of

adaptation measures has, until recently, been limited (Hemery *et al.* 2015, 2020). Most woodland managers do not appear to have implemented change on the ground, unless they have been pushed to do so by an extreme weather event, disease outbreak or some other disturbance. This reluctance to act is partly linked to the long timescales associated with planning for forest and woodland management and also to different levels of understanding about future risks and how they might be managed. As most woodlands are managed with multiple objectives this adds to the uncertainty and complexity. There have also been mixed messages regarding the right way to build resilience. These factors are often intertwined and compounded by low levels of awareness of local climate change projections (Hemery *et al.* 2020). Where there has been adaptation activity it has mostly been concentrated on tree species diversification and, more recently, adoption of continuous cover forestry practices (Hemery *et al.* 2020), and the wider range of options has been largely overlooked.

The land management sector has been requesting concise information about the risks posed to woodland management from the changing climate, how to identify suitable adaptation measures and examples of how other land managers are addressing these risks (Ambrose-Oji *et al.* 2018). In response we at Forest Research have developed an Adaptation Framework to support those looking to build resilience and to help them to select appropriate adaptation measures. We also developed a range of case studies where we celebrate and showcase the 'early adopters' who have implemented adaptive practice to reduce climate risks.

We describe briefly here the need for adaptation, raising awareness, the risk assessment approach, future aspirations for knowledge exchange and introduce the UK Forestry Standard (UKFS) Practice Guide *Adapting forest and woodland management to the changing climate* (Figure 1), published by Forest Research. A link to the Guide is given at the end of this article. For more on the UKFS, see Box 1.

Box 1 The UK Forestry Standard

The UK Forestry Standard (UKFS; www.gov.uk/government/publications/the-uk-forestry-standard) is the primary technical standard for sustainable forest management. It outlines the context for forestry and sets out the approach of UK government to sustainable forest management, serving as the primary source of information on good practice requirements and guidelines for forestry in the UK.

The Practice Guide's content was developed in collaboration with Forest Research colleagues, forestry sector practitioners and landowners across the UK; it involved external workshops with forest owners, managers and professionals and was much strengthened as a result of this approach. The Guide was developed to support the UKFS's Guidelines on Climate Change. The Guide provides advice on how to adapt management and plan for the changing climate and takes the reader

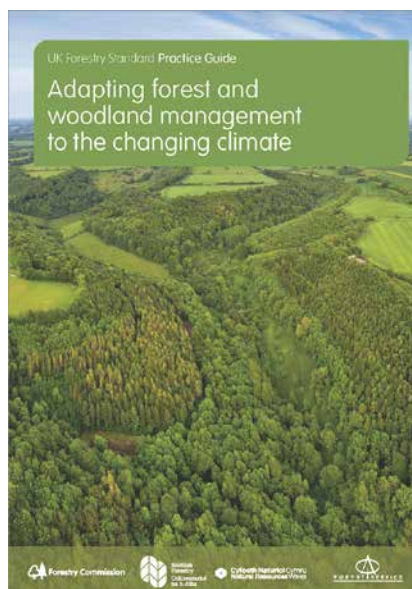


Figure 1. Front cover of the UKFS Practice Guide.

through the process of choosing and implementing adaptation measures. It brings together the latest insights from research and practice, supplemented by case studies. The Guide is not intended to be read cover to cover as it brings together a large volume of information, but it distils key points and signposts the reader to more information, resources and tools where required.

Risks from climate change

As the evidence on climate change grows, so does our understanding of the risks to forest and woodland from extreme weather events and changes in temperature and moisture regimes. Many of these risks were detailed in the Government's *Climate Change Risk Assessment* report (HM Government 2022) published at the start of this year. The report builds on evidence and advice published in the Independent Assessment of UK Climate Risk in June 2021, led by the Climate Change Committee. For the 3.1 million ha of existing woodland in the UK and the new woodland at the design stage, planning for the risks resulting from climate change is paramount for those ultimately responsible for management.

The Practice Guide introduces the risks and opportunities that the changing climate poses to forest and woodlands, from both gradual changes and more frequent extreme events. The focus of the Guide is on the risks of climate change rather than opportunities, which are comparatively limited. The types of

risk and their severity vary depending on geographic region and particular woodland location and include the impact on tree growth of milder, wetter winters with possible waterlogging, warmer summers with consequent increased drought and wildfire risk, and for coastal areas with sea level rise. There are also secondary or indirect risks associated with climate change such as new or more severe outbreaks of pests and diseases, which may also be more of a problem if trees are stressed (Seidl *et al.* 2017).

The extent to which the level of risk is acceptable or not will vary depending on owner and manager. Land managers range from commercial timber producers and multifunctional managers to more eco-centric managers, with other types in between (Ambrose-Oji *et al.* 2018, 2019), and will differ in their objectives and the extent to which they wish to balance new approaches with more established techniques. In short, different adaptive responses are appropriate for different risks, management objectives and timescales, so owners and managers should assess their risks before selecting adaptation measures (outlined in the Climate Change Adaption Factsheet; www.forestresearch.gov.uk/publications/climate-change-adaptation/). Sections of the new Guide cover each of the main risks from climate change to forests and woodland in the UK: wind, wildfire, drought, flooding and waterlogging, frost damage, and pests and diseases. There is also a specific section about risks to ancient, semi-natural and native woodlands.

Raising awareness of adaptation possibilities

For several years, tree species diversification has been considered one of the main ways to adapt forests and woodland to the future climate. This spreads risk by incorporating a range of different tree species from a palette of those which have a proven track record and/or look promising for future climate conditions. Species diversification is an important part of an adaptation strategy. However, as global emissions continue to rise, climate trends track the high end of climate projections and we experience their impact, such

as increased droughts, pests and tree disease outbreaks in our forests and woodlands, a much wider approach is clearly required. This approach should be underpinned by an awareness of medium and long-term climate risks (at local level) and an understanding of the range of different adaptation measures that can help to reduce them. This is important to inform decision-making (Ambrose-Oji *et al.* 2018, 2019) and action on the ground through the integration of adaptation measures into management plans. The Practice Guide provides a framework for adaptation and information on the possible actions.

Adaptation measures

Once the risks have been assessed, the next step is to select adaptation measures (Box 2), and several measures may need to be combined. Woodland management plans should identify the main risks and which measures are required. Once measures are implemented, monitoring is vital to build knowledge and inform future decisions and management practices. Examples of these measures and their real-world application are described in a set of case studies that are available with the Guide (see Examples section, below). They describe a wide range of situations where woodland managers have already assessed the risks, and chosen and started to implement adaptation measures, using parts of the Adaptation Framework.

Case study examples

In Scotland's central region, Queen Elizabeth Forest Park is one of the case studies supporting the Guide as a 'climate-ready' demonstration forest. Forestry and Land Scotland district staff, researchers and policy leads have worked together to understand the potential impacts of climate change, particularly an increasing frequency of storm events and increased winter rainfall. Tree species diversity is being increased through strategic planning, diversifying the range of novel conifer species planted, restoring ancient woodlands, increasing the area of native woodland and increasing the area of productive broad-leaved species. Suitable areas have been identified for long-term retention and for conversion

Box 2 The 10 main adaptation measures presented by the Practice Guide

1. Increasing tree species diversity, including using a wider range of species both in stands across landscapes and within stands. This has potential for increased biodiversity, improved productivity and a range of other benefits.
2. Using mixed-species stands, which can reduce several climate risks and improve overall performance through complementarity in resource use, depending on the location, site and species mix.
3. Provenance choice, which encompasses selecting appropriate seeds or plants for the site and local climate to reduce risks from drought, frost and pests and diseases (requires supplementary expert advice).
4. Encouraging natural regeneration through management to provide conditions for seed production and removing grazing pressure.
5. Diversifying stand structure to create a more varied age structure, for example through continuous cover forestry (CCF) approaches, potentially alongside other adaptation measures.
6. Establishment and management methods to address a range of risks while also reducing carbon losses at establishment. Recognising that planting methods, timing and weed control measures may need to change given milder winters and drier spring conditions.
7. Changes to stand thinning, where initiated early and appropriately to help reduce various risks, while providing opportunities to implement further adaptation strategies such as conversion to CCF approaches.
8. Contingency planning to identify and plan for risks, particularly extreme events such as wildfire or windstorms, which have a high impact but relatively low probability. Contingency plans can improve response time, reduce recovery time and add benefit by aligning with wider frameworks, such as local and national contingency plans.
9. Adapting infrastructure such as forest roads, drainage and fencing may need to be modified for future weather conditions and changes in management operations. When preparing for more disruptive storms and more frequent wildfires, for example, it will be essential to ensure that access, safety and communications can be maintained.
10. Creating new 'climate-change-ready' forests and woodlands through forest and woodland design and management which take climate change into account. Larger, better-connected woodlands with careful tree species choice in the design tend to be more resilient than smaller woodlands, and can help wildlife adapt.

to continuous-cover forestry to increase structural diversity and areas of the forest are being managed for high wind risk and for slope stability to reduce the incidence and impacts of landslides.

A case study from south east England explains how changing fire risk is being addressed in Swinley and Crowthorne Forest in Berkshire. The forest falls within the Broadmoor to Bagshot Woods and Heaths Site of Special Scientific Interest and Thames Basin Heaths Special Protection Area and includes a mixture of rotational forestry

plantation, secondary woodland, lowland heathland and ponds. In 2011 a major fire broke out, damaging large areas of the forest (Oxborough and Gazzard 2019). As well as open habitat damage, the fire reduced the quality of some of the timber stands and seed trees that had been retained in continuous-cover forestry approaches. Forest plans have been redesigned to address the increasing fire risk, and measures implemented. For example, new rides (i.e. tracks or corridors of open space) have been created to act

“ The Practice Guide features recommendations with links to research and information via the Forest Research website. We are developing a Forest Research Climate Change Hub, available later this year. ”

as fire breaks, which have additional benefits for wildlife, and fire belts have been planted with sweet chestnut, birch and oak to fragment stands of conifers and reduce the potential intensity of any future fires.

Lessons learned in developing the framework

We started with extensive evidence-gathering to better understand what is known, what is uncertain and what practitioners are doing in the field of adaptation for forests and woodland management. Early iterations of what is now the Practice Guide started out as a long, research-focused document, which was detailed and heavily referenced. However, this resulting document was considered by stakeholders to be too long and unwieldy; there was consensus that the intended users (practitioners) would prefer more practically focused advice. As a result, we distilled the work into recommendations with links to research and information via a landing page on our website. We are building on this further by developing a Forest Research Climate Change Hub, which will be available later this year, to facilitate knowledge exchange on adaptation and encourage the changes in woodland and forestry practice and management that are urgently needed.

Divergence in opinions remain about how best to approach adaptation of forest and woodland to the future climate and these can be linked to landowners' primary objectives or the lack of suitable or consistent evidence. However, given this uncertainty it is necessary that a range of available approaches should be identified rather than focus on a restricted set that might ultimately reduce resilience. In future it will be useful to capture where lessons can be learned from trying, from the success or failure of different measures, and through sharing the experiences across the forestry and woodland management sector.

Future knowledge exchange

The Guide covers the main individual risks from climate change to forests and woodland in the UK, but future revisions should seek to consider appropriate adaptation measures for combinations and interactions between risks, where evidence is emerging.

We are working hard within Forest Research and with our partners to better understand sustainable forest management in light of environmental change to provide an improved evidence base for the adaptation actions suggested and to underpin policy and practice. The Practice Guide is part of this wider programme of work within Forest Research (see www.forestresearch.gov.uk/about-us/frcore-research/). This includes our popular series of Forestry and Climate Change Factsheets, which are available on the Forest Research website, and the forthcoming Climate Change Hub. Our core research programmes for 2021–2026 are outlined at www.forestresearch.gov.uk/about-us/core-research-programmes-2021-26/. Planning for the future climate will need to be continual and requires those responsible to undertake regular monitoring and review of their local climate change projections. Our understanding of risks and potential adaptation measures will be enhanced as we gain more knowledge from researchers in the UK and elsewhere, and from practitioners.

Feedback

Forest Research developed the Guide with contributions from many colleagues, other researchers, practitioners, managers and landowners across the UK. We would value your feedback, experience and suggestions for new case studies or future editions. The Guide can be downloaded from www.forestresearch.gov.uk/publications/adapting-forest-and-woodland-management-to-the-changing-climate/.

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Marine Nature-based Solutions: Time to do Better and Think Bigger

Figure 1. View of the whole Wallasea Island managed realignment site, 2019. Photo credit: RSPB.



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Keywords: coastal, creation, habitat, resilience, restoration

The term nature-based solutions (NbS) encompasses a range of possible actions, from directly creating or restoring habitats to managing human pressures to support ecological recovery. Here, we describe the variety of NbS for marine and coastal environments. We explain what has been learned and outline what must happen now if ambitions for biodiversity improvement and climate change adaptation are to be realised. Progress has

been modest but many projects have been implemented that provide valuable lessons for the future. We need to build on that foundation, do more, think bigger and move with greater urgency.

Introduction

Many definitions of nature-based solutions (NbS) have been produced over the years, but two that deal specifically with coastal and marine environments are:

- “measures which protect, sustainably manage and restore coastal and

marine ecosystems in ways that address societal challenges effectively and adaptively” (Lecerf *et al.* 2021)

- “actions that use marine features to protect, enhance or restore biodiversity, deliver climate change mitigation, and/or adaptation and resilience to climate-related impacts, and realise benefits for people and nature” (Marine Management Organisation 2021).

These definitions are broad and encompass a wide range of possible actions. They include practical measures to create and restore habitats that can mainly be implemented for coastal habitats such as salt marshes, mudflats, seagrass meadows, kelp forests,

shellfish beds and dune systems. They also include site management measures to remove or reduce damaging marine activities and take pressure off existing habitats and species.

With NbS having such a broad definition, the term can mean different things to different people, depending on perceptions and priorities. Also, because past anthropogenic influences play such a major role in our environment, there are different perspectives about what constitutes 'natural' when identifying the best and most sustainable NbS.

What is clear, though, is that NbS need to be effective, meaningful and beneficial. Many marine and coastal NbS can, for example, contribute to climate mitigation through carbon sequestration, and help mitigate flood risk and coastal erosion as well as providing many wider societal benefits such as nutrient assimilation, fish production, improved seascapes and areas of recreational and health value. The types of NbS and the benefits they can accrue are explored here, and recommendations made for the future of marine and coastal NbS.

Habitat restoration

Broadly, the main methods for habitat restoration include:

- managed realignment: realigning coastal defences to create intertidal habitats on low-lying land (often historically claimed from the sea)
- coastal intervention: influencing or adjusting coastal processes to change environmental conditions to protect habitats or promote their recovery
- sediment recharge: replenishing deteriorating habitats, islands and barriers with sediment, including silt, sand, shell and/or shingle (as appropriate to the habitat in question)
- habitat recreation: techniques such as reintroducing keystone species (e.g. seagrass, kelp or native oyster *Ostrea edulis*) or altering the seabed substrata to restore habitats.

There are also many smaller-scale and complementary measures. These include enhancing habitats (e.g. clearing vegetation to facilitate bird nesting) or installing artificial features (e.g. building bird nesting platforms on infrastructure or adding reef blocks to the seabed). Within and across these broad categories, an extraordinary variety of techniques have been applied across different environments over the last 30

years. The scale and net benefits of these have also varied greatly, from impressive landscape-scale initiatives achieving distinctive and extensive benefits to small-scale proof-of-concept trials.

These completed projects have shown what can be achieved while illustrating the challenges, successes and multiple benefits that NbS brings. The range of techniques, and the implications for the future in each case, are discussed further below with reference to case examples.

Managed realignment

Of all the coastal habitat restoration techniques, the most impressive advances (and generally the greatest benefits) have been achieved through the managed realignment of coastal defences. The first UK managed realignment was completed at Northey Island in 1991 as a trial. In the years since, the scale and ambition of these projects have increased substantially. Around 77 have now been completed in the UK, with dozens more across northern Europe (see www.omreg.net).

In the UK, these projects have restored over 3000 ha of coastal wetland and improved the sustainability of many kilometres of sea defences. This has included the implementation of remarkable landscape-scale projects at sites like Wallasea Island, Essex (Figure 1), Steart Marshes, Somerset and Medmerry, West Sussex.

Wallasea is an 800 ha European rewilding site that achieved extensive benefits. Its implementation anticipated, and mitigated for, extensive damage from future flooding. It restored large expanses of mudflats, marshes and coastal grassland as well as a microtidal wetland, unique in the UK, which mimics habitats in the northern Mediterranean (in anticipation of climate change increasingly pushing bird species from southern Europe to the UK).

Steart Marshes covers 260 ha, and recent surveys indicate it is sequestering 18 times the level of carbon trapped in mature salt marshes (Wildfowl and Wetlands Trust 2020). Medmerry is a superb example of working with nature. Uniquely, it is a major realignment through a coastal shingle barrier and the first realignment to meet the IUCN's Global NbS Standard.

Even these achievements, however, are underwhelming in the face of national and international needs. They are

not confronting broader biodiversity declines, or fully addressing shoreline management actions. About 70% of the 3000 ha of restored habitat was actually compensation for losses of habitat elsewhere in protected areas. Also, hundreds of kilometres of coastal defences include managed realignment as the shoreline policy, yet only a fraction has been implemented so far.

Recent mapping exercises by the Marine Management Organisation (2019) and Natural Resources Wales (Armstrong *et al.* 2021) indicate the potential for future habitat creation. These studies identified thousands of potential realignment sites covering over 250,000 ha in England and Wales. Some of these potential sites are enormous, and some may be impractical, but this work indicates the potential that exists to sustainably reshape the coastline and create more valuable coastal habitat.

Coastal intervention and sediment recharge

In contrast to the landward adjustment of coastal defences (with which the term managed realignment is now generally synonymous), opportunities also exist for intervening more directly on the coast. There are many examples of breakwaters or groynes being installed or beach nourishments being pursued to stabilise or advance an intertidal zone to provide coastal protection and wider benefits.

One recent large-scale example is the 'sand-scaping' project at Bacton, Norfolk. In 2020 1.8 million m³ of sand was used to build up the beach and protect an oil terminal in a way that integrates with existing coastal processes to feed sand dune systems and beaches. There are also major features such as Hurst Spit, Hampshire, which is maintained for flood protection and visitor access but has protective benefits for the habitats behind. There are also examples of human-made, often historically constructed, structures protruding into the sea that have an indirect habitat protection and/or sediment-trapping function (even if that was not the reason for their construction).

At smaller scales, there are several examples of brushwood fences and similar structures being constructed to protect salt marshes and mudflats. They often have a limited lifespan, require frequent maintenance and only work where physical and sedimentary

conditions are appropriate. So, care needs to be taken when using this approach.

Another valuable tool for protecting, or even expanding, existing habitats is to use dredged sediment. Sand is often used for beach nourishment (as in Bacton), but comparable NbS measures to 'recharge' habitats using fine sediment on salt marshes or coarser shingle on barriers and islands are less common and smaller in scale (and their benefits) because of technical, financial and regulatory challenges (Manning *et al.* 2021).

A range of different recharge projects have been implemented, however. Recent examples include major shingle recharge initiatives at Horsey Island and Mersea Harbour, Essex, completed in January 2022. At another site in Lymington, Hampshire, salt marshes protect the harbour but are retreating rapidly and are likely to be gone by the middle of this century. Several practical and novel recharge measures have therefore been, and are being, pursued by interested parties (e.g. Lymington Harbour Commissioners and the Solent Forum) to recharge these marshes, delay their loss and buy time for adaptation.

For any interventions there can be concerns about 'naturalness' and sustainability with a reluctance to pursue active intervention in favour of preserving features in an existing or perceived natural condition. Also, high burdens of proof are placed on human interventions, especially in sensitive locations. This is understandable and important, but it can limit the options available. In reality, the boundary between processes and human interventions is indistinct, and a combination of the two contributes to ongoing coastal change.

Ways to address these issues and achieve more flexible and adaptive strategies will be needed if more NbS projects are to be realised. For example, around 20 million m³ of sediment is dredged from ports and harbours for navigation purposes every year, yet only a few thousand cubic metres are used for NbS annually. The potential for doing a lot more with this resource is immense, if the challenges can be addressed.

Habitat recreation

Over the last few years in the UK there has been a growing drive to restore intertidal and shallow subtidal habitats. New initiatives include restoring seagrasses meadow or native oyster beds (Figure 2). Several seagrass projects are



Figure 2. Increasing effort is being directed towards restoring seagrass, native oyster and kelp habitat. Photo credit: Andrew Pearson Photography.

underway that involve planting shoots or seeds at carefully selected receptor locations. Project Seagrass is leading and supporting many schemes, including a major initiative at Dale in South Wales. The Isle of Wight Wildlife Trust with Boskalis Westminster and the ReMEDIES project, led by Natural England with the Ocean Conservation Trust, are also seeking to improve several seagrass beds.

In recent years many partner organisations have been working to restore native oyster beds by introducing brood stock adults, juvenile spat or managing seabed habitats. For example, the Essex Native Oyster Restoration Initiative (ENORI) has a 2 km² 'restoration box' where mature oysters and hundreds of tonnes of 'cultch' (gravel and shell) have been placed and are being monitored. Blue Marine Foundation are seeking to restore native oyster in the Solent and elsewhere while in Dornoch Firth, Scotland, the Dornoch Environmental Enhancement Project (DEEP) is restoring oyster beds which were fished to extinction. For the latter project, around 20,000 native oysters were laid on shell material in a bid to ultimately make the beds sustain 4 million oysters in a 40 ha area.

Two other notable initiatives include Stronger Shores and ECO-CoBS, funded under the new Flood Innovation fund. They are exploring ways of enhancing the coastal resilience in the north east and north west respectively by developing new NbS methods to

restore salt marshes, seagrasses, native oyster beds and kelp habitats while strengthening the evidence base.

These projects are still in their early stages. Only around 3 ha of seagrass bed has been restored so far and meaningful native oyster projects are in their infancy. However, new lessons are being learned and, as confidence in the techniques grows, ways of delivering at larger scales are being explored. To facilitate this, the Environment Agency recently produced handbooks on salt marsh (Hudson *et al.* 2021), seagrass (Gamble *et al.* 2021) and native oyster restoration (Preston *et al.* 2020).

Site management

In addition to direct habitat restoration, it is vital also to actively manage sites to protect existing habitats and/or to ensure they can recover. Such pressure-reduction measures include:

- designating Marine Protected Areas (MPAs) to protect habitats and species from activities and developments
- managing/excluding damaging activities such as bottom trawling or reducing water quality impacts to facilitate the recovery of ecosystems and dependent food webs
- oversight and wardening to manage issues within an area (e.g. disturbance to sensitive bird populations) and facilitate public education and engagement.

Such management can be critical for ensuring the success of inshore restoration projects. Seagrass restoration, for example, will only work if the damaging factors which prompted the decline of historic meadows are removed. These pressure-reduction actions are also the main ones available for protecting offshore environments. We know that marine habitats often recover if conditions are right and they are left alone. Designating MPAs and then managing them is critical for achieving this.

Recent examples of this include fisheries exclusion byelaws enacted by Sussex Inshore Fisheries and Conservation Authority (IFCA) and the UK Government. The former excludes bottom trawling from a 304 km² area to facilitate recovery of a deteriorated kelp forest while the latter will protect the Dogger Bank Special Area of Conservation from bottom-towed fishing gear.

This kind of fisheries exclusion will be increasingly important for protecting MPAs and other areas of the seabed. To help realise this, the UK Government has proposals for piloting Highly Protected Marine Areas (HPMAs), where damaging activities will be prohibited, by the end of 2022. Internationally, there is a campaign for 30% of global seas to be protected by 2030. This would be a major advancement, but it requires strategic planning, clear goals and collaboration between stakeholders and seabed users. It will also need transnational cooperation, for example to manage foraging sites for migrating bird species.

What should happen now

Many valuable NbS have been completed and new proofs of concept are emerging. However, there is now an urgent need to do more and at larger scales to address the threats posed by climate change and confront marine biodiversity declines.

The potential to do more is evident. Large swathes of the coastline can still be realigned, far more dredge sediment could be used to build up coastal habitats and many areas of the sea could be better protected. The UK Government's 25 Year Environment Plan and the new (English) Environment Act 2021 set ambitions to do more and achieve Biodiversity Net Gain. How this is done under the evolving policy landscape is now the critical

consideration. It will require clear policies, improved regulations and workable methods including transparent and fair metrics for achieving net gain.

The Marine Management Organisation (2021) also recently reviewed how regulatory mechanisms could be improved to maximise NbS delivery. This review, led by ABPmer and supported by a stakeholder survey, provided several recommendations, including:

- improved and more flexible planning
- clearer targets
- dedicated funding sources
- funding guidance
- trained and dedicated NbS case officers and policy-makers
- improved communications with stakeholders and the public to raise awareness and engagement
- delivering more NbS pilot schemes (including at large scales).

Another recommendation worth emphasising is the need to have better, more standardised monitoring and lesson-learning. Monitoring of NbS has been inconsistent and the results often poorly communicated. Most communication happens when a project is consented or implemented, but the outcomes after several years are not as clearly disseminated (if indeed monitoring is done at all). Future projects and aspirations for change will be better served by implementing more thorough and consistent lesson-learning processes, perhaps enforced through consent conditions. Emerging technologies also offer improved ways to do this (e.g. environmental DNA, drones and underwater videos).

Improved and standardised monitoring should also be directed at better understanding and communicating the multiple benefits of NbS. Many knowledge gaps exist when it comes to valuing benefits and deriving natural capital accounts. Targeting monitoring at these gaps will help with better predicting the benefits of NbS and determining the best and most meaningful approaches to take forward. For example, new large-scale managed realignments should be planned now, where their prime motive is delivering substantial carbon sequestration and nutrient assimilation targets. The evidence exists, but we need urgent agreement on the science.

Ultimately, to meet the challenges of the present and future, we now need

to deliver more NbS at much greater scales, and in ways that provide much larger societal benefits. To achieve this, a clear and integrated strategic delivery process is required, where there is always a 'pipeline' of projects planned or underway, underpinned by coherent lesson-learning and communication.

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Ecosystem Modelling to Prioritise Nature-based Actions: Making Anguilla a Safer, More Biodiverse Island



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In the Caribbean UK Overseas Territories, nature-based solutions are a critical component of coastal protection. This paper introduces some of the key natural habitats that can be restored to form significant nature-based solutions to coastal flooding, demonstrated using a case study from the island of Anguilla. This innovative project implemented nature-based solutions to help protect Anguilla's biodiversity, local livelihoods and island infrastructure.

Why are nature-based solutions important?

Global climate change forecasts predict an increase in the frequency of severe storms occurring in the Caribbean region and raise concerns about the risk of sea level rise to low-lying Caribbean islands such as the UK Overseas Territory Anguilla. The International Panel on Climate Change (IPCC) has recommended that small island states, such as Anguilla, should focus their efforts on enhancing their resilience to climate-related disasters and implement appropriate adaptation measures as urgent priorities.

Important coastal habitats in the Caribbean

Certain habitats are critical to enhancing the resilience of coastal areas in the Caribbean UK Overseas Territories. These include mangroves, coral reefs, sand dunes and salt ponds.

Reef–mangrove–salt pond complexes

In the Caribbean, mangroves often form part of reef–mangrove–salt pond complexes, which are crucial to the economy and well-being of over 134 million coastal residents (Patil *et al.* 2016, UNEP-CEP 2020). Salt ponds occur in coastal mangrove wetlands and are typically hypersaline, with salinity levels of at least 5% (sea water is typically 3.5%).

The combined reef–mangrove–salt pond ecosystems are one of the most threatened ecosystems on Earth, largely due to coastal development and other anthropogenic activities. They are dynamic systems reliant on specific hydrological evaporation and sediment transport processes. They are particularly important habitat and food resources for migratory and resident birds (Scott and Carbonell 1986) and contribute to the wider range of ecosystem services provided by mangrove ecosystems, including shoreline stabilisation, nutrient filtration, carbon sequestration, flood protection and as a source of food, medicine, fuel and building materials (Tomlinson 1986, Giri *et al.* 2011). They support important industries, in particular fisheries and tourism. The value of the protection that mangroves provide by slowing the incoming wind and water in the Caribbean is estimated at US\$23,000–45,000/ha (Beck *et al.* 2020). As a highly effective blue carbon sink (Donato *et al.* 2011), they are also important in relation to international agreements in reducing greenhouse gases.

In the Caribbean, coral reefs support over 60 species of coral and 1500 species of fish (World Resources Institute 2006) and provide a range of goods and services including fish and shellfish, tourism, recreation and coastal protection. Reef systems typically dissipate around 86% of the energy associated with storms, vastly reducing the potential impact on coastal communities (Franklin *et al.* 2018). Nearly 70% of Caribbean coral reefs are threatened by human activities. Previous modelling in Anguilla (Williams *et al.* 2017) has demonstrated that coral reefs have the potential to provide flood risk reduction up to 500 m inland and protect homes, infrastructure and tourism developments.

Dunes

While reef systems typically dissipate around 86% of storm energy, dunes are vital to reducing the impact of the remaining 14% (Franklin *et al.* 2018). For this reason, they are highly valuable for protecting inland areas from storm surges and flooding during hurricanes by attenuating wave energy and slowing inland water transfer (USACE 2013).

Storms can damage dunes by removing sand, therefore lowering their height and reducing their coastal protection value. This can be exacerbated by vegetation loss (Durán and Moore 2013) so restoration of damaged and degraded dune systems has an important role to play in coastal resilience.

The Anguilla coastal resilience project

Anguilla is a UK Overseas Territory located in the northern Lesser Antilles. It is a low-lying limestone island about 25 km long and 5 km wide that depends economically on tourism. Tourist developments are often situated on the coast. Anguilla is particularly vulnerable to flooding from storm surges and heavy rainfall. Recent hurricanes and the slow effects of rising sea levels have caused significant coastal degradation together with extensive coastal development and illegal sand mining. Figure 1 shows Cove Bay in the south east of Anguilla. Cove Bay has some of the best examples of intact coastal dune systems but like much of the island has suffered from illegal sand mining activities and degradation of habitats.

In response to this, in 2019 the Department of Disaster Management, the Department of Natural Resources and the Anguilla National Trust, working with Environment Systems, were awarded UK Darwin Plus funding for a project to improve Anguilla's coastal ecosystem resilience to climate change.

The project used innovative mapping and modelling to:

- demonstrate how well coral, seagrass, mangroves, dunes and salt ponds reduce flood risk from storm surges
- illustrate vulnerability of the coast to flooding as a result of storm surges and how existing natural capital can reduce this risk
- locate sites that are biophysically suitable for the restoration or establishment of coastal habitat to improve coastal resilience to storm surges
- prioritise these sites and establish a planting programme with ongoing monitoring
- model the effects of planting to demonstrate the potential outcomes arising from adopting nature-based solutions.



Figure 1. Cove Bay in February 2022, one of the restoration sites, has one of the last (semi) intact sand dune systems on Anguilla, on the south of the beach. Photo credit: Katie Medcalf.

The majority of existing storm surge models require extensive volumes of meteorological data to accurately predict the path of a hurricane and tend to focus on ‘live’ storms to inform communities that may be at risk. In contrast, this project modelled the general effect of storms and sought to identify the level of likely risk of damage to coastal areas based on historical storm data.

The input data for the model included the following.

- One hundred years of historical hurricane data from National Oceanic and Atmospheric Administration (NOAA) (data available at www.ncei.noaa.gov), describing the speed and direction of all recorded hurricanes within a 160 km radius of Anguilla, were consolidated to establish the typical direction and speed of hurricanes.
- Data on ‘ground seas’ (winter storms) were also considered. These are important to include in the modelling as they approach the coastline from a different direction to the normal hurricane tracks, mainly from the north east.

- Data relating to terrestrial and benthic habitat, topography and fetch (a proxy for how sheltered/ exposed the coast is) were also obtained as they are factors in determining coastal resilience and the value of the natural capital.

The input data were scored from low to high based on how effective they are at reducing the energy of an incoming storm surge wave. A key output of the modelling is a flood risk assessment for the whole island. An extract is shown in Figure 2.

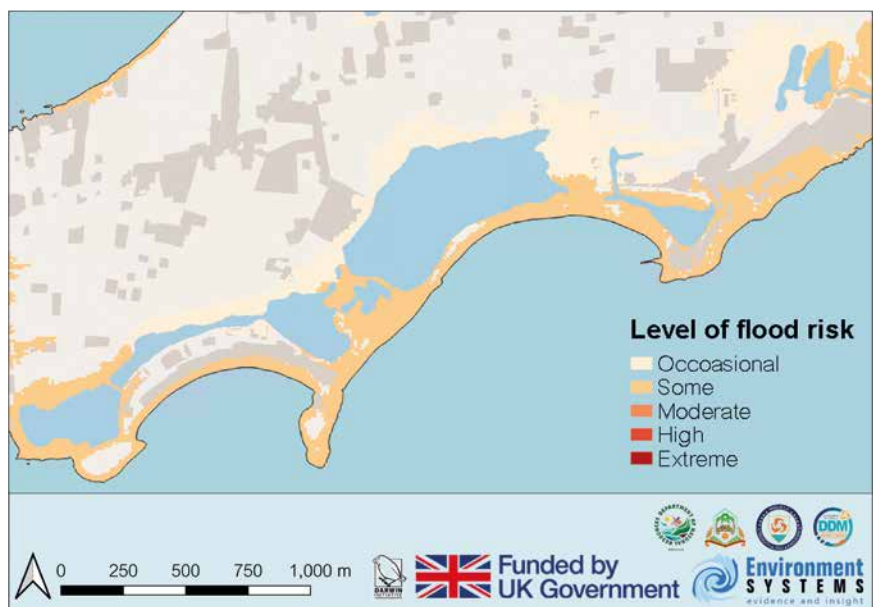


Figure 2. Flood risk in Cove Bay from coastal storm surges.

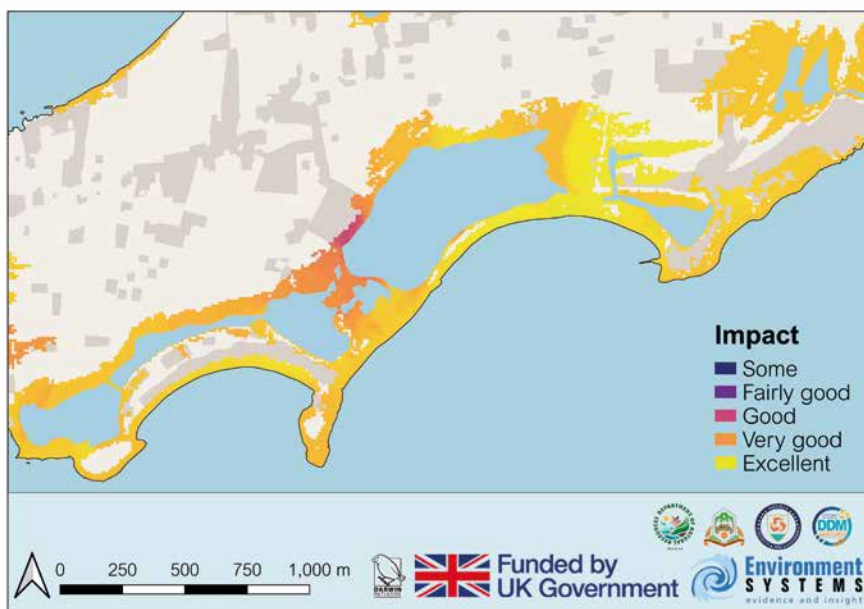


Figure 3. Impact of predicted improvements in Cove Bay, if sand dune restoration is carried out, on reducing storm surge vulnerability.

Opportunities for nature-based solutions on Anguilla’s coast

The coastal areas were investigated for their potential to support nature-based solutions using Environment Systems’ natural capital tool SENCE (Spatial Evidence for Natural Capital Evaluation). The analysis identified and mapped all parts of the coastline with the biophysical characteristics to support key species or habitat types that reduce the impact of storm surges (Figure 3).

Before and after scenarios

To demonstrate the impact of the restoration of coastal habitats the

storm surge model process was rerun with the same input parameters and scoring but assuming that all the nature-based solutions had been implemented. It was clear that there were substantial benefits to be gained by coastal communities, with reductions in flooding extending up to 750 m inland (Figure 4). These scenario and opportunity models were used to identify the extent of mitigation and restoration action required to restore ecosystem resilience at key locations.

Prioritisation of key sites

Using the results of this analysis, the project partners drew up a priority list

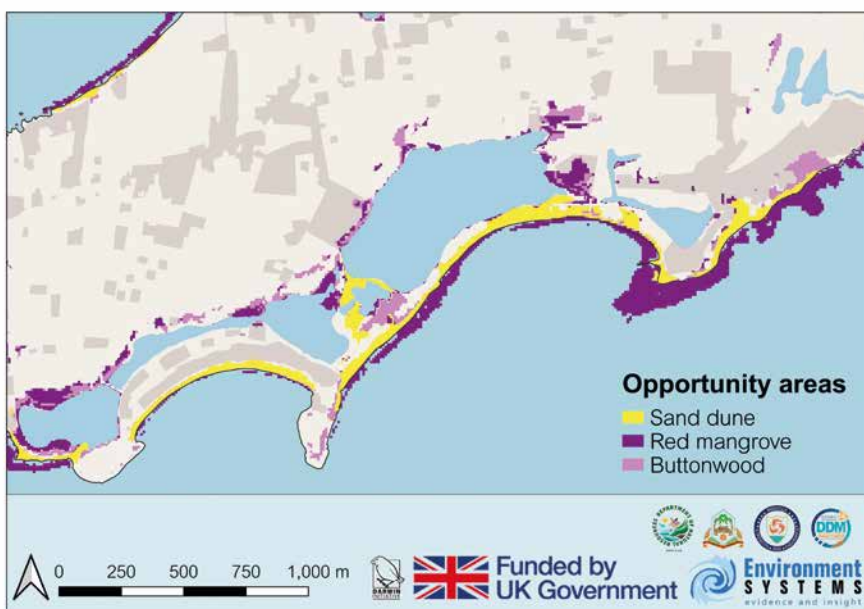


Figure 4. Opportunity areas in Cove Bay for establishing/enhancing coastal habitats.

for restoration, with seven key sites identified. For each site, a conservation action plan was developed. The modelled biophysical maps of suitability for the habitats and key species were critical for identifying key sites, but a period of on-site assessment was then required, particularly of existing vegetation, water salinity and pH, to ensure that species could be matched closely to the site-specific conditions.

As well as sourcing seeds of local provenance and propagules from the restoration sites, other similar sites were used as sources. These were as closely aligned as possible to the conditions of the restoration sites.

Establishment of a nursery

A seedling nursery for native coastal vegetation was established within the grounds of the Department of Natural Resources’ Agriculture Unit. This provided a dedicated space for the propagation of the species chosen for restoration of the coastal habitats, including red mangrove, white mangrove, black mangrove, buttonwood and seagrape. Propagation techniques included establishment from seeds, harvesting seedlings and air layering.

Initial challenges were low survival rates of newly planted mangroves. Through discussions with regional partners (Jost van Dykes Preservation Society in the British Virgin Islands and the Grenada Fund for Conservation), the climatisation process was adjusted and pre-planting protocols were implemented; these included introducing salt water to the plants in the nursery at least 2 weeks prior to planting out and moving them into sunnier locations so that they became acclimatised to the sun. This demonstrably increased survival rates. A best practice guide is being developed for both mangrove and sand dune restoration.

Restoring the coastal habitats

Community groups were trained in coastal mitigation and restoration protocols and the project has had involvement from over 200 residents from community, school and youth groups. It is important to give local communities an understanding of what the project set out to achieve

and involve groups to provide a sense of ownership and pride in restored areas. For example, to mark National Enhancement Day, the Little Harbour community helped with the air layering of buttonwood trees and also planted out potted buttonwood trees grown in the nurseries. The project ethos is that the more that local communities understand the role that dunes and mangroves have in protecting their livelihoods, the more likely they are to engage with protection of natural capital and its restoration. Figure 5 shows local project staff with school groups and youth ambassador programmes. The project officially ended in spring 2022, but the nurseries are still being used to provide mangrove and dune species with ongoing planting activities. There is support from local volunteers and input from a recently

started project to enhance pollinator resources (Rewilding: Anguilla’s Pollinators Project 2021).

Monitoring effectiveness

A monitoring plan was established and is ongoing. For each of the restoration sites there is recording of both survival and growth of the plants and documentation of the improvement in the quality of the habitats over time. Fixed-point photography is being used to record changes in the vegetation. Monitoring takes place every 6 months by site visit and early results of survival rates up until August 2021 were good (Table 1).

Key findings and lessons learned

The mapping and modelling were key to understanding the role coastal habitats play in protecting Anguilla

Table 1 Survival rates of mangrove species.

Species	Survival
Red mangroves	62%
White mangroves	75%
Black mangroves	83%
Buttonwood	83%
Seagrape	72%

and to help prioritise sites for actions. The models show that restoration and protection of mangrove species, coral reefs and sand dune communities along Anguilla’s coastlines reduce the risk of flooding and increase coastal resilience.



Figure 5. Community engagement with mangrove planting. Photo credit: Farah Mukhida.

The models showed that the most significant reduction in vulnerability, across all of Anguilla, is from restoration/establishment of sand dune communities although, in specific areas, the re-establishment of the reef-mangrove system would provide better protection. This was a crucial finding as the importance of sand dune communities is not well understood by local communities and dunes have been used as illegal sources of sand for building. Through local engagement and workshops the maps and models were used to show the value of coastal habitats and were important in raising awareness of policy-makers as well as community groups. Although this project has officially ended, work to enhance nature-based solutions is continuing in Anguilla with funding from other projects and an already active volunteer base developed through this programme.

Involving the community in restoration initiatives promotes a sense of ownership. More than 200 people have been trained in coastal mitigation and restoration protocols and been involved in planting. Local propagules, grown from seed sources on the island, were found to be best adapted to local conditions.

Making sure that the plants are well adapted to the local conditions and understanding the ecological tolerances of the species being planted is also key. For one of the sites, the salinity was too high for red mangrove, but black and white mangrove species fared better.

The restoration of Anguilla's coastal ecosystem using nature-based solutions not only enhances the resilience to storm events, but has the potential to enhance recreation, tourism, well-being and biodiversity. Community engagement has been a very positive aspect of the project and is considered key to its long-term success.

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Are you ready to take the next step in your career and demonstrate your distinction and high calibre? Are you an ambassador for the profession and a champion of the natural environment with a wealth of professional ecological and/or environmental experience? Then chartership may well be for you!

Our Chartered Ecologists and Environmentalists are experienced, well-established professionals at the forefront of work to protect and enhance the natural environment for the benefit of nature and society.

By being chartered, you will benefit from:



Personal recognition of your specialist skills and experience.



An enhanced professional reputation with colleagues, chartered professionals from other disciplines, and clients.



Enhancing your career progression and demonstrating your competence in a greater breadth and complexity of projects.



A post nominal you can display that acknowledges your greater level of competence.



Financial recognition – becoming chartered often comes with greater recognition through both salary and opportunity.

What's more, we've streamlined our chartership processes and introduced new entry points which means it's never been easier to apply for chartership.

Visit www.cieem.net/chartership to find out more about chartership and request an application form.

CIEEM Medal Winner 2022

Each year CIEEM's Governing Board approves the award of the Institute's highest honour, the CIEEM Medal, to a deserving recipient (who may or may not be a member). This year the Board decided that Mr David Tyldesley FCIEM FRTPI FRSA is an outstanding candidate who is well deserving of the 2022 CIEEM Medal.



David Tyldesley is regarded by many as the leading authority on interpretation of one of the primary legislative influences of the last 30 years

(i.e. the Conservation of Habitats and Species Regulations 2017) as well as a wide range of other environmental and planning policy/legislation. Indeed, he is synonymous with sound advice and guidance relating to much of the work of ecologists and environmental managers, with a reach across the UK and Ireland. But his influence extends beyond this role.

David is a Chartered Town Planner, a qualified Landscape Architect and one of the first people to have been awarded fellowship of both CIEEM and the RTPI in recognition of his outstanding contributions to both sectors. He is a prolific author, with texts ranging from *Birches, Badgers and Buttercups: Nottinghamshire's natural history* (1986) to the *Habitats Regulations Handbook* (2013).

To ecologists who began to practise in the late 1980s and early 1990s David was, and remains, a figure of calm authority and wisdom. His expertise in the role of local authorities in nature conservation was nationally renowned and universally respected, and is encapsulated in his publication *Gaining Momentum: An analysis of the role and performance of local authorities*

in nature conservation (1985). His training course on planning and nature conservation became the 'go-to' resource for professional ecologists working with the planning system at that time.

Active in the Local Government Nature Conservation Initiative in the 1990s, he was instrumental in the birth of the Association of Local Government Ecologists (ALGE). He authored, with Ian Collis, *Natural Assets: Non-statutory sites of importance for nature conservation*, which helped to kickstart an era in which the value of such sites was finally recognised, and indeed acknowledged in the 1994 PPG9 – *Nature Conservation*.

David was retained as a nature conservation and planning adviser by various statutory nature conservation bodies, advised national governments on related issues and was an approved contract consultant to Natural England, Natural Resources Wales, Scottish Natural Heritage (now NatureScot) and the Northern Ireland Environment Agency, undertaking research into, for example, the feasibility of introducing Biodiversity Net Gain into the English planning system. Between 1999 and 2005 he was commissioned by various bodies, including the government and NGOs in England and Scotland, to work across sectors to advise on the potential shape of a new marine spatial planning regime based on an ecosystems approach. This work influenced the marine planning system we have today, as embodied in the Marine and Coastal Access Act 2009.

He was renowned for his public inquiry work, notably a notorious encounter with Donald Trump over a proposed golf course near Aberdeen, and for the major Dibden Bay port inquiry, and gained a significant reputation as an effective expert witness. Through his work he developed our industry's understanding and application of Habitat Regulations Assessment (HRA), Strategic Environment Assessment (SEA) and Environmental Impact

Assessment (EIA) in the UK and Ireland, wrote authoritative guidance on the assessment of plans and projects under HRA, and also acted as a peer reviewer of others' work. He was the original author of the Scottish Natural Heritage EIA Handbook.

Over the years David began to focus increasingly on work related to HRA. David, increasingly assisted by Caroline Chapman FCIEM, authored many seminal pieces of guidance and was frequently called upon to provide advice on sensitive matters and controversial casework; his balanced and steadying hand having quietly guided many statutory decision-making processes.

As he started to wind down his working hours, Brexit loomed on the horizon and David provided a significant pro bono input to work being taken forward by CIEEM and the UK Environmental Law Association (UKELA) to influence the ongoing narrative. David still continues to be an active member of UKELA's Nature Conservation Working Group. For many years David also chaired the Judges Panel for CIEEM's Best Practice Awards and he has regularly contributed to working groups reviewing and updating the CIEEM fellowship criteria and nomination processes.

David stepped down from his formal consultancy role in 2015 but has since maintained an active role as co-Director of DTA Publications where he takes a leading role on work to update and maintain the award-winning *Habitats Regulations Assessment Handbook* and *Journal*. As such, even in his semi-retirement years, David continues to quietly and effectively influence policy and understanding.

David will be presented with the Medal at the CIEEM Awards event later this month.

(Text largely based on information contributed by Lisa Kerlake CEcol FCIEM.)

Putting Staff First



John Condron
MCIEEM

Director, Ecology
Resources

Let me start by saying I never had any intention of starting a consultancy; it was a happy accident. When I went freelance in 2016, I got a good gig on the roads due to an enquiry via CIEEM's (then) Professional Directory. The work requests kept coming and my subbie friends helped cover it. Perhaps inevitably, the point came where Naomi (MCIEEM), my partner in life and business, and I decided it would be better to start employing staff. So, we took on our first employee, Amanda, in November 2017. Four years later, we are now a team of 34 full-time staff.

We decided at the outset to treat our staff the same way as we would want to be treated. We were lucky that our previous employer, FPCR Environment & Design, allowed us the flexibility to work around our young family and for that we will always be grateful. Before FPCR, we had both worked for plenty of bosses who were only interested in the bottom line, and we didn't want to fall into that trap. So we concentrated on certain initiatives that focus on the employee:

Birthday bonus

I remember driving to work one day on my birthday and saying to Naomi, "Wouldn't it be great if you got your birthday off? Like your own personal Bank Holiday." That was the first

thing we did, and all of our team get a 'Birthday Bonus' day off work. This small gesture is very popular. It is nice to have your special day recognised by your employer.

Duvet days

We offer all staff two Duvet Days a year where they can just ring up and take a day off, no questions asked. Not only is it very popular with staff, but it also reduces sick leave, so everybody wins. If you just cannot deal with work on any particular day, call in a DD and come back the next day, hopefully refreshed.

Christmas break

All Ecology Resources (ER) staff get 25 days, annual leave from the start of their employment. Separately, they also get two weeks paid leave at Christmas, immediately after the company Christmas party. There is little going on anyway, with most construction sites closed, so this is not a big deal for us financially, and it is comforting that we can all switch off for the festive period, especially after working so hard during the silly season.

1-2-1s

This isn't exactly new, but probably the single best investment we can make for our team is monthly 1-2-1 sessions, where they lead the discussion and raise any issues with their Team Leader. All 1-2-1s are fed back to our HR Manager who addresses issues promptly.

Structured appraisals

As we have grown, we have gone from an informal chat over pizza and a pint to a properly structured appraisal process each November. Staff get as much time as they need with their Team Leader to discuss their progress over the past 12 months, and their goals in the coming year, through SMART objectives (that is, Specific, Measurable, Achievable, Relevant and Time-Bound). This is a normal process in any decent company but a vital one to let staff know you are invested in their

future. This year, we will be introducing CIEEM's excellent Competency Framework Self-Assessment Tool to assist each team member identify where their skills are sound and where there is scope for development.

General respect

There is no gender pay gap at ER. We also support any other issues that are important to the team. For example, last year Bethany Hunt ACIEEM highlighted substandard female welfare facilities on some work sites, and her subsequent campaign has kickstarted an industry change, warmly welcomed by Sally Hayns and the CIEEM team.

I could go on blowing this trumpet: inflation-tracked pay rises, generous continuing professional development budgets, a well-being pledge, anonymous staff surveys, annual staff wildlife photo awards, paying for further education, an atmosphere of looking after each other, staff days out, an annual 3 day get together and investment in a 6 acre meadow for staff training. But I won't.

All of the above really does matter. Staff investment brings obvious rewards to everybody. Recently, our team's feedback has resulted in ER being bestowed not one but two Great Place to Work awards: **Best Small Workplaces for Staff Wellbeing 2022** and **Best Small Companies to Work for in 2022**. We are even more proud that ER is the only ecological consultancy in the UK to receive either honour; from multinationals to SMEs like ours. It seems we are doing something right and as we continue to grow we will maintain that ethos.

Contact John at: john@ecologyresources.co.uk



Action 2030: Our Year of Action on the Climate Emergency and Biodiversity Crisis



Amber Connett
ACIEEM

Policy Officer, CIEEM

You may have seen the words 'Action 2030' in your inbox, on your social media feeds and/or on our website. Action 2030 is our response to the climate emergency and biodiversity crisis. It is a project that will see CIEEM:

- achieve net-zero carbon emissions by 2030
- provide information and advice to members on how they can help to address the climate emergency and biodiversity crisis
- lead change to professional practice to reflect opportunities to address the climate emergency and biodiversity crisis
- promote the use of nature-based solutions
- build relationships and share knowledge with other relevant working groups.

The project is guided by a working group of members who provide advice and information to meet these goals. It is then delivered by all teams of the CIEEM Secretariat, our Standing Committees, Member Networks and wider membership.

We recently published our project report for 2021–22 which sets out the steps we have taken to achieve our goals in the last operational year. Some highlights from the report are:

1. Published our first Carbon Reduction Plan (CRP) which sets out our progress on achieving our target of net-zero greenhouse gas emissions by 2030, and further actions we will take to achieve the goal.
2. Created our own bespoke greenhouse gas calculator to track our emissions set out in the CRP.
3. Joined as a signatory to Pledge to Net Zero and signed up to the Professional Bodies Climate Action Charter.
4. Integrated Action 2030 and its purpose as a key theme of CIEEM's Strategic Plan 2021–24, and therefore a goal of every part of our work.
5. Began reviewing the sustainability of CIEEM events and developing a Sustainable Events Policy.
6. Moved to a smaller, greener, more energy efficient office in Ampfield, Hampshire.
7. Published Action 2030 group member Penny Anderson's detailed review of carbon and ecosystems. Read the report at: <https://cieem.net/resource/carbon-and-ecosystems-restoration-and-creation-to-capture-carbon/>
8. Met with representatives from the Climate Change Committee to present the findings from Penny's review paper and set out our views in the position statement on *Habitat Creation and Restoration for Tackling the Climate Emergency*.
9. Jointly hosted events on COP15, COP26 and nature-based solutions with the Institution of Environmental Sciences and British Ecological Society.
10. Published a statement on the UN Biodiversity COP15 and Climate COP26 meetings calling for transformative change and for the negotiations to happen in an integrated way.
11. Attended fringe events at COP26 and published a blog, *COP26 Was Not the Success It Could Have Been*, setting out the outcomes from the event and our thoughts.
12. Delivered three webinars, hosted by the Action 2030 group, on issues related to the climate emergency and biodiversity crisis.
13. Published seven blogs by Action 2030 group members to start conversations and thinking around how we can lead as a sector.
14. Published two *In Practice* articles from Action 2030 group members on blue carbon and carbon offsetting.
15. In January, we launched a **Member Pledge for 2022** which seeks to get 500 members signed up and committed to reducing their own operational impacts and becoming visible champions for change in society.

You can find the full report (with links to the publications listed) and further details of the Action 2030 project at <https://cieem.net/action-2030/>.

About the Author

Amber is CIEEM's Policy Officer. She is leading the delivery of CIEEM's Action 2030 project to help to deliver CIEEM's actions on the climate emergency and biodiversity crisis.

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Lead by

Example

As ecologists and environmental managers you know that the work you do every day is imperative to protecting and restoring nature.

But there is always more that you can be doing to further the cause and encourage others to do the same.

That's why we're asking you to make a pledge to reduce your own carbon emissions in both your professional operations, and your personal lives. This can be as simple as travelling less, working with other sectors to find shared solutions, raising awareness of climate and biodiversity in your local community or capturing more carbon in your garden.

By submitting a pledge, you will demonstrate what you want to champion within your team, to your employers or in the projects you're working on. You'll receive a digital pledge badge you can proudly display to show that you're taking action for climate and nature.



Small actions lead to big progress.

**So, what's your small
action going to be?**

Visit

www.cieem.net/2022-member-pledges

or scan the QR code
to submit a pledge.



Policy Activities Update

It's been a busy first half of the year for our Policy and Country Project Officers team, with several key consultations from Defra and Scottish Government, planning a programme of events for the All-Party Parliamentary Group for Nature, and publishing the results of our survey of Local Authority Capacity in Scotland.

We would like to thank Stephanie Wray CEcol CEnv FCIEEM for her 6 years as Chair of the Strategic Policy Panel. Steph helped to set up the Panel and has been a driving force in CIEEM's policy work for even longer. We look forward to working with Ben Kite CEnv MCIIEEM as he takes over the reins.

UK and England

In April we submitted our response to the Biodiversity Net Gain Regulations and Implementation consultation, run by Defra, after running several workshops with members and the Spring Conference to inform our response. Ben Kite has also given oral evidence to the Lords Committee on Land Use on behalf of CIEEM.

The England Policy Group has also responded to the Government's proposals in response to the Landscapes Review, the Nature Recovery Green Paper and the Environment Act targets consultation. The latter two were also informed by workshops with members and other organisations through the Environmental Policy Forum and Wildlife and Countryside Link.

In March we held the AGM for the All-Party Parliamentary Group for Nature where Barry Gardiner MP was re-elected as Chair, and Baroness Barbara Young, Baroness Kate Parminter and Alexander

Stafford MP were re-elected as Officers. This year our events and activities will focus on COP15, the Nature Recovery Green Paper, skills and capacity to deliver nature recovery measures, and data-driven conservation. Find out more about the group at: <https://cieem.net/appg-for-nature/>.

Scotland

In March, we published the results of our survey of Local Planning Authority capacity in Scotland. The findings shed light on significant gaps to deliver effective ecological work in planning and the ambitions for positive effects for biodiversity in National Planning Framework 4 (NPF4). Check out the full survey report at: <https://cieem.net/wp-content/uploads/2022/03/Scotland-LPA-survey-v3.pdf>.

We responded to the draft NPF4 consultation in which we call for these capacity issues to be addressed. We are pleased to see that there is a real emphasis on addressing the climate emergency and biodiversity crisis in NPF4. However, despite a strong rhetoric, there are no clear delivery mechanisms to ensure the transformational change that is required. We also supported the Scottish Environment Link response and have met with Minister for Public Finance, Planning and Community Wealth, Tom Arthur MSP, as a member of Link to discuss our concerns. We will continue to engage with Scottish Government as it is finalised.

Wales

We have continued our liaison meetings with Welsh Government, particularly focusing on the development of our briefing on their approach to 'Net Benefits for Biodiversity' in Wales. We hope this will be finalised shortly after expected updates to Planning Policy Wales.

In March we signed up to support the Wildlife and Countryside Link response

to the consultation on Banning retail sale of peat in horticulture in England & Wales. We have also supported the Wales Environment Link letter to the First Minister on actions needed post-COP26 (<https://waleslink.org/wp-content/uploads/2022/01/220117-COP-26-COP-15-letter-to-FM-FINAL.pdf>).

Ireland

In February, we submitted a briefing document on the capacity crisis in the sector in Ireland to the Minister for Further and Higher Education, Research, Innovation and Science, Simon Harris. This document was drafted by members of our Irish Section Committee and Irish Policy Group, and set out the current need for ecology professionals, existing skills gaps, likely growth of the profession and challenges to implementing new measures, current work being done to support the profession and, finally, what is needed to further support ecology and environmental management.

At the time of writing, Our Ireland Policy Group has also responded to consultations on a Forestry Strategy and a Clean Air Strategy for the Republic of Ireland.

Our Ireland Project Officer, Liz O'Reilly, has been building relationships with various groups including Coillte Nature and the Local Authority Waters Programme (LAWPRO).

Future priorities

Our priority for the coming months will be engaging with the UN Biodiversity Conference COP15 as the second and final part is due to take place later this summer. We will also be looking to deliver proactive policy engagement on the green economy, natural capital, and data and evidence – as well as responding to expected publications such as the Biodiversity Strategy in Scotland and Agriculture (Wales) Bill.

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

Contact Amber at: AmberConnett@cieem.net



From the Country Project Officers



Mandy Marsh – Wales Project Officer

S'mae pawb/Hello everyone,

Our first Member

Network webinar of 2022 was led by Liam Olds, entomologist and expert on the biodiversity value of colliery spoil. Listeners included several people from mining areas outside Wales who were very interested in his work – it's good to see Wales taking a lead and passing on useful knowledge! Welsh Government is currently reviewing the state of Wales's coal tips. While the primary concern is safety, they also recognise the potential for prioritising biodiversity, with potential funding available for restoration.

Another potential for increased biodiversity lies along the Wales Coast Path. It doesn't seem that long ago that Natural Resources Wales (NRW) opened, to great acclaim, this first ever long distance walking route around a country's coast. Unbelievably, 10 years have passed since then. Welsh Government has been reviewing the path and has commissioned NRW to produce a report on *"some best practice and recommendations on how to scale up biodiversity improvement projects along the Wales Coastal Path corridor"*.

We have vacancies on both the Member Network Committee and the Wales Policy Group, so please get in touch if you'd like to know more about what's involved. It's not all about us! These volunteer groups are valuable for networking and advancing your own careers too. As members of Wales Environment Link, the Policy Group continues to input into responses to Welsh Government's Deep Dive into biodiversity, sustainable farm schemes and food security, as well as Ofwat's Price Review 24.

Hwyl, Mandy

Contact Mandy at:
MandyMarsh@cieem.net



Annie Robinson – Scotland Project Officer

Hello everyone,

After the event for Scottish Local Authority

Ecologists and Environmental Planners to discuss the emerging National Planning Framework 4 (NPF4) and Developing with Nature guidance we issued a survey on Local Planning Authority ecological expertise and capacity in Scotland. The survey highlights significant gaps to deliver effective ecological work in planning and the ambitions for positive effects for biodiversity in NPF4. You can view a summary briefing (<https://cieem.net/resource/survey-of-scottish-local-planning-authority-ecological-expertise-and-capacity-briefing-paper/>) and read the full report (<https://cieem.net/resource/scottish-local-planning-authority-ecological-expertise-and-capacity-survey-report-march-2022/>). The event and the survey responses fed into NPF4 consultation responses.

As part of the Scottish Biodiversity Programme Stakeholder Engagement Group, we have contributed to meetings on vision and outcomes, conditions for success and governance. The Scotland Policy group will be responding to the Biodiversity Strategy consultation process.

In May, we held the brilliantly titled member network event – "Can you hear me? Oh I'm muted!" Thanks to Ashleigh Kitchiner and Claudia Gebhardt for giving us a fascinating insight into bioacoustics and echolocation by cetaceans and bats. At the start of June, it was great to get back to in-person member network events with a field visit to Black Law Windfarm looking at 10 years of peatland restoration. Thanks to Rachel Short and Peter Robson from ScottishPower Renewables.

If you haven't yet seen it, do check out the Autumn Conference – Delivering a Nature Positive, Carbon Negative Future (<http://events.cieem.net/Events/EventPages/23112022000000CIEEM2022AutumnConferenceDeliveringa>

naturepositivecarbonnegativefuture.aspx – which will be in Edinburgh on 23–24 November. I look forward to seeing you there or at a member network event soon.

Thanks, Annie

Contact Annie at:
AnnieRobinson@cieem.net



Elizabeth O'Reilly – Ireland Project Officer

Greetings from Ireland,

Since the last update the Irish Section

conference, *Sector Symbiosis: The Art of Interdisciplinary Working for Ecological Benefit*, has taken place. We heard from a wide range of speakers on how they are working with other sectors and disciplines for ecological benefit, and it has inspired ways the Irish section can support our members in this work. These talks and sessions are available to access and if you are interested you can contact, training@cieem.net. What I personally enjoyed the most about this year's conference, was getting to meet our members in person again after two long years. This was possible at the field trips held across the country. On top of lovely locations and interesting field trip leaders, the sunshine also joined us and allowed for very enjoyable and informative socialising. I look forward to getting more in person events running later in the year.

For now, I am excited about organising a workshop at the ENVIRON conference running in Belfast and attending the National Biodiversity Conference in June. These will offer us the opportunity to raise the profile of the section in Ireland and engage with policy makers. I will let you know how they go in the next edition!

For now, enjoy getting out in nature and the buzz of the summer.

All the Best,

Liz

Contact Elizabeth at:
Elizabeth@cieem.net

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 March 2022 issue of *In Practice* we described a scenario where you are working on a major multi-disciplinary Environmental Impact Assessment (EIA) project. The project team includes both your own company staff as well as a wider team of specialist subcontractors. To date the client has been less than helpful in providing complete and detailed information in a timely manner to stakeholders. This has resulted in changing timescales, altered designs resulting in changing agreements to mitigation lands and issues with accessing land to establish the ecology baseline.

A consultation meeting with stakeholders (including the statutory nature conservation organisation (SNCO) and other stakeholders) is planned and the client's instruction is that the client will lead the presentation covering all environmental matters and the specialist consultants (including yourself as the named ecologist) will be available only for questions.

The project team provides detailed slides to the client for the meeting, including baseline, initial impact assessment and initial proposed mitigation plans, as part of a detailed briefing. As the client is leading the

whole presentation, they compile the final edits and order of the slides.

During the presentation (all parties are present – client, SNCO, stakeholders, project team including yourself) you notice that items have been altered in your slides and the presentation gives a subtly different message than intended. The justification and rationale that has been presented for required ecology mitigation has been downplayed and does not tally with your briefing of the client or earlier consultations that you have had with affected stakeholders.

We asked: What do you do during the presentation? What do you do after the presentation?

In thinking about the response it is important to note that this is probably one of the most common types of ‘problems’ that can be encountered with clients. It is equally important to acknowledge that clients are allowed to ‘put their best foot forward’ when presenting their case to stakeholders. There are limits, however, and it is vital that you intervene if you believe that a client has overstepped and is presenting misleading information.

There are several ways to address this kind of behaviour when it happens ‘live’ (as opposed to report edits where amendments can be tracked) and a lot depends upon your relationship with the client and who is present on the call/presentation.

The key message is that given there are external parties present (stakeholders, SNCO, etc.) the problem must be addressed in some way immediately. You cannot allow these parties to question the validity of the information (and your competence) or leave the meeting with a false impression of the project, which is ultimately not acting in the client’s best interest. If it had been a purely internal meeting with the client and project team but no external stakeholders, there may be scope for addressing the issue during the meeting (if there is a good relationship) or privately after the event, assuming it wasn’t going to lead to other teams doing abortive work.

One simple way of intervening would be to verbally intervene and point out that *“it appears the wrong slides have been uploaded... what this was meant to show is...”*, another good phrase

is *“I just want to clarify what this slide should show...”*, or *“there is a nuance here that I’d like to explain before we go further”* or *“I believe there has been a recent update to the situation that hasn’t been carried through to the slides”* and then verbally deliver the key messages that have been left off the presentation, followed by a promise of providing an updated presentation by email to all parties.

You need to ‘judge the room’ on exactly what phrasing to use, if you have a good client relationship it can be worth ‘taking the blame’ with *“I appear to have provided the old/out of date slides, my apologies...”*, and then discuss the issue with the client afterwards rather than embarrassing the client in public in order to maintain your good relationship.

If the relationship is less good then a ‘lawyerly’ option would be to request a short recess to discuss something with the client (this is a bit harder on a video call), or end the meeting and immediately outline your concerns. However, it should be noted that this will definitely alert other meeting attendees that something is amiss. If the meeting by video call and you have been alerted to the client’s approach in advance or just as good practice, suggest that the meeting is recorded.

However you choose to intervene, it is vital that no one leaves the meeting with false or misleading information. When discussing the issue with your client (who may be ‘upset’) it is important that you point out the implications of trying to mislead the stakeholders (planning consent at risk from challenge etc.) and that the SNCO etc. are specialists and would query

any erroneous-appearing results and reporting potentially leading to delays/extra costs. Additionally, it is worth pointing out that if the presentation does not tally with the final reports/plans submitted, the amendments would rapidly become apparent anyway and therefore amending the presentation served no purpose.

Such an occurrence will lead to a difficult conversation with your client, and it is therefore important to alert your manager and peers, so they can support you. It is also important that your company management knows what this client is like as they may wish to re-assess future contracts.

To strengthen the client relationship and avoid this re-occurring, being open, honest and timely in holding the difficult conversation with the client is essential. Make sure you have your manager or other project colleague in attendance and circulate a brief agenda in advance. You could offer to get involved in the programming and sequencing of tasks, delivering some technical updates direct to the client group if it is a new technical area for them or it is a particularly complex project, or another proactive measure, to avoid the same thing happening in the future.

The next dilemma

So, now for this issue’s dilemma.

You are running an environmental organisation which has a goal to become net zero. To help achieve that aim, you set an objective that all staff who use their own car for work (and claim costs) should use an electric car within a specified timescale. However, given the larger capital outlay required for electric cars compared with conventional ones, it soon becomes clear that this obligation is easier for senior, better-paid staff than for junior staff. Is this fair?

If any members of staff opt to retain their conventionally powered car, what should you do?



Increasing Capacity in the Sector



Sally Hayns
CEcol FCIEEM

Chief Executive Officer,
CIEEM

In recent months we have been talking to lots of employers about the employee capacity issues that they are struggling with. Almost all agree that this is a short-, medium- and longer-term issue that is prevalent

across the industry, regardless of employment sector and it is not going to improve any time soon. The problems are being felt across the UK and Ireland with no obvious geographic differences.

There are multiple causes, some of which date back to the financial crash of 2008 onwards and low recruitment into the industry in the following years, through to the high numbers of infrastructure development projects and changes to the legislative and policy landscapes which are focusing more attention on the protection and enhancement of biodiversity.

It is somewhat ironic (and frustrating) that for an industry that has fought so hard for biodiversity to be valued, protected and restored, we are now struggling to meet the demands that society is placing on us.

Where is the problem being felt?

Employers are telling us that the most urgent need is for ecologists and environmental managers with 8–10 years' experience but there is also a shortage of those with 3+ years' experience. It is not just the consultancy sector as recruitment is proving very challenging for local authorities and national park authorities, statutory nature conservation bodies (SNCBs),

eNGOs and industry. There simply are not enough experienced ecologists and environmental managers to go round. It is important to also acknowledge people leaving the profession to pursue other careers. For some people the profession is a disappointment – long unsocial hours, disappointing salaries and poor working conditions are factors that are leading people to vote with their feet.

The shortage is leading to significant increases in salaries as employers try to attract the candidates with the right experience. This is most obviously seen in the consultancy sector but employers are worried that these increases are not sustainable unless clients can be persuaded to pay higher rates for consultancy work.

The knock-on effect is felt in other employment sectors that cannot compete with the salaries being offered. For example, at a time when local planning authorities are being offered more (but insufficient) funding to improve ecological capacity ahead of mandatory Biodiversity Net Gain, they are struggling to recruit experienced staff at the salaries available.

Of course, a shortage of staff is only going to place more pressure on those struggling to meet demand for our services – longer hours, more stress, more pain, more people leaving the profession.

Looking for solutions

We want ecology and environmental management to be a challenging but fulfilling career with good working conditions and work-life balance, rewarding remuneration and the satisfaction of making a positive difference to biodiversity and societal wellbeing. We need to find solutions.

Discussions with employers have identified a number of areas for further exploration and action.

- Survey guidance is overly precautionary and leads to too much time undertaking survey work that doesn't add sufficient value to the ecological information available (and subsequent decision-making).
- We need to reduce the reliance on surveys during unsocial hours for protected species.



- There should be more investment/training in new technologies to reduce survey effort.
- SNCBs need to be more consistent in their expectations/requirements of survey work and mitigation in order to enable consultants to be as time efficient as possible.
- Employers need to invest more in recruiting and training early career ecologists and supporting them into more senior roles.
- CIEEM should develop a version of its Early Career Training Programme for those with 3–5 years' experience to help them develop into senior roles.
- Employers should look beyond salaries to creating better working conditions/improving work life balance as that will set them apart from other employers. Invest in retention rather than recruitment.
- There should be a published minimum wage for key roles/grades.
- CIEEM should help to create new routes into the profession to aid recruitment and avoid everyone coming in with overhanging debt (and also to reach a more diverse audience).
- The consultancy sector should look at the pricing of work and 'draw a line in the sand' about offering skilled work too cheaply.
- CIEEM should engage with final year undergraduates to better manage their expectations of the realities of working in the profession.

What do you think?

We are keen to hear your thoughts as to what the short-, medium- and longer-term solutions may be. Share your views via this online survey <https://www.surveymonkey.co.uk/r/FXZVH8F> and feel free to make your own suggestions.

We know that there are no fixes but if we want a profession to be proud of, one that people want to join and spend their career in, one that is respected and valued by stakeholders and one that has the capacity to deliver the biodiversity protection and enhancement our natural environment needs, we need to take this seriously and make some fundamental changes.

About the Author

Joining as CEO of the (then to-be-Chartered) Institute of Ecology and Environmental Management in 2010, Sally ensures our Strategic Plan is implemented effectively, looks after the Secretariat and oversees the governance of the Institute. Sally is also currently acting as Head of Professional Practice and is involved in our policy work, member and stakeholder engagement and being an ambassador for the organisation.

Contact Sally at: SallyHayns@cieem.net

New CIEEM Competency Standards

Setting standards for ecological and environmental management practice is an important role for any professional body. Having standards of practice to work to is often the hallmark of a profession – it sets the bar for how things should be done in order for them to be done well. Standards matter to the public, to clients and customers, to regulators and to decision-makers.

They should matter to practitioners as well.

Over the past 2 years, volunteers and key CIEEM staff have been working collaboratively to develop competency standards for specific areas of biodiversity survey, assessment, mitigation and management. This project has followed on from the example set by the ecology team at Atkins in their *Ecological Competences, Skills and Process* document produced in 2019.

The ambition has been to define taxa and preliminary habitat-specific survey, assessment, mitigation and management competence in the context of CIEEM's Competency Framework. The overarching CIEEM Framework, which is used as the basis for membership grade and Chartered Ecologist assessment as well as for planning and recording CPD, is necessarily high level and generic. These individual taxa and preliminary habitat assessment competency standards drill down into what that looks like for specific taxa at Basic, Capable and Accomplished levels of competence.

The outcome is a competency standard that can be used by individuals and organisations to assess and evidence competence and to plan progression towards the next level. By providing some consistency within the profession, it enables individuals to 'market' their achieved competence to potential employers and enables employers to specify the level of competence they are

looking for in their recruitment. In a private sector context it also enables companies to evidence the competencies of their staff to potential clients and for individuals to push back if asked to undertake surveys for which they are not competent.

The process

Development of the competency standards has been led by a volunteer steering group which has determined the format and scope of the standards and the priorities for development. The group also reviews and 'signs off' draft standards for publication.

A working group of volunteer members is formed for each standard under development. We have been extremely grateful and impressed by the thought and expertise that all of the volunteers have put into this work.

Once the working group has produced the draft standard and the steering group has provided feedback, it is then published on the CIEEM website on the Raising Standards project page (<https://cieem.net/raising-standards/>) together with an invitation to provide comments and feedback using the form provided (you may have seen this step promoted via eNews and our social media). In some circumstances specific organisations or industry experts will also be asked to comment.

Following the consultation, members of the working group will review the comments and suggestions received and report any proposed revisions to the steering group. Once the final version is approved it is then published again on the webpage, setting the standard to which members should aspire.

Progress so far

To date we have published four final version standards:

- Water Vole Survey, Mitigation and Management
- Great Crested Newt Survey, Mitigation and Management
- Reptile Survey, Mitigation and Management
- Preliminary Habitat Survey.

There are also draft versions (open for comments and feedback) for:

- Aquatic Macroinvertebrate Survey
- Badger Survey, Mitigation and Management.

In some cases we have published a 'mirror' table of good practice references, which are being incorporated into CIEEM's comprehensive *Good Working Practices* guidance (https://events.cieem.net/Portal/Publications/Professional_Guidance_Series.aspx).

Work is currently underway on terrestrial invertebrates, dormouse, otters, birds and invasive non-native species.

Next steps

We will continue to expand the suite of competence standards (and keep them under regular review) and welcome feedback on those already published (comments relating to final versions will be retained for the next review). If you have a suggestion for a standard not currently being worked on and you would like to help, please do get in touch via enquiries@cieem.net.

We are also exploring how to provide an assessment option, via self-assessment and/or peer-assessment, to enable you to identify your own level of competence and what you might need to do to develop your knowledge and skills and reach the next level. In the meantime, please do take a look at the competency standards that are relevant to your work and see how they can help you in your professional practice.

And we cannot say it often enough – thank you to all the volunteers who have contributed to this important work.

About the Authors

Sally is CIEEM's CEO, ensuring our Strategic Plan is implemented effectively, looking after the Secretariat and overseeing the governance of the Institute.

Contact Sally at: SallyHayns@cieem.net

Professor Max Wade is a Technical Director (Ecology) with AECOM and has been involved in surveying and assessing habitats and species from ditches and wet grasslands to mosquitoes and marmots.

Contact Max at: max.wade@aecom.com

Have You Considered Becoming a Trainer?



Craig Willcock
Professional
Development
Manager, CIEEM

CIEEM promotes the highest professional standards to ensure public confidence in the professional services offered by those working in the ecology and environmental management sectors.

Underpinned by the CIEEM Competency Framework, the CIEEM training programme provides a range of valuable continuing professional development (CPD) opportunities for members and non-members across the UK and Republic of Ireland. These courses are delivered by specialist trainers with expert knowledge.

The programme includes a mixture of online, classroom-based and field-based practical courses on a range of topics throughout the year. We also offer bespoke training courses that can be delivered for a specific team or organisation.

Building capacity

As we look to develop the training programme, we are keen to increase the pool of trainers to expand the capacity for specific courses. In particular we are looking for trainers who could deliver a course on one (or more) of the following:

- UK Habitat Classification – beginner and intermediate levels
- QGIS – beginner and intermediate levels
- Biodiversity Metric V3.1 and Designing for Biodiversity Net Gain

- Ecological Clerk of Works – we are delivering a brand new series of courses covering advanced communications, construction, and risk management.

Supporting you

The Professional Development team at CIEEM works closely with trainers to ensure that they are supported in the planning and delivery of their courses to the highest professional standard.

There would be opportunities to meet and shadow current trainers and you will be provided with relevant course materials and slides to assist in the delivery.

To support those new to training, wanting to develop a professional standard of tuition, and for more experienced trainers wishing to enhance their skills, we offer the 'Train the Trainer for Ecologists' course. One of the delegates stated that the course: "... equipped me with a range of practical techniques that help me ensure engagement and deeper learning for delegates".

Do you have a course to deliver?

We are also keen to expand the training programme to include new courses, so if you have a course that you would like to deliver or some ideas, then do contact us to discuss further.

Why become a CIEEM trainer?

There are several benefits of being a trainer with us:

- Promotion of your training course to over 6000 members – great exposure to build new connections across the sectors
- All course admin including bookings and liaising with delegates is managed by us
- Opportunities to work collaboratively with other trainers

- Being part of the trainer community – newly established trainer forum to share best practice, network and input into the training programme
- Playing an active role in developing the skills and understanding of practitioners across the profession
- Develop your own CPD and skillset.

What our trainers say about delivering training:

"Delivering a training course instils confidence in your own abilities, and sharing your knowledge is incredibly rewarding, particularly with those who are relatively new to the profession".

"One of the hidden benefits of running training for CIEEM is that, because you are learning yourself whilst researching your training, delivering training contributes towards your CPD hours!"

How you can become involved

If you are interested in becoming a trainer or have a course that you would like to deliver with us, then please do get in touch via email at training@cieem.net for further details.

Upcoming courses

Over the next few months we have a range of field-based courses including: 'Peregrine Falcon: Ecology, Survey and Mitigation' (15 June, Birmingham); 'Botany for Beginners' (16 June, Bristol); 'Bat Ecology and Survey' and 'Bats Impacts and Mitigation' (16 & 17 June, County Fermanagh, Ireland); and 'Working with Crayfish: Survey Methods, Ecology, Mitigation, Licensing and Invasive Species' (13–15 July, North Yorkshire).

The new 'Heathland Plants Identification for Botanical Surveying and Habitat Classification' course (6 July, Shrewsbury) will provide an introduction to heathland plant identification and will enable attendees the ability to recognise and name a wide number

of heathland plants, grasses, sedges and rushes. Another new course, the 'Aquatic Plants Identification' (24 August, Vyrnwy Aqueduct, Montgomeryshire Canal) will provide an understanding of the different groups of aquatic plants and how this helps to classify habitats.

A range of courses will be delivered online over the coming months including: 'Biodiversity Metric V3.1' (various dates), 'Water Vole Mitigation' (5 & 6 July), 'UK Habitat Classification for Practitioners' (28 & 29 July), 'Introduction to UK Habitat Classification' (25 & 26 August) and 'Eurasian Beaver Ecology and Management' (8 & 9 September).

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

About the Author

Having previously worked for an Institute in the healthcare engineering sector, Craig joined the team in February 2021 as the Professional Development Manager. He leads on the organisation of our professional development activities, including our training programme, and managing other professional development activities that are underpinned by our Competency Framework. He sits on the Student and Early Careers Working Group and facilitates the Student and Early Careers Focus Group. He is also setting up a new STEM Ambassador Programme for CIEEM members to engage with.

Contact Craig at: CraigWillcock@cieem.net


CIEEM

HOW TO BECOME A CIEEM TRAINER

- 

Initial contact between the **Training Provider** and the **Professional Development Team** to discuss the scope of the proposal, professional demand and the **Trainer's** experience.
- 

The **Training Provider** completes a 'Training Event Information Form' (provided by **CIEEM**) to outline the proposed training event.
- 

CIEEM reviews the training event outline, providing feedback and further suggestions to the **Training Provider**.
- 

If approved, the final training event outline is agreed with the **Professional Development Team**.
- 

Date(s) and venue(s) are confirmed with the **Training Provider**, who is required to provide **CIEEM** with a completed risk assessment, together with copies of the **Training Provider's** Professional Indemnity and Public Liability Insurance.
- 

A formal invitation to provide training is issued, together with a contractual agreement to be signed and returned by the **Training Provider**.

Investing in the Future of the Profession: CIEEM's Early Careers Training Programme



Craig Willcock
Professional Development Manager, CIEEM

In this article we look at the first two modules of the Early Careers Training Programme, and a look ahead at the next modules.

A new training programme

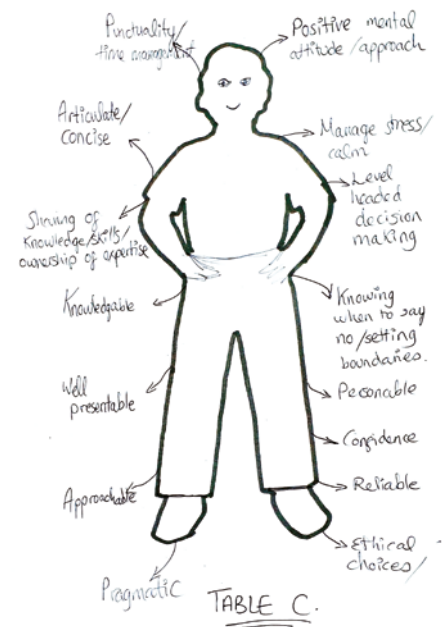
This new initiative aims to provide those entering the profession with a solid foundation in key areas and encourage good practice and a sense of professional responsibility. The programme is aimed at early career ecologists and environmental managers working across all sectors; CIEEM members and non-members.

Introductory module

In March 2022, 16 delegates from across the UK and Ireland travelled to Peterborough to attend a 2 day residential course for the first module of our new Early Careers Training Programme. Delivered by Sue Bell CEcol CEnv FCIEEM, the module – Introduction to professional practice, professional ethics, ways of working and communication skills – set the scene for the start of the programme by providing an introduction to the concepts of behaviours and standards that would be consistent with a professional ecologist or environmental manager.

The module covered a range of topics for delegates to discuss in small groups. Key themes explored on day one included: defining what is a professional and the characteristic and attributes of this; the importance of being professional and the benefits of this to the individual and organisation and wider society; the risks of not being professional; how to recognise professionalism; how to differentiate

professionalism and ethics; and an overview of the CIEEM Code of Professional Conduct. Delegates were provided with an overview of the CIEEM Competency Framework before undertaking a self-assessment of where they feel they are in the framework to help understand how to gain and



assess competence. The final sessions on day one looked at: what CPD is; how to plan and record CPD; and the role of laws, standards and guidance in guiding professionalism.

After dinner on the first day, delegates were joined by Chris Gerrard CEnv MCIEEM (Anglian Water's Catchment and Biodiversity Manager, and CIEEM's Vice-President for England) and Nathan Hall (Principal Freshwater Ecologist at Mott MacDonald). The evening provided an opportunity for delegates to meet and interact with two experienced professionals and hear about their roles and careers to date; some of the challenges they have encountered; some successes and rewards; as well as some top tips for starting out in the industry.

The second day focused on how to communicate in a professional manner and how to tackle poor working practices. Key topics included: type of communications and audiences; best practice for emails; use of text and messaging apps; use of social media; oral communication skills; best practice for meetings and presentations; overview of working practices; and how to challenge poor examples of working practices.

To help inspire and encourage the delegates as they embark on their careers, a short film from CIEEM President, Richard Handley CECOL MCIEEM, was shown before a panel of guests talked about their careers and provided useful advice and insights.

A positive response

The module has received great praise from delegates, with the average feedback score of 4.9 out of 5.0, which is great, especially as this was the first time the module has been delivered. Some areas that delegates found valuable included:

"Learning the usefulness of the competency framework for tracking learning and goals, as well as getting a better feel for experiences of other early career ecologists." – Wayne

"Hearing experiences from people new to the industry and also people who have been involved longer. The training was reaffirming and really promoted confidence. I came away feeling inspired and proud to be a CIEEM member." – Sam

Throughout the programme, delegates will be able to network and support to each other, which we hope will continue throughout their careers. Even after the first module, we can see the benefit of this in the feedback:

"It was really valuable to have conversations with other ecologists about the sort of issues we face as young professionals." – Helena

"Being able to engage with other ecologists from different companies that are working at the same level as me." – Daniel

Nature conservation legislation

The second module of the programme – Introduction to nature conservation legislation in the UK – was delivered by Dr Alina Congreve and Professor Anthony Gallagher over two online sessions at the end of March and start of April 2022.

In preparation for the course, delegates were tasked with completing a short survey and to read a briefing document. The first session looked at: the context for nature conservation in the UK including the importance of this and the key drivers; devolution and the dynamism of UK policy; and the legal framework for designated sites and species. At the end of this session delegates were tasked with reviewing a case study and preparing notes as homework.

The second online session was held a week later and started with a review of the case study in small groups. The final part of the module looked at: species conservation and legislation; challenges to the protection of wildlife; species licensing; enforcement and how offences can be avoided by derogations such as protected species licensing; and policy change and the Environment Act, Biodiversity Net Gain and Conservation Covenants.

Having completed the first two core modules, the class of 2022 will now progress through the programme by taking a range of core and optional modules.

Core modules

This month, the delegates will attend their third module – Habitat Survey and Mapping, a 2 day field-based course

provided by Paul Losse MCIEEM. The module introduces habitat survey and the main principles involved. This includes a look at Phase One habitat survey, mapping protocols, UK Habitat classification survey and field-based elements identifying and mapping habitats in the field. At the end of the module delegates will gain an understanding of: what a habitat survey is and why it is done; the various classification and mapping techniques; how to plan and map a habitat survey; and how to present the results.

Next month, the delegates will attend their fourth core module – Introduction to Preliminary Ecological Appraisal – which is being delivered online by Mike Dean CECOL CEnv FCIEEM. This module will focus on providing an introduction to the process of Preliminary Ecological Appraisals (PEA). The module will equip delegates with an understanding of the purpose of PEA; how to set an appropriate scope of work for PEA in different scenarios; being able to differentiate between PEA and Ecological Impact Assessment (EclA); and to make proportionate recommendations for design changes, further survey, mitigation and enhancement in different scenarios.

In October 2022, delegates will undertake the final core module – Introduction to ecological report writing – which will be delivered online by Mike Dean CECOL CEnv FCIEEM. This module will look at how to produce good quality ecological reports for species and habitat surveys and PEA. The module will cover a range of topics including: the importance of high-quality ecological reports and the consequences of poor-quality reports; challenges faced in producing ecological reports; the different types of reports, their purposes and target audiences; how to structure the report and what content to include; and top tips on writing a good report.

Optional modules

In addition to the five core modules, delegates (with support from their employer) will select five modules from the existing CIEEM training programme based on their interests and specific areas of work. These modules will be undertaken as and when the courses are available. For more information on

training courses, see the diary on page 89, have a look at www.cieem.net/ events or contact training@cieem.net.

The class of 2022

The current intake has a mixture of delegates from small and large consultancies, and representatives from a local authority and a water company. These delegates are working in a variety of roles including: assistant ecologist, graduate ecologist, graduate biodiversity officer, environmental analyst and environmental scientist. On average, the delegates have between 6 months and 2 years of experience. Just over half are CIEEM members, and of these, the majority were at Qualifying grade – attending the programme will help provide them with an evidence base for a future upgrade of their membership to Associate level to help them progress their career.

"I came away from the training feeling inspired to be an ecologist and more grounded in my knowledge of the sector." – Henry

Could you be in the next intake?

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

About the Author

Having previously worked for an Institute in the healthcare engineering sector, Craig joined the team in February 2021 as the Professional Development Manager. He leads on the organisation of our professional development activities, including our training programme, and managing other professional development activities that are underpinned by our Competency Framework.

Contact Craig at: CraigWillcock@cieem.net



The class of 2022.

Membership Update

Support for Members



Stuart Parks

Head of Membership and Marketing, CIEEM

Hopefully you're reading this having decided to grab a drink, maybe a biscuit, and take a well-earned breather from whatever you've been doing during what, for many of you, will doubtless be another very busy period. If that's you, well done! Life can be hectic at the best of times, and the additional stresses caused by factors largely beyond our control can soon feel pretty overwhelming. If that's you too, allow me to remind you of the Member Assistance Programme and the support you and your dependants can access through it. Through the programme, you have access to a wealth of online resources, guidance, practical advice and information covering such issues as managing debt, and legal, financial and tax information as well as family care and support. You can also benefit from a free and confidential telephone Adviceline through which you can discuss your worries and concerns with a trained counsellor and seek to find positive solutions. More details about the Member Assistance Programme can be found under 'Member benefits' in the 'MyCIEEM' area of the website.

There are also other ways in which we can offer support to you if you find yourself approaching or considering a change in circumstances. A brief reminder is below, with much more information available online or from membership@cieem.net.

Putting membership into abeyance

Current Fellow, Full, Associate and Qualifying members are able to request to place their membership into abeyance

for a maximum of five consecutive subscription years. The most common reasons given for this are maternity/paternity leave and childcare; issues related to long-term/chronic illness or a temporary career break. While in abeyance, members do not have to pay subscription fees, but can choose to receive selected member benefits to enable them to keep in touch with developments in the sector and undertake some CPD should they choose to. CPD courses can also be undertaken at the member rate and you can also use the Member Assistance Programme while in abeyance. Thanks to feedback from members we have made some changes to the abeyance process recently. Although members in abeyance should not undertake any relevant professional employment, those in abeyance for a period of maternity, paternity or adoption leave may undertake KIT/SPLIT (Keeping In Touch/Shared Parental Leave In Touch) days and those in abeyance for a period of ill health may undertake some paid activity as part of an agreed phased return to work. You can specify an end date for the abeyance agreement so that you don't need to remember to confirm this annually. We have made it much simpler to reinstate your membership at the end of the agreed abeyance period. If applicable, it is also possible to place your Chartered status into abeyance. Full terms and conditions and an abeyance request form can be found online.

Returning to study

If you are a current Fellow, Full, Associate or Qualifying member returning to full-time study on an examined degree, HND, foundation degree or equivalent qualification, then you can apply for a 50% discount on your annual CIEEM subscription until your course ends. You will be able to make continued use of any post-nominals you hold and all other associated benefits, but must be able to

meet your CPD obligations, so that your membership will still reflect the current level of competence you are at.

At the end of your studies, the discount will be removed from your subscription and you shall be asked to pay the full subscription rate for subsequent years, on the condition that you have met the CPD requirements for the year(s) you have been studying. If you are studying full time on a course as outlined above but do not wish to take advantage of the discounted subscription fees, or are studying part time and not in any relevant paid employment, you can choose to place your membership into abeyance as an alternative.

Considering retirement

If you have retired and are an Associate, Full or Fellow member undertaking a maximum of 24 days, paid work in any subscription year, you could be eligible to become a Retired member of CIEEM. As a Retired member, you keep all of your current member benefits – such as discounted training events, policy briefing mailings and *In Practice* magazine, as well as gaining (rtd) to add onto the end of your existing suffix. Additionally, Retired members are not required to complete CPD although they do still have the option of recording CPD in our online CPD tool. Retired members also receive a discounted subscription fee.

You also have the option to remain a Chartered Ecologist (CEcol) and/or Chartered Environmentalist (CEnv) as a Retired member and continue to use the associated suffix. If you choose to become a Retired member and keep your Chartered status(es), please note you would not be exempt from CIEEM's CPD requirements and Chartership registration fees are also still payable on top of the annual Retired member subscription fee.

Deferring your subscription payment

If you are a Fellow, Full or Associate member of CIEEM, are experiencing financial hardship and cannot afford to pay your membership subscription when requested, you may be able to enter into a deferral agreement, allowing you to postpone your subscription payment for up to one subscription year. You will still have to pay your deferred subscription in full and if you have not paid this by the following year you will have to pay 2 years' subscriptions to maintain your membership. We will always do our best to agree a mutually acceptable way to support members at what can often be a difficult time, so please get in touch at the earliest opportunity to discuss available options should you find yourself in this position. If you are a CIEEM member and are on a low income, retired, a student or currently unemployed then you may be eligible for reduced rates to attend our Training and Events. To be eligible for this discount your yearly income should be less than £13,433 (€21,658 in Ireland), and you will need to provide written proof of this (i.e. Tax Credit Certificate, P60, self-assessment tax form or similar paperwork).

If eligibility is confirmed, you will be able to attend two subsidised-rate training courses per calendar year and an unlimited number of subsidised-rate conferences. All webinars can be joined free of charge and these too are unlimited.

For our standard 1 and 2 day training courses, the low-income rate is 50% of the member rate. For confirmation of the subsidised rate for our specialised courses, masterclasses or conferences, please contact training@cieem.net.

About the Author

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

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CIEEM Welcomes Another New Fellow

At its meeting in March 2022, the Governing Board was pleased to approve the nomination of Mr Robert Raynor as a new CIEEM Fellow.

Robert Raynor FCIEEM

Robert (Rob) Raynor is NatureScot's lead specialist adviser on mammal species conservation and management. In the opinion of the assessors, Robert has made an outstanding contribution to biodiversity conservation in Scotland over three decades, including:

- developing policy and coordinating the production of the revised GB guidance on bats and wind turbines
- influencing future conservation and management policy for the mountain hare
- leading on the development of strategic mink control and water vole conservation programmes.



In addition, Rob works closely with several mammal and herpetological NGOs and contributes to a range of external working groups and advisory committees. Rob is also involved with the Advisory Committee to the Eurobats Agreement under the Bonn Convention on Migratory Species and, more recently, the Bern Convention Group of Experts on the Conservation of Amphibians and Reptiles.

The members of the review panel agreed that:

"Rob is an extremely knowledgeable, experienced and well-respected professional with a wide and comprehensive knowledge of Scottish protected species, who has consistently used science to underpin the development of policy, strategy and guidance. He has undertaken a breadth of research and survey in this field and has an authoritative knowledge of his subject. He is recognised by his employer, the Scottish Government agencies and further afield as being an extremely knowledgeable practitioner."

British Ecological Society

Protected Areas in the UK: Delivering for Nature?

Daniela Russi

Senior Policy Manager, BES

A new report from the British Ecological Society (BES) examines the Prime Minister's pledge to protect 30% of UK land and seas by 2030 to support nature recovery.

Protected areas (PAs) and other effective area-based conservation measures (OECMs) have the potential to play a pivotal role in reversing biodiversity loss in UK. The BES has just published a new report on this topic, which was put together and reviewed by a wide range of experts from across the four UK nations.

Currently, 28% of UK land and 38% of UK seas are designated as some sort of protected area, including statutory protected areas and protected landscapes. However, many of these protected areas are not effective at protecting biodiversity, due to both internal and external pressures, as well as insufficient funding.

A recent study calculated that between 43 and 51% of UK statutory protected sites are in favourable condition. Since these sites cover about 12% of UK land, the researchers conclude that *effectively* protected areas cover only around 5% of UK territory¹. Another report found that bottom trawling (an extremely destructive fishing practice) is taking place in 98% of UK offshore marine PAs².

The new BES report defines four criteria that protected areas and OECMs should meet before they count towards the government's pledge to conserve 30% of UK land and sea by 2030 (the 30x30 target):

1. Area delivers for nature in the long-term. Long-term biodiversity protection allows land managers and other relevant stakeholders to make choices that may need years to deliver ecological and economic benefits. These

choices may be too risky without the security that long-term legislation and financial incentives bring.

2. Builds ecological resilience and improves biodiversity under rapid global change, resulting in an increased abundance and distribution of habitats and species within site boundaries.

3. Conservation outcomes are achieved through effective management and monitoring. This requires good planning, adequate resourcing and an appropriate governance structure. Regular monitoring should cover both specific features and wider ecosystem functioning over time.

4. Developed and delivered inclusively through early and sustained stakeholder engagement to ensure buy-in and benefits for local communities.

OECMs can provide an essential contribution to the 30x30 target as well as protected areas. An OECM is defined as a geographically defined area other than a protected area which is managed in ways that result in long-term benefits to biodiversity^{3,4}. They often result from bottom-up initiatives and are supported by local communities, due to the wide range of socio-economic and cultural benefits they deliver.

A particular type of protected area that needs to be improved in the UK is the category of landscape designations, such as National Parks and Areas of Outstanding Natural Beauty (AONBs). These areas are often not adequately funded for conserving nature, and they were originally established to safeguard landscapes, natural heritage and public access, not biodiversity⁵.

In their current state, landscape designations should not count towards the 30x30 target. However, these landscapes do have great potential to contribute to nature recovery due to their large coverage (17% of UK land), existing governance structures and good relationships with local communities. They could count towards the target in the next few years, if they



View from Catbells looking towards Skiddaw, Lake District National Park (Michael Conrad).

are adequately funded and undergo a transformational change to repurpose them to ensure nature's recovery.

The current network of terrestrial and marine protected areas are already playing a key role in protecting the UK's biodiversity, as nature would be considerably worse off without them. The ambitious 30x30 target can represent a timely and very valuable policy window of opportunity to substantially increase the ecological and societal benefits that PAs deliver. But only if increased financing, improved management for nature and adequate monitoring are ensured.

Find out more:

www.britishecologicalsociety.org/ProtectedAreas

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By Members For Members



What do you really know about CIEEM Member Networks?

So much goes on behind the scenes of our Geographic Section Member Networks and Special Interest Groups, and there's never been a better time to join in! Visit <https://cieem.net/member-networks/> for more information.

Ecological Restoration & Habitat Creation Special Interest Group

Woodland Creation Webinar Series

The ERHC SIG held a fantastic two-part webinar series focusing on Woodland Creation, aiming to stimulate reflection and discussion on potential approaches to woodland creation. Part one of this highly topical webinar series focused on the strategic context and planning for woodland creation.

Woodland creation has risen up the political and economic agenda with governments setting out ambitious targets to increase woodland cover. It is seen as having an important role in climate change amelioration as well as providing recreational, biodiversity and other natural capital benefits. However, reconciling different objectives and deciding on priorities can be difficult. The webinar had a range of prominent and experienced speakers who stimulated discussion and learning about different approaches to woodland creation.

Speakers included Simon Mageean (Programme Director of the Northern Forest at the Woodland Trust) on planning the Northern Forest and some of the strategic thinking underlining the project, Christine Reid (Principal Conservation Advisor at the Woodland Trust) on introducing the Woodland Trust's guidance for woodland

creation, Professor John Rodwell (formerly Lancaster University) on how understanding the cultural heritage and ecology of trees can inform woodland creation, Dr Keith Kirby (University of Oxford and previously English Nature) on what constitutes the right tree, right place and right reason for expanding woodland cover and reconciling different objectives and Dr Kieron Doick (Head of Urban Forestry Research Group at Forestry Commission) on woodland creation on urban/brownfield land the importance of soils.

Part two focused on woodland creation case studies and the implementation of creation and restoration methods. Presentations included Dr David Hetherington (Ecological Advisor, Cairngorms National Park) on landscape-scale approaches to woodland expansion in an upland environment, Pete Leeson (Woodland Advisor, Woodland Trust) on working with landowners on woodland creation, including wood pasture systems and incorporating flower-rich habitats, Hugh Chalmers (Land Management Advisor, Tweed Forum) on creating native community woodlands in the Scottish Borders and Hugh Dorrington (Owner, Aveland Trees) regarding how to grow a resilient woodland.

UK Overseas Territories Special Interest Group

Herpetology in the UK Overseas Territories: Spotlight on Iguana Conservation

In this webinar, delegates heard about some of the fantastic conservation projects currently underway in the UK Overseas Territories. These included talks regarding the current threats, opportunities and conservation stories focusing on iguanas; namely the lesser Antillean iguana (*Anguila*) and the blue iguana (Cayman Islands).

The lesser Antillean iguana (*Iguana delicatissima*) once had a home range that spanned much of the Antilles, but is now heavily restricted due to habitat loss, over-exploitation and pressure from invasive species. Efforts have been made to translocate individuals to safe locations, to ensure the continuation of the species.

The blue iguana (*Cyclura lewisi*) has undergone significant population declines in recent decades due to habitat loss and human pressure, with only an estimated 30 individuals left in the 1990s. Since then, captive breeding and release of iguanas has started to result in the recovery of the species, with the 1000th individual being released in 2018.

Ireland Geographic Section

An Introduction to the Use of Detection Dogs in Ecology

This online talk introduced delegates to the capabilities and uses of detection dogs for ecological research and conservation purposes. It took a detailed look at the effectiveness of dogs, but also the limitations, and how you might proceed to engage a dog team, based on the questions the speaker Ciarán Cronin regularly gets asked.

Ciarán is a highly active and experienced ecologist, birdwatcher and general naturalist, with over 35 years of bird identification experience, and over 20 years as a professional ornithologist and ecologist. Ciarán has been training and developing skills as a wildlife detection dog handler for a number of years. Along with his wife Abi, he currently operates several wildlife detection dogs, mostly focused on the location of bat and bird carcasses at windfarms in Ireland. They are currently the only certified Conservation Detection Dog Handlers in the Republic of Ireland (Lantra Accreditation).

Ecological Restoration and Habitat Creation Special Interest Group

Nick Coppin MCIEEM (rtd)

Convenor, ERHC SIG

The ERHC SIG was established nearly 4 years ago, and now numbers some 900 members. The last year has been somewhat disrupted by the COVID-19 pandemic, so as life starts to regain some normality it seems like a good time to reassess what we do and how we progress forward.

There is no doubt that ecological restoration and habitat creation skills will be increasingly required at both local/urban and landscape scales, in combating the climate and biodiversity crises. Professional ecologists will be at the heart of this. Yet there remains a perception that the focus of the majority of CIEEM membership is on ecology for planning and protected species. The objectives of the ERHC SIG are partly intended to counter this perception, and can be summarised as:

- Raising awareness of ecological restoration and habitat creation within (and without) the profession, and help CIEEM reflect this through training, competency and professional standards, and policy.
- Provide resources on best practice, evidence, advice and guidance, making them available to the membership, and broadening the skills and scope of the profession.

Up to now we have been guided by the inaugural SIG meeting at the Autumn Conference in 2017; now we have the benefit of some experience (and hindsight) and we intend to take the opportunity to get further feedback from the membership on how the SIG can best respond to members' needs and contribute to CIEEM's aims. We also want to involve and make better use of our SIG membership resource in meeting this challenge.

In general, we believe we have been delivering on our objectives, with activities on several fronts, though we wish we could be doing more:

1. Events – We have successfully run several field visits and field-based workshops, but we could do more, especially involving the Country and England Regional Member Networks.
2. Conferences and Webinars – As a SIG we have run conferences and webinars, notably practical restoration of grassland (venue event) and woodland (two linked webinars), along with other webinars. Organisation takes time and effort, but attendance and feedback are good, so are well worthwhile.
3. Resource Hub – We took on the Flora Locale resource database (and legacy funding) and incorporated some of this into CIEEM's Resource Hub. However, we have struggled to maintain and develop this into a functioning resource of good practice and case studies. We need to consider a different approach, perhaps seeking funding to resource it properly.
4. Good practice guidelines and advice – The intention was always to produce good practice guidance and advice for practitioners. However, apart from our webinars and conference papers, which are uploaded into the Resource Hub, this has been slow to develop. We plan to make more substantial inroads into this, in response to feedback from members.
5. EcoWorks – This initiative (developed by John Box) was initially a success at pilot stage (i.e. within the SIG), and feedback has been very positive. However, recent enquiry numbers have been falling despite the full-page adverts in March and June 2021 issues of *In Practice*. We are currently analysing the feedback from a members' questionnaire on how we should take this forward.
6. Society for Ecological Restoration, Europe Chapter (SERE) – In 2019 we affiliated with SERE with an agreement to cooperate. Richard Scott is our representative with them. We do more to develop this relationship and perhaps align ourselves more with SERE and its Standards. SERE is perceived as having a mainly North American focus, but the European Chapter is very active.
7. Soils Charter – This initiative is aimed at improving the use of soil resources and avoiding fertile soils where biodiversity is the main objective. This has got some enthusiastic interest from other organisations and has gained some momentum and has reached a critical stage. More details will follow!
8. Involvement in Policy – Several committee members are on other committees, such as Training, Education and Career Development (TECDC), Member Admissions (MAC), Fellows Forum, Action 2030 and the England Policy Group, so our contribution to both internal and external policy development has been through this involvement.
9. Communication – Getting the message out. We have been producing SIG newsletters fairly regularly (we aim for quarterly). Feedback on these has been very positive so we plan to continue. However, we recognise that we could be doing more to raise the SIG's profile, with perhaps more regular contributions to *In Practice*.

For more information, contact membernetworks@cieem.net or visit the members' area of the website.

From the Patrons

Tectonic Plate Spinning?



**Baroness Barbara
Young of Old Scone**

Depending on the weather, I am either buoyed up by the range and pace of government utterances on the twin crises of climate change and biodiversity decline or anxious about the ability of the system and the skills to cope. It feels like almost every single system scheme is being reformed or new ones invented. Reform of the agricultural subsidy system would be a big policy shift and implementation task all on its own, but there is also continued implementation of Biodiversity Net Gain and the reform of the planning, sorry, Levelling Up, system together with that alternative planning system, Local Nature Recovery Strategies. Oh, and I forgot the announcement of the targets from the Environment Act, more environmental and climate change requirements on Nationally Significant Infrastructure Projects and add a liberal application of Nature for Climate projects. The tectonic plates of environmental management are not just on the move, they are positively spinning!

All of which bodes well for employment of environmental management professionals. But am I wrong to worry that we don't have enough of you to go round? And what other challenges are posed by this frenzy of activity by Defra, the Department for Levelling Up, Housing and Communities (fondly known as the Department of Luck) and the Department for Business, Energy and Industrial Strategy (BEIS)?

It is no coincidence that Private Frazer in *Dad's Army* was Scottish. We are doomed, all doomed! I too am a gloomy Scot and my worries are that

having all the moving parts of some very complex systems in motion at the same time may result in a few plates falling to the floor. Not only do ministers and government departments need to drive these big programmes forward but a whole flotilla of others need to keep up with the pace, including local government, farmers and land managers, and planners. Are there enough knowledgeable folk to keep all these plates spinning?

All the schemes need environmental management expertise to support them. We are all aware of how few local authorities now have in-house ecologists, yet the role of local authorities in tackling the twin crises is growing daily. Biodiversity Net Gain is becoming amazingly complicated and needs more effective assessment and ongoing monitoring if it is to fulfil its promise and do a good job by biodiversity and not fall foul of gaming. Local Nature Recovery Strategies founded on good data and modern mapping techniques could form a parallel land use planning system particularly for the rural areas but also for urban biodiversity. But good data for modern mapping techniques needs skills in surveying, recording, and gathering together the data from a myriad of sources. Are the skills and human resources around to do this effectively and can local government afford to employ them?

The Nature Green Paper announced a review of site designations and I pondered why far fewer SSSIs are in good ecological condition than when I chaired English Nature (EN). Firstly, there was a real commitment to raise the condition of all SSSIs and two successive chief executives of EN personally put the main owners of SSSIs on the spot for the improvement of their sites. The RSPB, the National Trust and the Wildlife Trusts looked at their feet, stared at the sky and then got on with it. Secondly, the statutory nature conservation agency still had

enough skilled resources to ensure SSSI condition was assessed and monitored.

One particular resource we need to nurture is memory. We all know the huge value of long-time-series ecological data, but we are cavalier in the extreme about recording and using the learning that comes from implementation over time of programmes in the biological field. I know at my age that it is too easy to say we tried that in 1979 and it didn't work then, but who has looked at the learning from 40 years of Common Agricultural Policy to cherish what worked and make sure we don't repeat what didn't. Ken Clarke, when he was Secretary of State for Health during yet another re-organisation of the NHS, amused and horrified us all in equal measure when he said: *"Thank goodness all these levers we pull aren't attached to anything."* Government is pulling some pretty big levers right now and they are attached to things. A priority must be to press for good ecological and environmental advice to be available at all levels in all parts of the system. So the job market looks buoyant but if I were you I would start buying some spare plates.

About the Author

Barbara Young, Baroness Young of Old Scone, is a member of the House of Lords and Chair of the Woodland Trust. Barbara Young was the Chief Executive of the Environment Agency (2000 to May 2008), an appointment which led to her becoming a non-affiliated member in the House of Lords. Other posts she has held include chair of English Nature; vice chairman of the BBC and Chief Executive of the RSPB.



Networking: Ecology is a Small World

Drew Lyness

Volunteer Engagement Officer, CIEEM

If you already work in the world of ecology and environmental management, you will probably be aware that it often feels as though ‘everyone knows everyone’. To some extent, that is because it’s true! How can anyone build up a list of contacts from scratch, and where would you begin? If you’re looking for a career in the sector, this might seem like a daunting and scary task, but it doesn’t need to be. Networking can be the key to getting your foot on the career ladder, but, beyond that, it will provide future opportunities for peer support and even raise standards in the sector. It’s time to get connected, and here are a few tips to help you do exactly that.

Get online

Firstly, maintain an active professional online presence through websites such as LinkedIn and Twitter. Both of these suggested social media platforms have a large representation from the ecology and environmental management profession. Having a profile on one of these sites creates opportunities to showcase your enthusiasm for the natural world more widely, and also

provides a method of contact for networking and for any connections you make to also get in touch with you. Keeping your online profiles professional is very important, but they don’t need to be strictly formal either, as it is important when networking to be both approachable and friendly when contacted. Incorporating your own personal brand that reflects your preferred areas of professional interest can really help here. For example, if fieldwork is your thing, use photographs that show you in the field doing what you do best. In any profile photos you use, make sure you are identifiable so any potential contacts can put a face to a name. Include a concise summary on your profile of who you are, what you do and what you have to offer. If you write any relevant blogs, or a part of any related projects, include links to them.

Once your profile is set up, ‘follow’ or ‘connect’ with as many people as you can in areas relevant to career options you are thinking about pursuing. Once you’ve begun to follow a few pages of organisations, charities or key people, the platform algorithms will suggest relevant profiles to follow which will likely include people who work in the area of our sector that you are interested in. Look at their profile, follow them and see whether they have potentially useful connections. Having this professional online profile will be useful when networking in person, as it gives opportunities for follow-up conversation using messenger-type functions of these platforms and a chance for the connection you have made to learn more about you. If done well, it can progress what may have been an initial contact into more of a professional relationship where you can

call upon this person for peer support and knowledge exchange.

Get involved

The second step to networking is to put yourself out there and meet new people. This can be done both in person or online, but the key is to attend the right events, with the right audiences and to arrive prepared. Taking the initial two points into consideration, identifying the best opportunities to meet (the right) people is crucial. A great place to start is by using CIEEM Member Networks and Special Interest Groups, as well as other clubs and societies. There will be groups out there that connect people in our sector around a topic or region. At CIEEM, our Member Networks and Special Interest groups are run by committees of enthusiastic and friendly volunteers, and provide opportunities for CIEEM members to share knowledge, meet like-minded people and learn more about the science and practice of our profession. These groups often lead more social or career-orientated events, giving members the opportunity to talk to those who are more established in the sector on a one-to-one basis. You can always get in touch with volunteers from these groups and express your interest in networking if no events are being held in the foreseeable future, as this may encourage the committees to set something up.

You could also consider networking through volunteering for an organisation, group or charity that you are interested in. Showing the initiative to get involved will get you noticed, and by carrying out tasks on a voluntary capacity, you will have something to demonstrate what you are capable of

and illustrate the type of person you are to those who you volunteer alongside. In time, you will be able to build better relationships with contacts you meet while volunteering, and diffuse any pressure related to 'selling' yourself as you are already demonstrating who you are and what you can do. The time you contribute will be valued and you increase the chance you will be the first considered as opportunities arise either directly with who you are volunteering for or indirectly (the sector is connected, and people talk to one another all the time). You may also find that, through volunteering, you enjoy the experience of networking much more as your focus is brought back to subject or location you are particularly passionate about.

Get talking

This all might seem fairly easy so far, but it can be made difficult if you find socialising difficult or, perhaps even, are not very outgoing as a person. When meeting new people, be prepared for what you want to achieve from the interactions, but get yourself out of the mindset of needing to 'sell yourself' while networking! Although it is OK to let people know what you do, show some expertise and get to know people on a personal level, remember that most contacts you meet are not in a position to offer you a job then and there. Building relationships is more important so that your contacts can grow to trust you and understand what you're all about, and then they will hopefully be in a position to give you a valuable

referral or forward you appropriate opportunities when they arise.

Having two or three conversation openers prepared that you can use with a variety of people you meet can be very useful, so you won't struggle to engage in conversation when you first meet someone. For example, a simple *"what brought you here today?"*, *"how did you get to where you are now?"* or *"what do you find particularly interesting in the sector?"* can be great ice-breakers. If you're friendly and genuinely curious, listening and allowing a person to respond to your questions, they will quickly feel comfortable talking to you. Try to ask follow-up questions if you can, but also focus your attention on finding common ground. Think back to what you might want to get out of this conversation, and any useful information you would like to gain. Even if you just need some contact details or to establish whether that person has an online profile so you can contact them later, make sure you have these questions ready to bring up in conversation once you feel comfortable and happy that this person might be able to help you with their background and expertise. Ending a conversation with *"I'll send you the article we've been discussing"* or *"how would I be able to contact you to talk further?"* is a great way of ensuring you have the details you need to get in touch again if you wish to. It will also help your new contact reflect on the discussions you've had with them at a later date.

Other opportunities

Remember that CIEEM offers a mentoring platform to student members. A mentor can help you with potential networking opportunities and support you with it as well as setting next steps and objectives. Additionally, CIEEM offers five free student places at its conferences, which present specific networking opportunities.

Remember, we're all working to protect and improve the environment for nature and future generations, and our sector should always be willing to help others who work within it for the common cause. Whether you are a student, in the early years of your career journey or well established in the sector, never be afraid of networking. There is enormous value in knowledge exchange, peer support and making connections for collaborative working. Don't be afraid to get involved. You never know where in the sector your next networking session may lead you.

About the Author

Drew develops and assists CIEEM's brilliant volunteer community, so they continue to make positive impacts in all areas of our Institute. Drew is an BSc(Hons) Ecology graduate from UEA and has previously worked for the RSPB supporting its volunteers and community groups in Eastern England. He is a highly passionate birder and naturalist, based in Norfolk.

Contact Drew at: DrewLyness@cieem.net



Q&A

Tamsin Morris CEcol CEnv MCIEEM

Self employed ecologist, Walking-the-Talk

How did you get into the sector?

I volunteered for a local Wildlife Trust before going to university to study ecology, so knew from a fairly early stage what kind of career I wanted to pursue. After university I worked in organic agriculture for a spell, then moved onto managing a river restoration and catchment management project in Aberdeenshire. After a short period working for the Scottish Environment Protection Agency, I took the plunge into self-employment as an ecologist in 2008.

What does your current role involve?

As part of a small business (we're a partnership of two, or four if you count the two fieldwork dogs!), my role covers everything from Accounts to Zoology. But I specialise in ecological surveys, preparing agri-environment schemes and peatland restoration projects. That gets me a nice mix of time outside and indoors and also means I get to see a lot of different landscapes around Scotland and work with a wide range of land managers.

What is your favourite part of your current role?

I'm happiest when I'm working on a project that leads to a tangible change on the ground – whether that's peatland restoration, changing grazing regimes to improve a habitat or implementing new management actions on a local wildlife site. But being outside on a gloriously sunny day with just enough breeze to keep the midges away is always a good day!

What is your least favourite part of your current role?

Climbing over barbed wire and electric fences in horizontal sleet. And dealing with tedious paperwork, where I end up saying the same thing but in multiple different formats.

Why did you become a CIEEM member?

As I'm self-employed, I wanted the opportunity to talk and engage with other ecologists, rather than working away in a bubble by myself. CIEEM also gives me an opportunity to access training and stay up to date with changes in the sector.

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

Ensuring that the transition to net zero delivers multiple benefits – putting the right habitats in the right places to tackle the climate and biodiversity crises together, while bringing people with us. We need to ensure that the ecology and environmental management sector is at the heart of decisions, so that we make the best possible choices for our natural world.

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

Changing people's idea that 'tidy' is always good. Nature is messy and I wish we could all learn to love that.

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

Improving our ability to discuss and compromise and to explain things in a non-technical, engaging way.

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

Try to get involved in as many different projects and tasks as possible, so you can really figure out what you enjoy. Learn your craft on the ground before trying to influence policy, and if you take on different roles and jobs, you may be surprised at what turns out to float your boat.



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

Well, obviously I have to say my dogs. But if we're talking non-domesticated, I have a little bit of an obsession with listening to corncrakes. You can never hear too many corncrakes.

If you could be any species, what would it be and why?

A basking shark – so majestic and yet so peaceful.

What is your favourite thing to do outside of work?

I love running, walking and camping in the hills, especially if I know I've got a decent coffee stashed away in my bag. There's a lot to be said for a hot drink with a good view.

Can you tell readers something random about yourself?

I'm a double bass player – not a very portable instrument.

BOOKS, JOURNALS AND RESOURCES

Compiled by the Academia
Special Interest Group

Paper Review 

Applications of digital imaging and analysis in seabird monitoring and research

A.J. Edney & M.J. Wood

Ibis, 2020, 163: 317–337.

<https://doi.org/10.1111/ibi.12871>

This is a useful and relatively up-to-date (submitted in early 2020) review of various digital imaging approaches that can be used in seabird monitoring, particularly at breeding colonies. It compares and contrasts approaches including satellite imagery, photos from manned and unmanned aerial vehicles (drones), fixed-position (including time-lapse, motion triggered, or video) cameras, handheld cameras, animal-borne cameras and 'night vision' approaches (IR illumination and thermography). Considering factors such as "disturbance impacts, accuracy of results obtained, cost-effectiveness and scale of monitoring possible compared with 'traditional' fieldworker methods" the paper helpfully discusses and cites real examples of each approach and then presents fully referenced tables laying out the advantages and disadvantages of that approach. The latter part of the the paper then focuses on image analysis, from manual (looking through images oneself) through to semi-automated and automated approaches.

Paper Review 

Aligning ecological compensation policies with the Post-2020 Global Biodiversity Framework to achieve real net gain in biodiversity

J.S. Simmonds, A. von Hase, F. Quétier, S. Brownlie, M. Maron, H.P. Possingham, M. Souquet, S.O.S.E. zu Ermgassen, K. ten Kate, H.M. Costa & L.J. Souter

Conservation Science and Practice, 2022, 4: e12634

<https://doi.org/10.1111/csp2.12634>

Changes in ecological compensation policies are driving an increase in the requirement for "net gain" outcomes for biodiversity. This study looks at the opportunities net gain brings to align with the United Nations Convention on Biological Diversity Post-2020 Global Biodiversity Framework's (GBF) proposed ambition for overall biodiversity recovery. In order to align and achieve meaningful outcomes from "net gain" there is a requirement for residual losses from development to be compensated for by (1) absolute gains, which are (2) scaled to the achievement of explicit biodiversity targets, where (3) gains are demonstrably feasible. At present there are insufficient policies currently meeting these conditions, which risks undermining the effort to achieve the Post-2020 GBF goals. To aid decision-making to support the GBF goals and ensure biodiversity gain, the paper includes a useful decision tree to outline net gain compensation feasibility.

Paper Review 

A practical conservation tool to combine diverse types of evidence for transparent evidence-based decision-making

A.P. Christie, H. Downey, W.F. Frick, M. Grainger, D. O'Brien, P. Tinsley-Marshall, T.B. White, M. Winter & W.J. Sutherland

Conservation Science and Practice, 2022, 4(1)
DOI: 10.1111/csp2.579

This paper explains the background to the Evidence-to-Decision tool that has been developed by the Conservation Evidence group and practitioners. The tool has three steps beginning with defining the decision context (i.e., the problem to be solved), followed by gathering evidence (i.e. What actions are likely to be the most effective to address this problem in my local context?) and finally making an evidence-based decision (i.e. What are the next steps? Which actions will be implemented based on the evidence you have assessed?). This tool is aimed at landowners, reserve managers, and small NGOs working on specific projects dealing with a specific problem and has been designed to streamline the evidence-based decision-making process for those with limited time and resources, but can also be the foundation for a more indepth decision-making process using other tools and frameworks. For those short of time and put off by the thought of reading a 20-page paper the user guide to the tool may be for you – available at <https://www.evidence2decisiontool.com/>

A taxonomic, genetic and ecological data resource for the vascular plants of Britain and Ireland

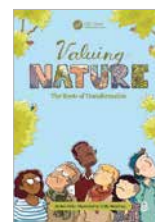
M.C. Henniges, R.F. Powell, S. Mian, C.A. Stace, K.J. Walker, R.J. Gornall, M.J.M. Christenhusz, M.R. Brown, R.D. Twyford, P.M. Hollingsworth, L. Jones, N. deVere, A. Antonelli, A.R. Leitch & L.J. Leitch
Scientific Data, 2022, 9: 1
<https://doi.org/10.1038/s41597-021-01104-5>

While the vascular flora of Britain and Ireland is well studied, finding taxonomic, ecological and genetic data and information when you need it can present challenges. This paper introduces what the authors describe as the first comprehensive data repository for both native and alien species inventory based on the most recent references and with taxon names linked to unique Kew taxon identifiers, as well as DNA barcode data. It includes data on 3227 species and 26 traits, and covers both existing and unpublished genome sizes, chromosome numbers and life strategy as well as life-form assessments and data on functional traits, species distribution metrics, hybrid propensity, associated biomes, realised niche description, native status and geographic origin of alien species. The aim is to provide fast and easy online access for ecological, evolutionary and conservation analyses. The paper is just 8 pages long and provides a link to the database and information on how to download a static version of the database (<https://github.com/RBGKew/BIFloraExplorer>) as well as on updates.

WomBot: an exploratory robot for monitoring wombat burrows

R. Ross, S. Carver, E. Browne & B. S. Thai
SN Applied Sciences: <https://doi.org/10.1007/s42452-021-04595-4>

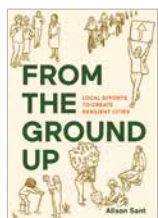
Although not many UK ecologists will encounter wombats on their surveys, this paper might have some applicability across to our own fossorial species. Monitoring can be particularly challenging for burrowing species, with life underground representing a “hidden” aspect of their ecology, despite being essential for survival, reproduction, and aspects such as social interaction and disease transmission. This study tests a robot designed to enter and record data within wombat burrows in Australia, with a particular focus on environmental conditions that may influence spread of disease such as mange. The challenges for such a robot include difficult terrain within burrows (steep slopes, sharp turns, mud, roots), signal attenuation, locational awareness and size constraints. The paper provides lots of technical detail on the robot and the testing approach. The robot weighed 2 kg and had a gripper system that could leave objects such as environmental sensors, insect traps or cameras in a burrow for later collection. As well as testing the robot’s function, they were also able to make some interesting observations, such as relative stability of temperature through the diel cycle and a substantial increase in burrow temperature when a wombat was present.



Valuing Nature: The Roots of Transformation

Authors: R. Fish & H. McKelvey
ISBN: 9780367762650
Published by: Routledge (Taylor & Francis)

A graphic novel for ecologists – is this a first? This is based on a group of students doing an assignment about nature in the modern world. I’ve used this as a teaching resource, but it’s also an easy yet thought-provoking read for anyone interested in the different value systems people form from different cultural and socio-economic backgrounds have about nature and the natural world and the options for positive future management. The characters – the class members – are a diverse group and they not only question people to find out what they think but also draw on international examples and the need to bring together science and economics to find solutions to problems and take action. It is well researched with links to further information but as it is presented in the form of a comic strip, what’s not to like? Highly recommended for outreach activities and anyone involved in teaching environmental issues at any level.



From The Ground Up: Local Efforts to Create Resilient Cities

Author: A. Sant
ISBN: 9781610918961
Published by: Island Press

For decades, American cities have experimented with ways to remake

themselves in response to climate change. These efforts, often driven by grassroots activism, offer valuable lessons for transforming the places we live. Design expert Alison Sant focuses on the unique ways in which US cities are working to mitigate and adapt to climate change while creating equitable and liveable communities. Although focused on US examples, the efforts

discussed in the book demonstrate how urban experimentation and community-based development are informing long-term solutions. Sant shows how cities are reclaiming their streets from cars, restoring watersheds, growing forests, implementing green infrastructure and adapting shorelines – all to improve people’s lives while addressing our changing climate.



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Forthcoming Events

- Conferences
- Training Courses
- Webinars

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

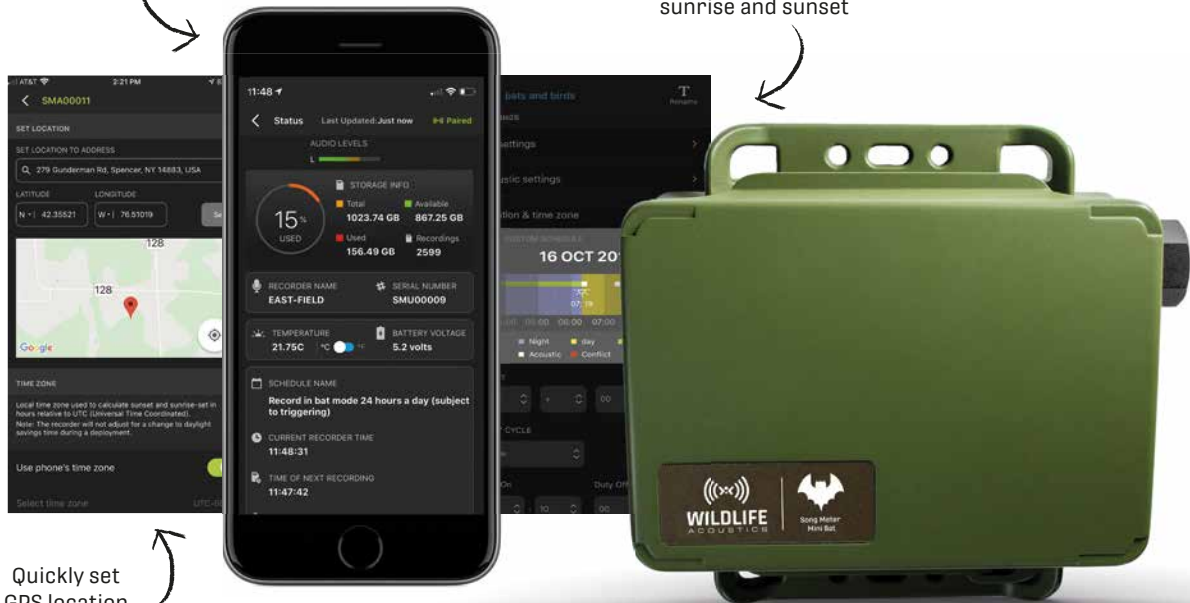
<p>13–14 June</p> <p>Bats: Assessing the Impact of Development on Bats, Mitigation & Enhancement</p> <p>Online</p>	<p>15 June</p> <p>Peregrine Falcon: Ecology, Survey and Mitigation</p> <p>Birmingham</p>	<p>16 June</p> <p>Bat Ecology and Survey</p> <p>Newtownbutler, Co. Fermanagh</p>	<p>16 June</p> <p>Botany for Beginners</p> <p>Bristol</p>
<p>17 June</p> <p>Bat Impacts and Mitigation</p> <p>Newtownbutler, Co. Fermanagh</p>	<p>22 June</p> <p>Early Careers Webinar: Top tips on applying for a job in the sector</p> <p>Online</p>	<p>24 & 27 June</p> <p>Water Voles: Ecology and Surveys</p> <p>Online/Ilkeston</p>	<p>5 & 6 July</p> <p>Water Vole Mitigation</p> <p>Online</p>
<p>6 July</p> <p>Heathland plants identification: for botanical surveying and habitat classification</p> <p>Stiperstones, Shropshire</p>	<p>13–15 July</p> <p>Working with Crayfish: Survey Methods, Ecology, Mitigation, Licensing and Invasive Species</p> <p>Settle</p>	<p>19 July</p> <p>2022 Summer Conference: Facilitating nature's recovery through environmentally-friendly land management</p> <p>Online</p>	<p>24 August</p> <p>Aquatic Plant Identification</p> <p>Wales</p>
<p>5 September</p> <p>Introduction to Fern Identification</p> <p>Bristol</p>	<p>7–9 September</p> <p>Understanding the Vegetative Key: an essential tool for Ecologists for extending the survey season</p> <p>Shrewsbury</p>	<p>8–9 September</p> <p>Eurasian Beaver Ecology & Management</p> <p>Online</p>	<p>13 September</p> <p>Fern Identification for botanical surveying and habitat classification</p> <p>Telford</p>
<p>4–5 October</p> <p>Train the Trainer for Ecologists</p> <p>London</p>	<p>5–6 October</p> <p>Identifying and Managing Non-native Invasive Plant Species</p> <p>Online</p>	<p>6–7 Oct</p> <p>Plant Identification and Botanical Keys</p> <p>Online</p>	<p>10–11 October</p> <p>Introduction to Bat Ecology & Bat Surveys</p> <p>Online</p>
<p>11–14 Oct</p> <p>Beginners QGIS for Ecologists and Conservation Practitioners</p> <p>Online</p>	<p>17 & 19 October</p> <p>Bats: Assessing the Impact of Development on Bats, Mitigation & Enhancement</p> <p>Online</p>	<p>18, 19 & 21 October</p> <p>QField for Ecologists and Environmental Practitioners</p> <p>Online</p>	<p>23–24 November</p> <p>2022 Autumn Conference: Delivering a nature positive, carbon negative future</p> <p>Edinburgh</p>

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