Chief Scientist Report 2023:
The impact of our work

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NATURAL ENGLAND

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And to Elizabeth Mitchell

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Foreword

Natural England, one of us was told during a recent Board meeting with stakeholders, has a reputation amongst partners and stakeholders for the quality and breadth of its scientific evidence and technical expertise. The complexity of science needed to inform nature recovery is made very clear in this report. The disciplines we must keep abreast of as an evidence-led organisation range from the social science surveys and focus groups used to understand accessibility of nature to blind and partially sighted people, to the data-heavy spatial analysis, algorithms and artificial intelligence models required to map restoration opportunities or habitats at national scale. The Living England team won a Business Innovation Award in 2023 (see page 13), for making such an excellent, accessible habitat map. Congratulations to them!

One thing that shines out is the way our Key Performance Indicator on engaging people with nature runs deeply through the science and evidence work. In this report, some of our individual scientists reveal their own connections with nature. We are struck by how often these relate to childhood experiences of small pieces of common or garden nature, cherished by many but not always valued by society as a whole, and seldom protected by regulation. The challenge is to find ways to protect these small sanctuaries, alongside the important threatened species, habitats and ecosystems individually protected in law. Natural England has statutory duties in both areas under the Environment Improvement Act 2021, and evidence-based guidance of the kind described by Claire Pinches (p.17-19) on supporting woodland creation in the right places, always plays a crucial role.

As Co-Chairs of the Natural England Science Advisory Committee (NESAC), our job is to guide independent oversight of the quality and relevance of science underpinning Natural England's advice. Our committee draws world class independent expertise across disciplines from among the best scientific institutions in the UK. We act as a sounding board for key scientific questions and strategic approaches to evidence, working with teams handling science across Natural England. We work closely with the Chief Scientist's Directorate, also acting as one of many cross checks during processes of scientific peer review, with a focus on particularly challenging or high-profile issues.

What we see through NESAC, and what you will see in this annual report, is deeply impressive and impactful science tackling a wide diversity of issues. This can include new research, data gathering using the latest monitoring methods or research synthesis. Through its science and evidence work, Natural England collates the best available evidence to inform advice and policy decisions *from the front*. Which is exactly what the organisation sets out to do.

Very soon we will welcome Professor Sallie Bailey as our new Chief Scientist, and we look forward to working with her on the undoubted challenges ahead. For now, we want to say a huge thank you and farewell to Dr Tim Hill, for 32 years of service to Natural England, culminating in being the Chief Scientist, where since 2011 he has delivered with integrity and sincerity, inspiring a massive amount of loyalty from

his team. Tim's Natural England story is told by Ginny Swaile (p20-24) through the history of marine conservation in England. It has been a seismic shift in emphasis for nature conservation in England, always underpinned by evidence, which Tim was involved with from the start. Some legacy!

Professors Clare Fitzsimmons and Lynn Dicks

Natural England Board Members, co-chairs of Natural England Science Advisory Committee (NESAC)

Welcome and Introduction

Welcome to Natural England's Chief Scientist Report for 2023. It is the last of this series that I will be introducing; I am retiring, and my successor will be Professor Sallie Bailey who joins us from her role as Deputy Chief Scientific Advisor for the Scottish Government.

The sixth in our series, this report focusses on the impact our work has, and how we know what that impact is. We look at many interesting topics including how we can make nature more accessible, the immensely positive impacts our work has on habitats across England and how our evidence led approach resulted in woodlands being established to help nature recovery.

Our 'Spotlight on…' features usually showcase people across the organisation, however, this year we have decided to focus the spotlight onto our amazing colleagues within Chief Scientist Directorate. These sections highlight the important and valuable contributions everyone across the breadth of CSD in Science, Evidence and Analysis have in recovering nature.

As this is my last Chief Scientist Report, I would like to take the opportunity to thank colleagues across the organisation who work with the upmost dedication on achieving our goals to recover nature. It has been an honour to be Natural England's Chief Scientist and I have no doubt this incredible work will continue under the guidance of Sallie.

I do hope you enjoy this report and I look forward to reading about next year's accomplishments. Over to Sallie!

I am delighted to be joining the Chief Scientist Directorate at Natural England and to see all the amazing work highlighted in this year's report.

I first worked with Natural England (then English Nature) during my PhD, which drew on the Ancient Woodland Inventory, and then as a project officer. Twenty-five years later, with the need to protect and improve outcomes for nature in the face of climate change and biodiversity loss being ever more urgent, I am thrilled to return and build on Tim's legacy to ensure science, evidence and analysis are at the heart of all that we do.

I have been driven to bring science to the heart of nature recovery throughout my career. I believe resilience through restoring ecosystem function is critical in our response to climate change and protection of natural capital on which society depends. My last few roles have demonstrated to me that society and economic well-being must be front and centre of environmental policy and practice, and we

must improve society's understanding of the value of natural capital to ensure lasting and meaningful outcomes for nature.

I sincerely hope you enjoy the report and all the fascinating science and evidence work that is crucial to delivering these outcomes.

Dr Tim Hill MIEnvSc MIoD &

Professor Sallie Bailey (FICFor)

Chief Scientist, Natural England
June 2024

Fostering Inclusive Access to Nature: Breaking Barriers for People with Visual Impairments

Louise Montgomery

At Natural England, our unwavering commitment to the vision of 'thriving nature for people and planet' drives our efforts to address the challenges faced by individuals with visual impairments in accessing green and blue spaces (e.g., parks, allotments, forests, lakes, rivers, canals, mountains, beaches, nature reserves, countryside). In acknowledgment of the overwhelming benefits of nature on physical and mental wellbeing, we wanted to present a recent report highlighting our dedication to making the great outdoors accessible to everyone.

The positive impact of nature on wellbeing is substantial, however, individuals with visual impairments encounter significant barriers that can hinder their ability to access and benefit from engaging with the natural world. The Royal National Institute of Blind People (RNIB) anticipates by 2050 one in five people will start to live with sight loss in their lifetime, and currently 40% of people with visual impairments feel isolated and disconnected from both their surroundings and others.

A group of people, including guide dog owners, walking beside a waterbody. Photo: MyVision Oxfordshire

In a proactive approach to better understand the unique experiences, needs and preferences of people with visual impairments accessing green and blue spaces, Natural England collaborated with local and national organisations, including Research Institute for Disabled Consumers (RiDC), Oxfordshire County Council, University of Oxford, MyVision Oxfordshire, Fight for Sight, Vision Foundation, RNIB, Guide Dogs, Disabled Ramblers, The Ramblers, Reading Association for the Blind, and Open Country. Collaboratively, and thanks to over 750 participants who have a visual impairment completing a survey and a select number participating in focus groups, one of the largest datasets of its kind was produced. This has helped us with the discovery of new insights, improve decision-making, and improve our understanding of how to tackle barriers to nature. The collaborative work has enabled us to identify key challenges faced by individuals with visual impairments, including difficulties in accessing information, transportation issues, physical obstacles, technology-related challenges, and safety concerns to accessing green and blue spaces.

Our report, 'Creating More Accessible Green & Blue Spaces', outlines a set of recommendations that came out of this research to enhance accessibility, focusing on providing information in various formats, improving transportation options, addressing physical barriers, enhancing facilities, and offering organised activities. These recommendations underscore the importance of a comprehensive co-production approach, ensuring that green and blue spaces are inclusive not only for individuals with visual impairments but for people with disabilities more broadly.

Using a long cane on a lakeside walk. Photo: MyVision Oxfordshire

Following the release of the publication and communication of the research across different networks, the interest and awareness in the area has blossomed. This has led to more partnership opportunities and national interest in implementing the recommendations on the ground, such as within National Nature Reserves, Local Nature Partnerships, and rippling into further areas of inclusive access, such as communication of the Countryside Code. The work has also opened the door to further research opportunities including a pilot project currently underway with some of our new partners in Oxfordshire. Additionally, the development of national funding bids with new partners is ongoing, with the objective of establishing multiple walking groups for individuals with visual impairments. These groups will convene regularly to tackle social isolation and mental health concerns, while also investigating whether confidence in utilising green and blue spaces grows with consistent project engagement.

Our science and research have made a tangible impact through partnerships, national interest, and ongoing pilot projects with positive responses. We anticipate that this impact will persist and contribute significantly to policies, resource allocation, advocacy, and the promotion of inclusive design practices. This ongoing effort aims to advance a future where everyone, regardless of their abilities, can fully enjoy the beauty and benefits of nature.

Spotlight on...
Chris Hogarth

What is your first memory of an environmental or conservation issue?

I grew up on the western fringe of Salford in a place called Monton in the 1960s/70s. My local greenspace was a Beeching-axed railway embankment that was a haven for wildlife, and it was here the local kids experienced our local nature and where I gained my love of wildlife. At some point in my teens or early 20s the drilling rigs arrived to do ground investigations and within months what was a massive landscape feature had been bulldozed away and replaced by houses. It has stayed with me just how quickly and easily these local greenspaces which are so valuable to local communities and local wildlife can be lost.

What is your role in NE and what does it entail?

The Senior Urban Ecology role in NE is about making sure the urban ecosystem, including the people component of that ecosystem, is represented in the delivery of our programmes and priorities. This representation often takes the form of input and advice to developing projects and policies such as Biodiversity Net Gain, 'Green in 15', Recreational Disturbance and Citizen Science. Being an evidence-led organisation it is important that our advice is rooted in solid science and partnering with external groups and academics on the development of new research areas helps to achieve this. Getting out and about to see what works in urban settings helps to keep our urban expertise grounded and practical. Supporting area teams on the delivery of LNRS and Priority Places is one way of seeing what works on the ground.

What effect or impact does your work have, and how do you know?

The effect of our urban ecology work has been to increase the profile of our urban areas not only as a place that is home to around 80% of the population but as a place that can contribute to nature recovery. The impact will be felt with the implementation of projects and programmes such as the Green Infrastructure Framework, and particularly the Urban Nature Recovery Standard. In the past two years our urban ecological capacity has allowed us to project manage spend which has identified the degree to which some accessible urban greenspace is not mapped; will improve the quality of the priority habitat layer for Open Mosaic Habitats (an urban speciality) and created data and tools that can help us understand where our SSSIs might be impacted by recreational impacts due to population and lack of green infrastructure.

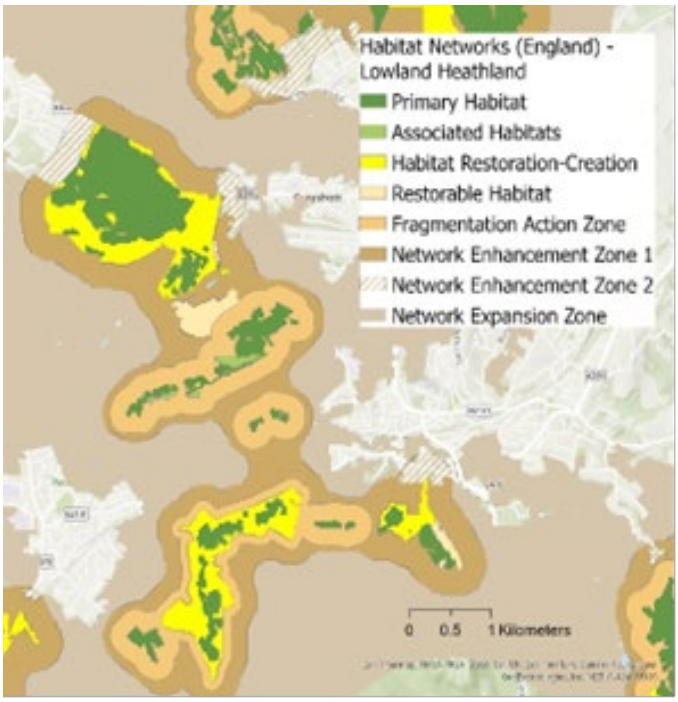
Mapping habitat networks across England and beyond

Michael Knight, Carole Adolf and Zachary Dickeson

Since its release in 2020, Natural England's Habitat Network Mapping Tool has been used by a wide range of projects and partners to map and analyse ecological networks all over England and beyond.

Nature Recovery Networks are a central part of the UK's ambitious plan to become "Nature Positive" by 2030, and to make this the first generation to leave nature in a better state than the past [1,2]. Following the Lawton report and its key principles of "more, bigger, better and joined" habitats to improve England's ecological networks [3], Natural England developed a collaborative and adaptable Habitat Network Mapping Tool to support the mapping of ecological networks and planning for nature recovery at national or local scales.

What is the Habitat Network Mapping Tool?



Excerpt of the Lowland Heathland Network Map, an output of the HNM Tool.

The Habitat Network Mapping (HNM) Tool is a Geographic Information System (GIS) tool that analyses the spatial distribution of Priority Habitats in relation to data on habitat restoration and creation potential to identify and map zones with opportunities to enhance, expand and join up existing habitats (Figure 1).

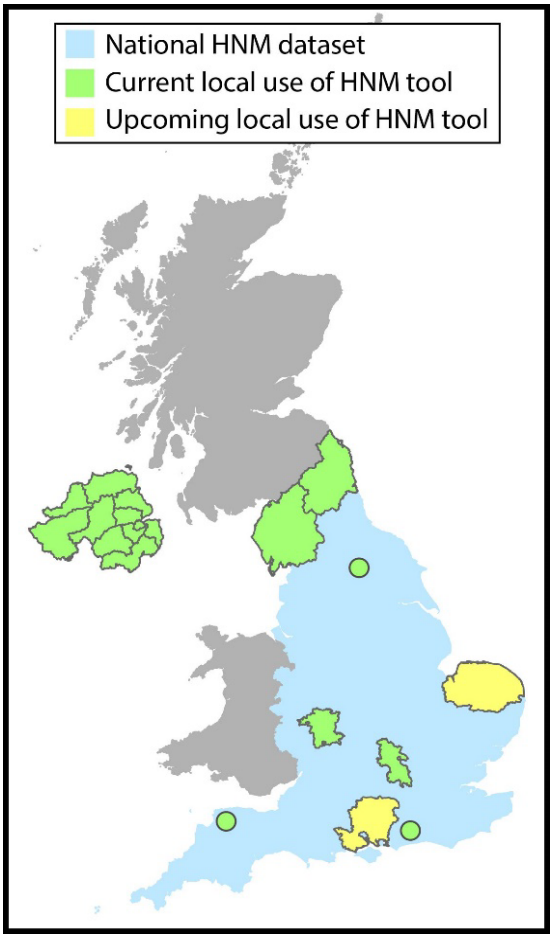
The tool was first used to create a set of National Priority Habitat Network Maps [4] for England. Published on Magic, the NE Open Data Portal and the Local Nature Recovery Strategy Data Viewer [5]. However, the tool was also designed to be shared with partners allowing them to analyse local habitat data and map ecological networks that reflect local knowledge and priorities, while following a consistent national methodology.

Projects and partners across England

Across England the HNM Tool and the ecological network maps it produces are being used by a wide range of local and national projects and partners (Figure 3). Examples of national scale projects include:

The Favourable Conservation Status Project to identify the scale of habitat expansion required to improve ecological resilience; the National Nature Reserve (NNR) Strategy for identifying future site expansion; Agri-Environment Scheme spatial prioritisation and ecological connectivity work; as well as the Environment Agency's Land Use Change Project. The Habitat Network mapping is also featured in the Nature Networks Evidence Handbook [6].

The HNM tool has been an important part of many Local Nature Recovery Strategy pilots and Nature Recovery Plans, such as in Cumbria, Buckinghamshire and the river catchments of Coquet, Pont and Blyth, and Wansbeck in Northumberland. Other local projects are distributed across the country, such as the Worcestershire's Green Infrastructure Partnership, South Downs National Park, Nidderdale AONB and the
North Devon Pioneer ELM Trial.



A map of local authorities and partners that are currently making direct use of the National Habitat Network Tool.

We are currently in conversation with the Hampshire and Norfolk County Councils, to assist them in adapting the tool for use in their counties, too.

We are planning to run updated Priority Habitat Inventory data through the HNM Tool to produce a new set of National Habitat Network Maps later in 2024. For more information contact the Habitat Inventory mailbox at habitatinventories@naturalengland.org.uk

Our work is also having an impact outside England:

Showcase in Northern Ireland

We recently showcased the use of the Habitat Network Mapping Tool in Northern Ireland to an international scientific and stakeholder audience at the British Ecological Society Annual Meeting in Belfast (Figure 2). This was a joint poster presentation with our partners from Ulster Wildlife and the Northern Ireland Woodland Trust.

A group of key stakeholders including: Ulster Wildlife, NI Landscape Partnership, NIEA and JNCC adapted the tool to map habitat networks in Northern Ireland. The resulting network maps are being used as a powerful decision-support tool for assessing sites and landscapes, as well as for designing projects or considering strategic land purchases.

Ulster Wildlife, Woodland Trust NI and NE colleagues presenting the joint poster regarding our partnership in using the HNM in NI. British Ecological Society Meeting 2023, Belfast.

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Spotlight on…
Karen Kramer Wilson

What is your first memory of an environmental or conservation issue?

As a very young kid, I remember them channelizing, cementing, the creek that ran behind our neighbourhood to “improve” it. The frogs that used to sing every spring were suddenly silenced and what had been a green oasis in suburbia was quite bare. Subsequently in rainy periods the creek would flood the roads in the area because the water could not flow naturally or be absorbed by the banks. When I was twenty, I took my first course in Environmental Ecology and learned that one of the leading causes of environmental pollution at that time was agricultural runoff. Coming from an extended family of farmers, I thought I should focus on improving that – so my first degree was in Agronomy and my second was in Entomology – studying alternatives to chemicals and focused pest control in crops.

What is your role in Natural England and what does it entail?

I work with a team that supports projects and the programme of the NCEA – ensuring they can access, analysis and share the data and evidence. We engage across NE more widely where our work can have an impact, liasing with external data providers and supporting the biological recording infrastructure and huge external community of partners that help support gathering evidence to support nature recovery.

What effect or impact does your work have and how do you know?

For projects, we know we have an impact when they can meet their ambitions, publishing and improving products like Living England, Green Infrastructure and the England Ecosystem survey. We also know we are helping when the people on those teams let us know our support has given them some clarity or direction to move forward. The wider partners are grateful for the chance to influence our own thinking as well.

Living England: a satellite-derived national habitat map

Anne Stefaniak

Living England provides a broad habitat map for the whole of England, created using satellite imagery, field data records and other geospatial data in a machine learning framework using a random forest algorithm. The Living England habitat map shows the extent and distribution of broad habitats across England aligned to the UKBAP classification, providing a valuable insight into our natural capital assets and helping to inform land management decisions.

The Living England Phase IV Habitat Map was first published in March 2022 under an Open Government Licence (OGL) and is freely available for all. Living England Phase IV provides predictions of habitat distribution and extent on a national scale for 2019-21. This can be used to help inform a wide range of applications, including...

- Environmental policy decision making
- National habitat extent and connectivity assessments for targeting nature recovery
- Assessment of natural capital assets
- Ecosystem service modelling.

Since the release, Living England has been used to support multiple projects and provide a core dataset for the Defra Environment Improvement Plan (EIP)/25 Year Environment Plan (25YEP) D1 indicator – Quantity, Quality and Connectivity. Furthermore, it is used for Environmental Land Management schemes (ELMs) to help build asset baseline mapping to drive spatial targeting and Land Use Modelling. This supports the development of the Land Use Framework (including statistics reporting) ensuring an open and adaptable product is delivered, which aligns with emerging policy areas across Defra.

Living England is one of the key outputs of the Natural Capital and Ecosystem Assessment (NCEA) Programme. As such, it has been integrated with a number of other NE projects including England Peat Map, Green Infrastructure, Priority Habitat Inventory, Local Nature Recovery Strategy (LNRS) Data Viewer (arcgis.com), and JNCC's Landscape evaluation app, and Northern Ireland habitat map.

The reach of Living England goes far beyond Defra, and it has been used by commercial organisations in their development of land use decision-making apps. These support landowners achieve Net Zero and Biodiversity Net Gain (Verna Earth Ltd) and in implementing condition assessments which align with the Biodiversity Metric Calculator (Map Impact). The variety of projects highlight the range of use cases Living England supports. The need for an open dataset initially arose from ELMs and 25-Year Environment Plan, yet its adaptability has already gone far beyond its initial expectations.

2023 Highlights…
Living England won the RSPSoc Business Innovation Award 2023 based on the Phase IV national habitat map published in March 2022. This was a significant acknowledgement of the work and time the team have put into creating and developing the project.

The Living England Team with the RSPSoc Business Innovation Award certificate

Where can I access the Living England Map?
From March 2022, you can access the Living England Map on MAGIC, WebMap2, ArcGIS Online, the Natural England Open Data Portal, DEFRA Data Services Platform, and data.gov.uk. Follow the link to the data **here**. A technical report with more detail as to the methods and data used is available to view **here**.

Living England 2022-23
A number of improvements and updates to the method have been implemented since the release of Phase IV. A new version Living England 2022-23 will be released internally for Defra colleagues in March 2024. It is due for public release in Summer 2024. Living England 2022-23 has been produced using a standardised methodology which will be consistent for future iterations, enabling assessment of habitat change over time. If you have any questions or would like to know any further details, please get in touch with the Living England team at livingenglandenquiries@naturalengland.org.uk.

Spotlight on…
Jo Gamble

What is your first memory of an environmental or conservation issue?

I have always preferred being outside and had a curiosity about the natural world around me, this has not waned. As a child I would spend hours in my shed watching a bird station or watching a bucket, I had sunk in the garden, hoping for sight of the frog eyes popping up to watch me. I record the dawn chorus on my tape machine. I am still very curious and interested in everything.

First memory of environmental disaster would be the storms of October 1987, when Sevenoaks became One-oak. First conservation issue that I became aware of was the decline of Otters and Water Voles. I used to walk along Basingstoke Canal from school, I enjoyed spotting water voles and hearing the distinctive plop as they entered the water, this became less and less over the years. I took an interest in mammals. I read Ring of Bright Water by Gavin Maxwell, my focus moved to Otters. I heard about the Skye Bridge proposal which had the potential to impact Eilean Bhan, the 'otter island' where Gavin Maxwell lived. I sent a letter of concern and received my first development report, it was a heavy envelope. Little did I know, I would come full circle.

What is your role in Natural England and what does it entail?

My current role in Natural England is Team Leader to the Marine Ornithologist Team. I am on a temporary promotion. I worked in the West Anglia Team in Protected Sites and Sustainable Development. I completed the Southeast Future Leaders Pilot course, which gave me the confidence to apply to the expression of interest.

As Team Leader my priority is the wellbeing of my team and that they have the support to enable them to carry out their role, manage workloads, continually develop and enjoy working within the Marine Ornithologist Team and Natural England.

What effect or impact does your work have and how do you know?

Tricky question, as I have not been in my role very long. I hope that as a team leader I help create a good working environment for my team to thrive in and enable them to carry out their roles as Marine Ornithologist Specialists, so that the team can improve the conservation status of birds in England and increase bird abundance by providing scientific led, evidence-based advice.

Natural England: leading the delivery of soil health research across England

Eleanor Reed

We depend, economically, agriculturally and socially on the ecosystem services and benefits that healthy soils provide, including clean water, food security, carbon storage, flood and drought reduction and thriving wildlife.

Soils are formed over long periods of time, reflecting the five soil-forming factors and are therefore highly variable, with different soil characteristics and capabilities. Understanding soil capability can inform the right land use and land management in the right place. And soils in a healthy state will be best delivering the ecosystem services to which that soil type is best suited.

Over the past 3 years, Defra have provided Natural England Soils team with funding to deliver soil health projects to contribute evidence, guidance and tools to better understand and improve soil health. Further funding has been provided to Natural England to continue this suite of work into 2024/25.

To date, we have delivered 27 soil health projects, through a mix of internally delivered and externally commissioned projects. We have developed strong partnerships with a range of specialists from a range of disciplines, including soil science, but also including other specialisms such as geospatial science and agronomy.

What made a difference?

This allows Natural England to ensure that our work is evidence-led, strengthening the weight of the advice and guidance we are able to provide to our staff, Defra and other end-users.

Natural England hosted its inaugural Soil Health Conference in 2023, showcasing the work commissioned by Natural England to an audience of over 100 delegates from a range of sectors. The event brought together a variety of attendees to discuss the shared priorities of understanding and improving soil health, whilst developing and strengthening partnerships.

This work area has demonstrated Natural England as key leaders in the development and delivery of soil health research within England, which is further evidenced through invitations to present our soil health work, most recently at the Westminster Food and Nutrition Forum Soil Health event and the Future for UK Agriculture Conference. Attendance at these events provides opportunity for knowledge exchange, exposure to other areas of research and generate future opportunities for collaborative working.

The second Natural England Soil Health Conference is currently being organised for this summer. For more information contact Eleanor Reed Eleanor.reed@naturalengland.org.uk.

Spotlight on…
Megan Dugdale

What is your first memory of an environmental or conservation issue?

I have been aware of environmental issues since a young age, as my mother worked for the Countryside Agency, and I had birthday parties learning to forage and make bird feeders at my local Nature Reserve. A moment that defined my perspective however, came when I was in primary school. I wrote a letter to my local MP (Christine McCafferty) about a bill that was being put through parliament. Not only did I receive a response, but she attached a copy of the 'Climate Change Bill' with her signature added and commended me for my concern. This taught me that ordinary voices are the key to getting politicians to take action and act upon the vital science and evidence being produced by environmental conservation charities, NGO's and governmental organisations. I still have the letter to this day.

What is your role in Natural England and what does it entail?

I sit in the Science Engagement and Impact team. We oversee and support all science communications and monitor our reach as a directorate both internally and externally, through specific channels of communication. This entails everything from maintaining and developing SharePoint sites, running our newsletter, producing our Appliance of Science podcast, to developing stories for our intranet and external blog platforms. We support our colleagues in creating stories that are useful to the audiences they are seeking to engage with. As our Chief Scientist Tim Hill says; "Our work is not complete until we have talked about it", and for us the most important part of our job is telling the important science and evidence stories in a way that is useful and palatable to our many different stakeholders.

What effect or impact does your work have and how do you know?

Our work enables CSD to target those inside and outside the organisation who may want to utilise our science and evidence. We monitor the engagement of our communications outputs with continuous data gathering, which is fed into an annual report to enable the team to reflect on what we have learned and to develop our approach to increase our reach and impact.

Putting down new roots: taking an evidence-led approach to establishing new woodlands for nature's recovery

Clare Pinches

Where and how we establish new woodlands profoundly influences their value for nature. Taking an evidence-led approach to the development of new incentive mechanisms and guidance is of critical importance. It ensures we arm land managers with the tools they need to protect and restore both woody and non-woody wildlife whilst also contributing to net zero.

Specialists in Natural England's Chief Scientists Directorate have played a central role in ensuring that the best available evidence is used to new policy, incentives and guidance associated with delivery of the Government's tree target. Here we look at specific examples where NE's evidence-led advice is securing significant benefits: on peat and breeding wader protection from new afforestation, and through ensuring the design principles for establishing new native woodlands deliver wildlife rich and resilient new habitat.

Structurally diverse woodland in North Yorkshire. Photo: Natural England/Clare Pinches

In the right place native woods, trees and woody shrubs have a pivotal role to play in addressing the nature crisis, injecting much needed structural complexity into our landscapes. However, in the wrong place, its well-recognised trees and woodlands can damage existing environmental assets, causing further declines in the

populations of rare and declining open habitat species and compromising the condition of priority open habitats such as grasslands and peatlands.

On peatlands of course, woodlands not only compromise the integrity of peatland habitats, such as blanket bog, and associated species, but also dry out the peat releasing previously stable carbon into the air and water exacerbating the climate crisis. Whilst the UK Forestry Standard already protects deep peats of 50 cm or more from planting, large expanses of shallower peats are left unprotected and little emphasis was afforded to the damaging impacts on deeper peats of planting on hydrologically linked shallow peats. These facts coupled with the Berrier End case in Cumbria, and a flurry of woodland creation applications on peat in the uplands in the early days of Defra's Nature for Climate (NCF) tree programme provided impetus to urgently rethink the English guidance, not least so it aligned with the peat restoration component of the NCF programme.

NE specialists collated and analysed best available evidence on peat and tree interactions and impacts on carbon and biodiversity and worked with Forestry Commission and Defra to translate this into new best practice joint NE/FC guidance for England published in 2021. Importantly this defines deep peat in a forestry context, as being peat greater than 30cm depth. It also precludes new planting on any shallower peat hydrologically linked to peat of 30cm or more. The guidance has resulted in a significant reduction in the number of woodland creation applications on peatlands, thereby protecting the nature and carbon integrity of many more peat bodies from afforestation.

Similar joint decision support guidance first published in 2022 and revised in 2023 has been developed for upland breeding waders and new afforestation. This guidance helps ensure that new woodland creation schemes avoid important areas for the conservation and recovery of rare and declining ground nesting species such as Curlew, Redshank and Golden Plover. This work also draws on best available evidence including on the so called "predation halo" effect new woodland habitat can have. Through provision of denning, nesting and perching habitat, woodlands can increase the number of mammal and bird predators within a landscape, thereby increasing predation pressure on the eggs and chicks of ground nesting birds, so reducing productivity. The guidance helps better identify and protect areas of importance for wader recovery from piecemeal woodland creation which would have predicted serious cumulative impacts on upland wader populations, whilst better identifying those areas where woodland creation can safely proceed with nil or minimal impact, or where the trade-off between wider nature recovery benefits outweighs a minor impact on waders.

Finally, evidence-led input and advice from NE specialists led to enhanced requirements for the nature recovery additional payment in FC's flagship England Woodland Creation Scheme. Newly planted woodlands receiving this payment must include a higher proportion of native species, be significantly more diverse in their species composition, include a minimum of 30% shrubs and encompass a far higher proportion of open space/glades. The greater range of ecological niches and resources provided by designing in greater structural and species complexity at the

start, enhances the habitat's value for wildlife and ecological resilience to climate change, pest and pathogens. Continued high uptake of this additional payment means that many thousands of hectares of new woodland will be established I this way, providing biodiversity benefits in the short and medium, as well as longer term.

Collectively, the evidence led input of NE's specialists is helping ensure new tree cover is established in right place and in the right way to minimise risk and provide greatest gain for nature.

Wet woodland in Norfolk. Photo: Natural England/Clare Pinches

The timeline of marine conservation in England's waters

Ginny Swaile

For newly qualified marine scientists joining Natural England today, it is a busy, complex work area with a high political profile and significant public interest. We are working at the forefront of technology and research to manage the ever-increasing demands on our natural resources and promote sustainable use that will support the recovery of our marine ecosystems. We say that casually as if it has always been like this, but when some of our more experienced colleagues joined, it was a bit different...

England has a coastline of 4.422km and our marine area is nearly twice the size of the land. As an island nation, our seas have been deeply embedded in our culture as a source of materials, food, transport and trade for many centuries. Sadly, they have also been considered a solution to the disposal of waste of all types. Nature conservation in the marine environment lagged behind that on land. Only 35 years ago there was little in the way of protection beyond a few international laws and treaties, protected sites which could extend down to mean low water and one statutory marine nature reserve: Lundy.

After many years of research and persistent lobbying, it was recognised that information was required on which to base decisions. This triggered the Marine Nature Conservation Review (MNCR), an initiative of the Nature Conservancy Council (later the Joint Nature Conservation Committee) to analyse existing evidence and fill data gaps through mapping and surveys. In 1992, our Chief Scientist Dr. Tim Hill joined the survey team as a newly graduated marine ecologist. The MNCR established the first common standards for monitoring and the biotope classification system (Hiscock, 1996).

In the early 1990's there were several legislative changes including the Sea Fisheries Act (1992) and the Conservation of Habitats and Species Regulations (1994) and the UK signed the international Convention on Biological Diversity. For the first time, the marine environment was on an equal footing to the land. Special Protection Areas and Special Areas of Conservation were designated, and processes put in place to assess the impact of activities and developments. This was underpinned by the MNCR evidence and the expertise of a very small group of specialists under the watchful eye of Tim, now Designated Sites Manager for English Nature. The UK Biodiversity Action plan was launched and the nature conservation agency's role as a regulator for protected species was extended to cover marine species.

By 2008, Natural England was in its infancy and Tim was Director for Regulation and Access. Around the same time the Marine Bill was being worked up, which would become the Marine and Coastal Access Act (2009). Specialist advice and evidence provided to Defra during that period was instrumental in creating the marine spatial planning process, identifying the list of habitats and species for designation of a new network of protected areas. As well as supporting the formation and early

development of the Marine Management Organisation and the transition of Sea Fisheries Committees to Inshore Fisheries Conservation Authorities.

When Tim became Chief Scientist in 2011, emerging techniques such as eDNA, satellite tagging and earth observation and advances in modelling were providing new ways to collect and process data, alongside the traditional (and still necessary) survey methods. Tim was a founding member of the Natural England Dive Unit and has championed this expert team who can collect data on sensitive habitats and species where other techniques are not suitable. Maintaining this capability has allowed in-house collection of high-quality data and valuable long-term datasets.

Over the next decade Natural England would provide evidence and analysis to support designations, monitoring, condition assessments and provide operational advice. This was used to produce more robust conservation advice packages to inform the management of the new network of marine protected areas. Influenced by Tim's naturally collaborative and inclusive working and network of contacts, much of our monitoring work is carried out with partners (Environment Agency, JNCC and Cefas). Those relationships have been critical to increasing Natural England's influence and our ability to make best use of funding available.

When the UK left the European Union, the Fisheries Act (2020) and Environment Act (2022) brought in a suite of objectives and targets described together in the Environmental Improvement Plan. The accelerated timeline of marine conservation is challenging but has allowed a more strategic approach, learning from decades of experience on land. Compared with 8% of land, 40% of the English marine area is now designated as a network of MPAs. Designation was the first step and managing pressures to achieve favourable condition was the next. Natural England provided evidence that taking a broader approach to the management of protected sites, as opposed to protecting specific features, would facilitate whole ecosystem recovery. In 2023, with advice from Natural England, 3 Highly Protected Marine Areas were designated, where nature will be allowed to recover to a more natural state.

Natural England's remit in the marine environment is now as broad as it is on land and our statutory advice covers everything from marine developments, aquaculture, and fisheries management to protected sites and species, the historic environment, recreation and access. Science and evidence have driven a lot of the changes in legislation and policy that we have seen in the last 30 years, and we are working proactively with Defra and partners to create and present evidence to support marine nature recovery in new ways.

Some of these ways have already had real impact: taking stock of the contribution that marine habitats make to carbon stores (Gregg et al, 2021) and investigating their potential to mitigate climate change (Swaile et al, 2022). In response to evidence around the impacts of pressures from human activity and disease on seabird populations, the Government have put in place a series of 74 actions: the English Seabird Conservation and Recovery Pathway. Related to this, Natural England used ecosystem modelling and a natural capital approach to show the potential benefits of allowing sandeels to remain in the ecosystem as a crucial source of food for larger fish and seabirds. This contributed to the Government's

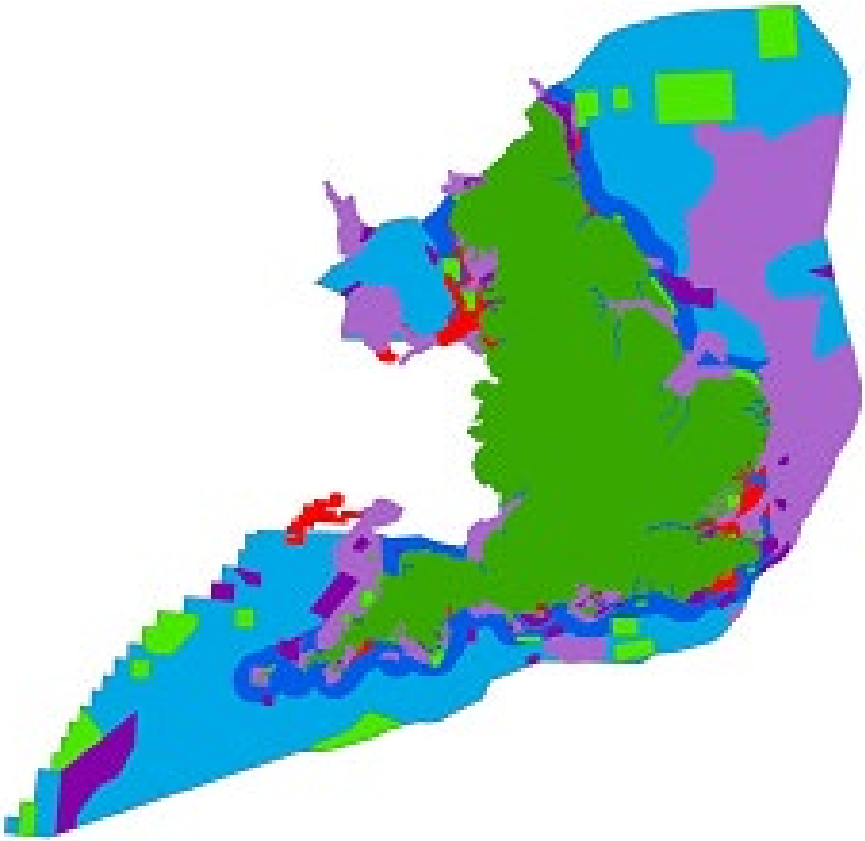
decision to prohibit the fishing of sandeels in English waters from this coming season.

There have also been some surprising findings during work with partners. After almost a century of speculation around the migration patterns of the European eel, a tagging study showed their passage to the Sargasso Sea as had been hypothesised but never proven (Wright et al 2022). Also, whilst trialling the use of small lights to replace bait in lobster and crab pots, it was found that scallops were attracted to the lights and gathered in large numbers, opening a potential new way to catch scallops which is much lower impact than current dredging techniques and more cost effective than diving (Enever et al, 2022).

Things have certainly changed at pace during Tim's career, so as he prepares for retirement this summer, what of the future for marine science in Natural England? Collaboration and evidence kick started this journey, presented by a small and passionate group of marine scientists, shouting to make themselves heard. This community is much larger today and we have the engagement of Government and general public, but there are still significant challenges to overcome which rely on continued collaboration and high-quality evidence.

Our work requires a holistic approach and the ability to integrate actions for nature recovery across land and sea, something that Natural England is uniquely placed to do. Ever increasing demands on marine resources have steered us towards more strategic solutions to mitigating and offsetting impacts. Much of our science and evidence work happens in our Area Teams as well as nationally and specialists and advisers across the organisation work together, sharing their achievements and ideas at our annual Marine Event. We must continue to invest in this expertise and seek a level of funding which will allow us to monitor the marine environment effectively and track nature recovery.

England's Marine Protected Areas



England - land in green and marine areas in blue, with Marine Protected Areas overlaid

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