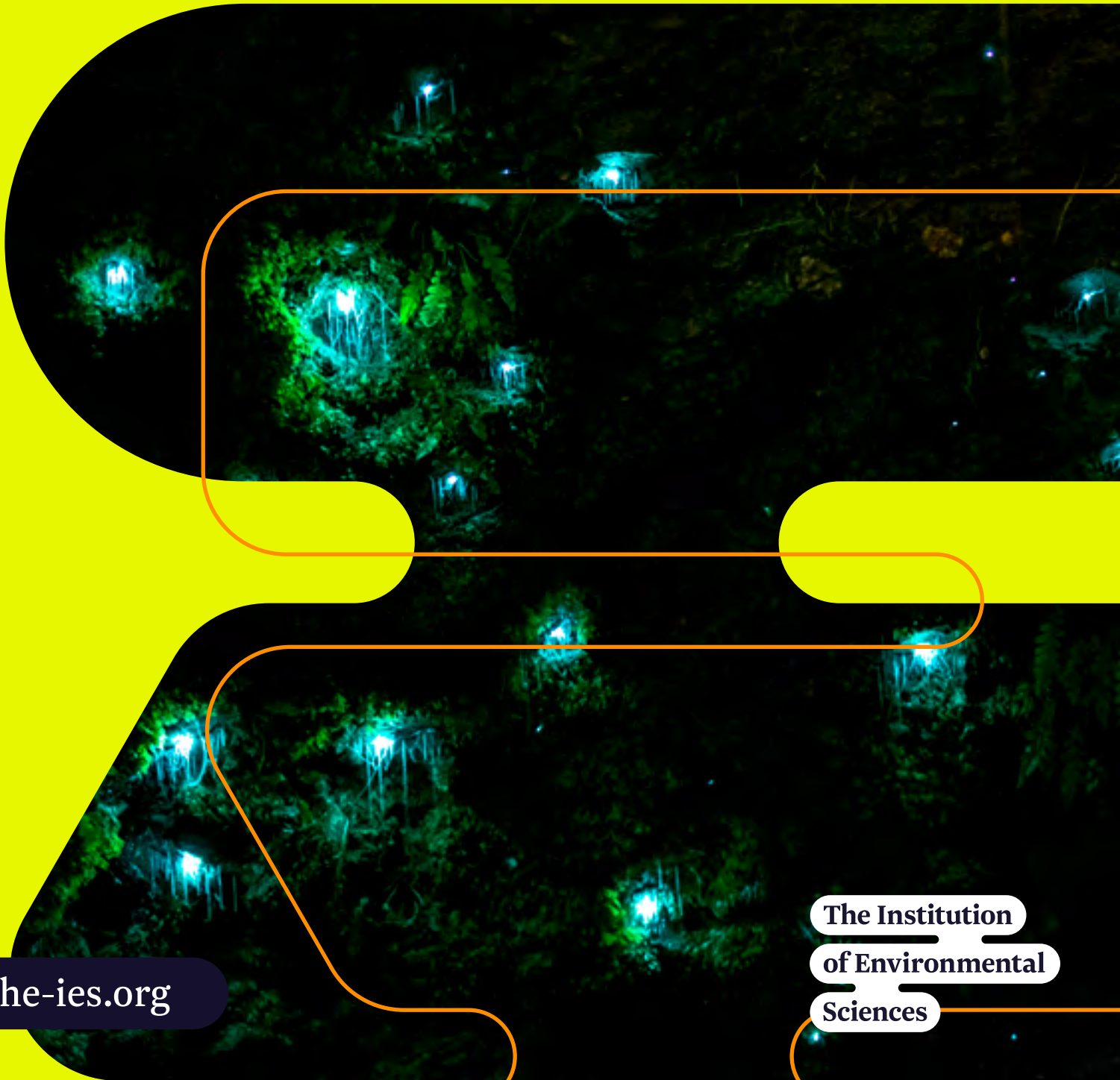
Speaking up for science and the environment

Case studies for effective environmental engagement throughout the policy process

January 2025



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Contents

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About the Institution of Environmental Sciences

The Institution of Environmental Sciences (the IES) is at the forefront of uniting the environmental sciences around a shared goal: to work with speed, vision and expertise to solve the world's most pressing environmental challenges, together.

As the global professional membership body for environmental scientists, we support a diverse network of professionals all over the world – and at every stage of their education and careers – to connect, develop, progress and inspire.

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Introduction

As a professional body, the IES understands that expertise is not an abstract concept: it is something that people have and that communities can share.

Case studies are a key part of sharing expertise. They support learning through clear examples of how a particular lesson was applied in practice, and they bring potentially intangible approaches to life.

Policy is increasingly emerging as a key area for skills development in the environmental sciences, and for environmental professionals more broadly. As climate change, biodiversity loss, and pollution cause increasingly severe consequences for human society, those challenges have further blurred the lines between the environment sector and policy decisions.

In that context, understanding how to effectively engage within the world of policy will be important for environmental professionals. This collection of case studies offers a starting point. Further training is available through the IES website.

Contents of the collection

This collection will take readers through the policy process, identifying how we can effectively engage with environmental policy at each stage.

From issue identification to implementation, it offers insights intended to spread good practice throughout the environmental policy community.

In case study one, insights from the Soils and Stones Project from Society for the Environment are shared. The project is a stellar example of raising environmental issues on the policy agenda, with clear impacts on the way that policy makers seek to address soils.

Once we are aware of issues, how do policy makers address them? Often, the next step is evidence gathering, if evidence is not already being collected. The next two case studies address how evidence can support the policy process from inside and outside of government.

In case study two, Ed Hill and Alan Evans offer the perspective of the National Oceanography Centre on negotiations around the Biodiversity Beyond National Jurisdictions Agreement, including the role of science in supporting international policy.

Case study three provides two examples from ClimateXChange, Scotland's centre of expertise for climate change, covering the hydrogen economy and home decarbonisation. The comparative examples show how trusted relationships between

research and policy can deliver informed policy decisions.

The next two case studies address alternative options in the face of limited evidence.

In case study four, Ruth Calderwood from the City of London Corporation outlines a novel approach to the use of citizen science in air quality monitoring, as well as the role it played in filling evidence gaps and improving citizen engagement.

Case study five responds to the question of what happens when we cannot know for sure. Gary Kass discusses the ways that uncertainty affects climate policy and how the Intergovernmental Panel on Climate Change has responded.

After evidence has been collected, a decision must be made on whether and how to respond. Even policy makers who are well-informed by the evidence may have tough subjective choices to make, including whether they prioritise responding at all.

To help them decide, they may take advice from trusted sources that seek to influence the decision one way or another. Case study six outlines how an organisation's approach to engaging with these policy decisions can be transformed to focus on impactful engagement.

Joseph Lewis shares the story of how the Institution of Environmental Sciences went from a reactive yet trusted voice, to developing a strategy based on proactively seeking positive change through policy.

Once a decision has been made, policy is put in place and must be implemented in practice. The next two case studies provide commentary on two examples of implementation, identifying what works well.

In case study seven, Ellie Savage provides a perspective from the Environmental Policy Implementation Community on the roll-out of mandatory Biodiversity Net Gain, offering insights on what the process can teach us.

Case study eight, from James Longhurst, takes a longer-term view of policy delivery in practice, analysing how Local Air Quality Management has been delivered through local government. The case study provides a perspective on the limiting factors that can cause policy implementation to fail.

No matter how well a policy is implemented, we cannot know for certain that it will succeed, because environmental policy operates within complex social and natural systems.

The final case study, shared by the Logika Group, tackles the vital issue of policy evaluation, considering the question of how we know whether or not policies achieved their intended outcomes and how this can feed back into design and implementation.

The case study discusses the evaluation of the Government's 25 Year Environment Plan and Environmental Improvement Plan, led by Logika alongside specialists from RPA, ABPMer, Anderson's Centre, Lockhart Garratt and Morris Resource Economics. It offers a perspective into the world of complex policy evaluation.

Overall, the collection provides a window into how environmental professionals are engaging with policy, from the early stages of emerging issues to long-term implementation and evaluation.

The hope of the IES is that these case studies will provide readers with techniques and approaches that they can adopt, as well as with a deeper understanding of how to engage effectively in the potentially unfamiliar realm of policy making.

Figure 0.1: The policy process (simplified)

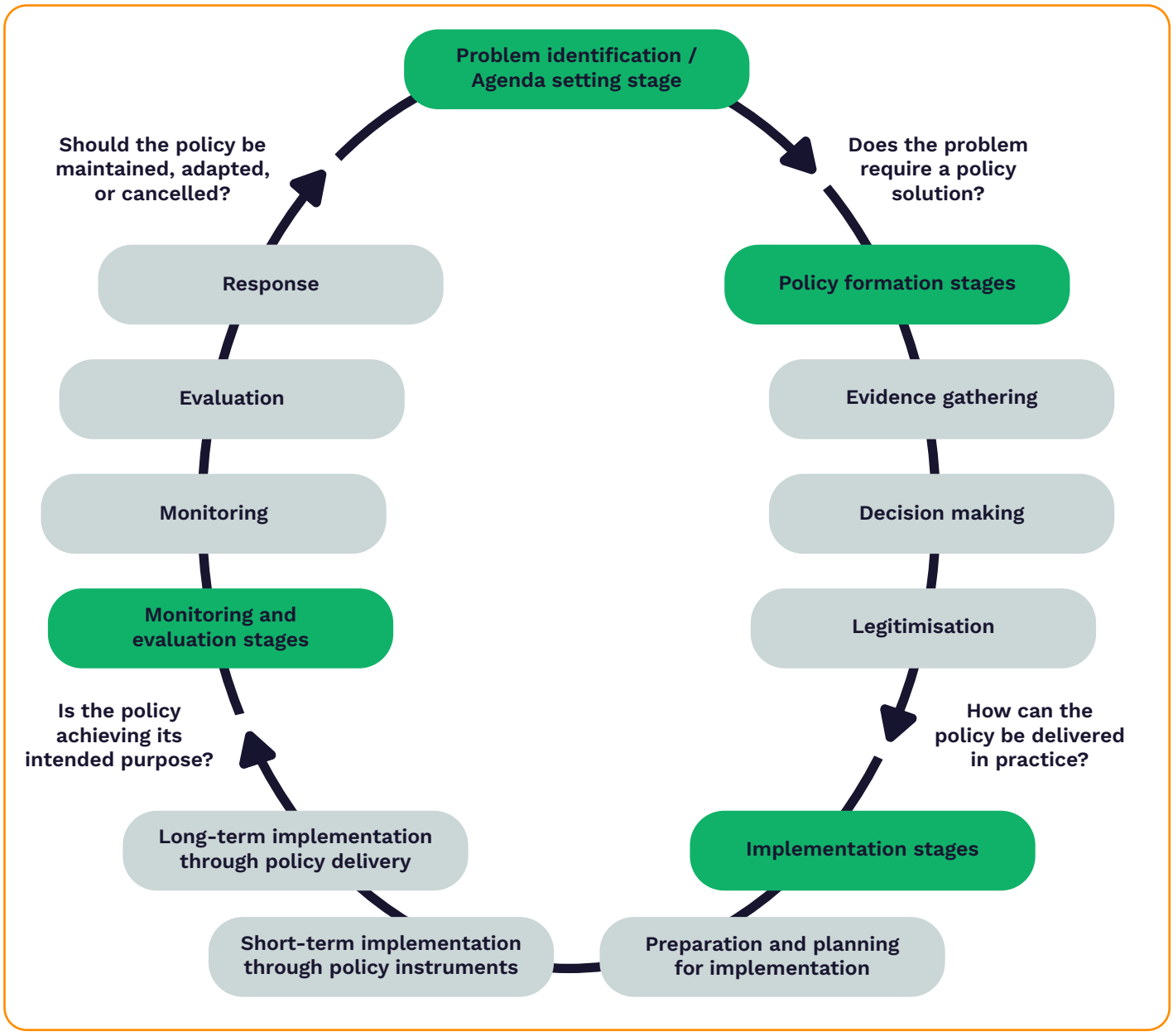

Figure 0.1 provides an outline of the policy process as a cycle with four key stages: problem identification, policy formation, implementation, and monitoring & evaluation. This is an indicative diagram to help those unfamiliar with policy making to identify how the case studies in this collect interact with the policy process.

Note that policy is a complex system and does not follow a linear path, but it can be helpful to visualise different aspects of the policy cycle as a continuum, identifying opportunities for engagement with the policy process.[1] Often policies do not directly adhere to this cycle, so readers should be aware that real examples may deviate from it.[2]

Additionally, good practice in policy increasingly recognises that monitoring, evaluation, and response should be iterative throughout each stage of policy design and implementation.

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"Case studies are a key part of sharing expertise ... they bring potentially intangible approaches to life."

Case study one: Agenda setting

Editor's commentary

In the first case study, Society for the Environment sets out the role played by its 'Soils and Stones' project in raising the profile of soils (and indeed stones) on the policy agenda.

For environmental scientists, this is a critical case study, for two main reasons:

Firstly, because environmental scientists will often be in the difficult situation of seeing environmental challenges when they first arise, before they have entered the mainstream of public understanding.

Secondly, because the case study handles a uniquely evidence-led approach to agenda setting. There are many examples of strong public engagement activities and campaigns conducted to drive policy action, both in the environment and more broadly.

What sets the Soils and Stones case study apart is that it starts from the perspective of individuals with expertise, then builds outwards to a diverse set of issues affecting soils and stones and how they can be addressed by policy, as well as through improved professional practice.

Society for the Environment's work is deeply grounded in coalition-building and does not shy away from the science. Soils and Stones is a clear example of how a story can be told clearly without forfeiting the complexity of the topic or simplifying it down to the point that solutions are no longer effective.

For the environmental scientist that has evidence of a challenge, or of a potential solution, this case study should be a clear gateway into the world of raising the profile of those ideas with policy.

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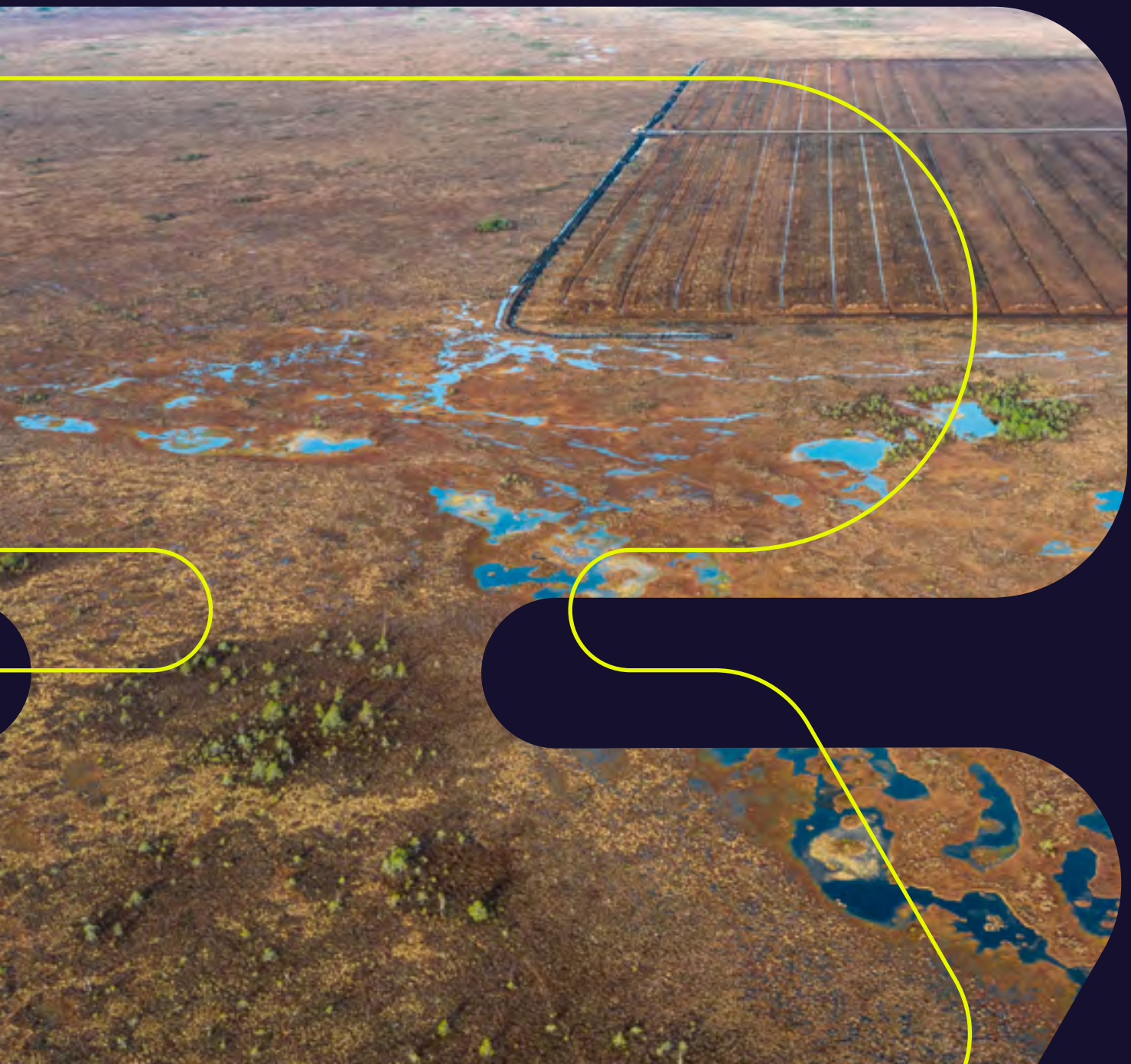
Case study one: Soils and Stones: Setting the agenda

Sarah Ridgeon, Society for the Environment (SocEnv)



Introduction

The SocEnv Soils and Stones project is an example of how effective collaboration, even with limited resources, can raise the profile of a pressing environmental issue for policy makers.

While much more needs to be done, the project has facilitated collaboration and knowledge sharing to make the case for evidence-based policy. At the core of the project is the knowledge that safeguarding soils and soil related material, when it comes to use and reuse (aka 'Soils and Stones'), is to the benefit of our economy, environment and society.

Project background

The Soils and Stones project is a cross-sector network of environmental professionals.

Established in 2019, sectors brought together by the project include construction, resource management, forestry, engineering, agriculture and land management. Volunteers are united in their mission for soils and stones to be recognised for their enormous natural capital and the variety of ecosystem services they provide.

This vision marks a significant shift away from widespread soil degradation and soil related material making up 58% of the tonnage received by landfills.[1]

The project is evidence-based, bringing together experts from across sectors to share their knowledge, experience and solutions. To demonstrate their expertise and commitment to professional standards, project volunteers must be a current or aspiring Chartered Environmentalist (with project involvement supporting progression to CEnv for the latter group) and have membership of a relevant professional body.

Although led by these volunteer experts, the project is coordinated by SocEnv as an organisation ideally suited to cross-sector work and with longstanding experience in facilitation and influencing policy.

All our volunteers value soils and stones because of their ability to capture carbon, improve biodiversity, mitigate flood risk and ensure food security. Because of this, our goal is to connect the expertise of practitioners with policymakers, inspiring those making legislative decisions to remove barriers and provide incentives for achieving optimum soil health and reuse in policy and practice.

This includes taking a joined-up approach to policy making and delivery, which recognises the vital role that soil plays in our ecosystem and should therefore be afforded the same environmental status as air, water, biodiversity and resource efficiency.

Key output to date

The project's first key outcome was our initial Soils and Stones report, published in 2021 (**the SandS 2021 Report**).

The report explored challenges and opportunities relating to key topic areas such as engineering, construction and landscaping; land management: agriculture, forestry and conservation; healthy soils, natural capital and carbon management; and climate change and soil water

dynamics. The report concluded by outlining a set of key recommendations for ensuring soils and stones are treated as valuable resources and identifying leading and supporting actors in achieving these recommendations.

Amongst the SandS 2021 Report headline recommendations was the need for an overarching Soils and Stones framework, against which existing legislation and regulation can be reviewed and improved.

In 2023, this was achieved via 'The Ten Principles of Good Soils and Stones Management' (the **Ten Principles**), guidance which seeks to provide a clear, straightforward outline of how to use and reuse soils and stones and provide benefits to the economy, society and the environment in the process. These principles should be embedded into all government policies, mobilising the expertise of environmental professionals working across disciplines.

Our most recent output came earlier this year, as we published our 2024 progress report (the **SandS 2024 Report**). Produced three years on from the SandS 2021 Report, this new publication provides an honest assessment of progress achieved so far against the 2021 recommendations and provides a focus for our efforts over the next three years.

As part of this report, we have set several strategic calls to action, the effective delivery of which will remove the barriers to delivering on our 2021 recommendations. Key to our calls to action for policymakers is the implementation of the recommendations from the Environment, Food and Rural Affairs (EFRA) Committee's 2023 inquiry into soil health (**2023 Soil Health Inquiry**) and the creation of a National Soils and Stones Policy.

Methods

The project has got our message across via several different methods. In addition to producing our own reports and the Ten Principles, as outlined above, other activity has included giving evidence to the 2023 Soil Health Inquiry.

The project has also produced case studies, responded to government consultations and engaged with partners to maximise our voice and impact, including by feeding directly into the output of the Environmental Policy Forum,[2] delivering CPD webinars and writing journal articles aimed at practitioners.

We have also regularly communicated our output via our communication channels, such as the SocEnv website, e-newsletter and social media accounts. Recent research has indicated that such communications are an important way of reaching policy makers, as well as our network of practitioners.[3]

Our methods have helped to make our case to policy makers, by:

- Providing rigorous evidence of the challenges related to soil degradation and the negative impact this has on the economy, society and environment
- Setting out clear solutions and the benefits of investment (for example, in green skills), showcasing the opportunities on offer should we treat soils and stones as valuable resources

Box 1.1: Environmental Priorities for the next UK Government: Three asks on soil[2]

Policymakers, with support from business, should:

1. Provide a legislative framework for soil. Ensure soil health is put on the same footing as water and air quality within government policy, through the introduction of statutory targets on soil health by 2028, improved soil monitoring data, agreed soil health indicators and widely accepted definitions of 'sustainable soil management'.
2. Remove the barriers to resource efficiency. We call for the introduction of a regulatory framework by 2035 that takes a joined-up approach to the reuse, recovery and recycling of soil. This framework should focus on preventing soil degradation and contamination across various sectors, including construction, planning, and agriculture.
3. Improve governance to unlock soil's financial value. Joined-up, evidence-based policy and practice (see priority 1) will provide an improved climate for investment in sustainable economic growth, including the growing voluntary biodiversity and carbon offset markets that will fund improved soil management.

- Highlighting examples of solutions already in action, via case studies – a crucial part of the evidence base
- Presenting clear calls to action and being clear about the role of policy makers in achieving change, working alongside business[4]

Outcomes

There is growing recognition of the value of soils and stones, perhaps best demonstrated by the calling of the 2023 Soil Health Inquiry. This inquiry was set up to analyse the Government's role in preventing further soil degradation and restoring soils across England. The project's traction was reflected in our invitation to give oral evidence to the inquiry, alongside other leaders in the soils and stones space, including the British Society of Soil Science (BSSS).

The resulting inquiry report referred to our oral and written evidence, with many of our headline asks featuring in the inquiry recommendations, including calling for statutory targets on soil health by 2028 and the introduction, by 2035, of a regulatory framework to focus on preventing soil degradation and contamination.

The range of sectors represented among the supporters of our SandS 2021 Report is another indication of our impact. Supporters of the report included UK Soils and 11 professional bodies including the BSSS, IES and other influential bodies at the forefront of the built environment, resource management, water, forestry, environmental management, fisheries, forestry, engineering and agriculture sectors.

Since the publication of the SandS 2021 Report, we have expanded our volunteer

base and partners further, including being approached by organisations outside of these initial supporters to deliver CPD webinars on the project's output. The traction of our Ten Principles is also shown by the range of organisations sharing case studies, demonstrating how their projects have met the principles.

Limitations and learnings

Despite the project's impact to date, in the SandS 2024 Report we assess the progress of each SandS 2021 Report recommendation and acknowledge that some of the recommendations haven't been met to date and only partially in other cases.

A significant factor behind these shortcomings remains limitations in partnership working. Although we have expanded our partners since 2021, there remains a lot more potential to address existing silos and collaborate across the expansive SocEnv network.

We are developing a collaboration plan to address these limitations, expected in late 2024, with key areas of collaboration including getting our message across to policy makers, improving soil monitoring and making links between regional land events and their activities. For example, we are supporting Midlands Land Events (MidLE)'s #SILOtoSOIL campaign.[5]

Another area limiting our impact is the project's UK focus. Despite scanning international soils and stones policy for the SandS 2024 Report, challenges remain to taking a more international approach, including limited resources and the complexity of coordinating data related to soil health across nations.

Box 1.2: Summary and advice for others

Reflecting on the project's activity to date, we have five top tips for those looking to engage effectively with policy makers:

1. **Be clear on the benefits:** demonstrate the clear, evidence-based economic, social and environmental benefits of the solutions presented and where possible, feature case studies of solutions already in action
2. **Collaborate:** partnership working is vital in ensuring that good practice is shared, the weight of support for solutions is demonstrated to policy makers and resources are used wisely, ensuring that activity isn't duplicated across different organisations
3. **Clearly set out roles and timelines:** communicate clear calls to action for different actors and timelines and emphasise the need for policy makers and practitioners to work together
4. **Value facilitation:** experts should lead, but facilitation is important in keeping a project on track and maximising impact
5. **Adapt:** any longstanding project needs to adapt to changing circumstances in order to succeed. Have contingency measures in place and don't hesitate to change approach if the evidence says that it's needed

Find out more about the Soils and Stones project via the SocEnv website. You can also view the project's key output via our dedicated publications platform.

The project has also had to adapt to changing circumstances, from shifts in volunteer availability to varying working practices. As just one example, we found that the task group structure used for the creation of the SandS 2021 Report no longer proved effective in 2023. This was due to reduced volunteer availability as a result of higher workload in their day jobs.

As a result, earlier this year we took the decision to move to a centralised executive team to maximise our impact. This decision has proved effective, resulting in the publication of the well-received SandS 2024 Report, despite working with limited resource within a tight timeframe.

Table 1.1: Soils and Stones Progress Report 2024: Summary of Actions [4]

Call to action	Target date	Lead organisation
Develop a Collaboration Plan to pursue initiatives and opportunities and to improve influence, communications, standards, policies, information sources, research, training and competency, for the sustainable management of soils and stones across all sectors.	October 2024	SocEnv Licensed Members network, CL:AIRE, the BSSS and the UK Soils Network
We call on representatives from all professional bodies managing the reuse of soils and stones to agree a workable resource hierarchy for presentation to the UK Government.	December 2024	SocEnv Licensed Members network, CL:AIRE, the UK Soils network and the Mineral Products Association
Bring together representatives of the voluntary offset markets, soil-based professionals and economists, to agree and implement an assurance structure that will foster economic growth and real estate value, through the sustainable management of soils and stones.	April 2025	UK Government
Publish a National Soils and Stones Policy to set the framework for reforming and implementing regulation and legislation pertaining to soil health and the beneficial reuse of soils and stones.	June 2025	UK Government
Publish a prioritised and costed cross-sector research and development programme, to identify where R&D initiatives will generate the best value for money with the greatest economic benefit for the sustainable reuse of ex-situ soils and stones, and for assurance in the carbon and biodiversity offset markets.	October 2025	SocEnv Licensed Members network, the BSSS, the UK Soils network, the Mineral Products Association and Wilder Carbon
Complete a consultation exercise with relevant stakeholders on the practicality of including assessments of soil biodiversity in the mandatory guidance for calculating Biodiversity Net Gain in England.	December 2025	DEFRA
Incorporate Natural Capital Accounting in the 2028 update to the 25 Year Environment Plan	December 2027	UK Government

Case study two: Using evidence

Editor's commentary

In the second case study, Ed Hill and Alan Evans, both either currently or recently affiliated with the National Oceanography Centre, outline the role that science played in supporting the development of the Agreement for Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction Treaty (the BBNJ Treaty).

This will be a particularly interesting case study for any environmental scientists working internationally, but the lessons to be learned from it are applicable to any environmental professionals hoping to embed evidence in the policy process.

The National Oceanography Centre (NOC) is an excellent UK institution that plays a leading role in research and the provision of evidence on oceanography.

The NOC is a great example of the importance of trusted institutions in evidence-informed policy. Though it is independent and self-governing, it receives funding from UK Research and Innovation and has strong relationships with key decision makers in the UK, fostered on the basis of the NOC's expertise and reliability.

It also champions collaborative science and international cooperation, both of which are clearly on show in case study two, where Ed and Alan discuss the support that the NOC provided to the UK's delegation, with a clear connection to the positive impact on the Treaty.

Too often, international policy discussions can appear to be burdened with process and complexity, but this case study showcases the power of scientific advice to cut through at every stage: Ed and Alan discuss how science supported negotiations but also how it continues to play a part through Environmental Impact Assessments.

Case study two demystifies the world of evidence-informed policy, particularly at an international level.

For any environmental scientists seeking to learn more about how evidence can shape the fundamentals of policy making, this case study is an excellent place to start.

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Case study two: Science and the BBNJ Agreement

Ed Hill and Alan Evans, National Oceanography Centre, UK

The United Nations Convention on the Law of the Sea (UNCLOS)[1] was agreed in 1982 and came into force twelve years later, following the sixtieth ratification. With 119 signatures on the first day of opening, and unprecedented in the history of treaty law, UNCLOS is recognised as one of the most important UN agreements ever, providing overarching principles for the governance of the ocean, settling years of ambiguity, and providing the basis for resolving disputes. Whilst some significant States are yet to ratify, including the US, such States generally recognise UNCLOS as customary international law and have tended voluntarily to observe its provisions.

Crucially, UNCLOS defines the limits of marine and maritime areas, distinguishing also between areas of the seafloor and sub-seafloor and the water above them, over which Coastal States have varying degrees of jurisdiction. This ranges from full sovereignty (territorial waters) to exclusive rights to exploit living and non-living resources in the water and on or beneath the seafloor (Exclusive Economic Zones, EEZs) and just on or beneath the sea floor (Continental Shelf, CS). In areas beyond 200 nautical miles, the water column (High Seas) and seafloor (The Area) are beyond national jurisdiction. The vast area beyond national jurisdiction (ABNJ) covers over sixty percent of the ocean - greater than the entire land-surface of the Earth - and comprises ninety-five percent of the ocean's volume – almost all living space on Earth (the biosphere).

Whilst beyond national jurisdiction means no States have legal entitlement to that area, it doesn't mean States have no say or obligations. Rather it means all States (including land-locked countries) have an equal say. Neither does it mean, as is sometimes said, that the ABNJ is a 'Wild West' where anything goes. Indeed, there are already numerous international agreements and frameworks including for seafloor mineral exploration and exploitation, shipping and regional fisheries that govern ABNJ.

Nevertheless, when UNCLOS was agreed, it was recognised it could not cover every detail and that future legally binding 'implementing agreements' would be needed to fill in gaps, but always within the overall framework of principles set out by UNCLOS. So it was that after six years, negotiations concluded at the UN in New York in March 2023, and with formal adoption in June 2023, of a hugely significant implementing agreement for almost all of the Earth's biosphere by volume.

Snappily known as the 'Agreement under the UN Convention on the Law of the Sea for Conservation and Sustainable Use of Marine **B**iological Diversity of Areas **B**eyond **N**ational **J**urisdiction',[2] it was abbreviated to the **BBNJ** Agreement and has become popularly, but inaccurately, known as the 'High Seas Treaty'. In line with UN principles, it does not supersede and cannot undermine any existing treaty (e.g. Antarctic Treaty)[3] or other existing agreements such as relating to seabed minerals or fishing, where they have a mandate to deliver obligations in ABNJ – it is strictly to address gaps not covered by anything else. As its name implies, its focus is on marine biota and it does not cover EEZs, except where activities within them could cause substantial pollution of, or significant and harmful changes to, the marine environment in ABNJ.

The lead departments in developing UK positions and constituting the majority of the UK Delegation during the BBNJ negotiations were the Foreign, Commonwealth and Development Office (FCDO) and the Department for Environment, Food and Rural Affairs (Defra). Recognising the value of informed position making, the UK Delegation worked closely with the UK's National Oceanography Centre (NOC), on account of its expertise and long experience of undertaking and enabling marine scientific research in ABNJ through its capabilities and responsibilities for managing global-class deep sea research vessels, development of novel technologies, and ownership of a major deep sea biological specimen repository (Discovery Collections) and the British Ocean Sediment Core Research Facility.

Such expertise is fundamental to core components and obligations within the BBNJ, including in the delivery of non-monetary benefits, where knowledge of expedition planning and marine genetic sample collection, storing and sharing are key enablers in the delivery of many Treaty obligations – whilst also enabling equity in its implementation through capacity building and the transfer of marine technology.

Given this, the NOC provided a member of the UK Delegation, supporting UK planning and participation in the negotiations. Furthermore, concerted efforts by the UK Delegation in reaching out to the broader UK marine scientific research community included consulting with domain experts at the Natural History Museum as well as seeking feedback on draft Treaty text through consultations via established research networks.

Scientific research and the need for scientific evidence features prominently throughout UNCLOS, which provides general encouragement for States to conduct it, the rules by which it is to be undertaken, and its use to manage the marine environment. The rationale for the BBNJ Agreement was both motivated by scientific evidence and also sought to put in place a framework to share the benefits of scientific discoveries in ABNJ. By the same token, the agreement would apply to research activities as much as to other activities.

Interestingly, therefore, scientists were involved in the development of the agreement from two perspectives: (i) informing provisions of the agreement with scientific evidence; (ii) as parties that would eventually be subject to the agreement. As such, garnering scientific information and knowledge was critically important in drafting the BBNJ Treaty text.

The BBNJ Agreement covers four substantive Parts, and the influence and role of research is briefly summarised for each:

i. Benefits Sharing of Marine Genetic Resources (MGR) – deals with how to share benefits from scientific advances that make possible discovery and commercial exploitation of MGR, such as for new drugs or bio-products obtained from the deep sea. Scientific advice into the negotiations concerned the collection, storage, sharing and traceability of MGR collected in ABNJ. In terms of impacts on science, the Treaty addresses: the need for advance-notification of collecting biological specimens and/or eDNA for the purpose of undertaking R&D on them; bringing

visibility to activities; access to samples/ eDNA and transparency should such samples be utilised, potentially through their exploitation leading to revenue generation.

ii. Area-Based Management Tools (ABMTs) – which include Marine Protected Areas (MPA) in ABNJ. ABMT proposals will require scientific input, including in providing a description of the state of the marine environment and biological diversity. Similarly, given a proposal for an ABMT will be open to consultation, scientific evidence and expertise will be crucial for informing responses, either by the State or interested parties, which need to take into account: the merits and geographic scope of the proposal; any other relevant scientific input; views on the potential implications of the proposal for areas within national jurisdiction and any other relevant information. Such requirements can only be fulfilled on the basis of the best available science. Ambitions such as protecting thirty percent of the ocean by 2030 (30x30) depend on protection not just within EEZ where most MPAs are currently located but expanding into ABNJ. The BBNJ Agreement does not itself protect the ocean (as misquoted in much press coverage) but it does provide the legal basis for implementing such ABMTs.

iii. Environmental impact assessment (EIAs) – unlike requirements often set by national authorities in their own jurisdictions, there was no mechanism to conduct such assessments in ABNJ. Scientific input will be critical at all stages of the BBNJ EIA process. Initially it is the proponent's responsibility to undertake screening, scoping and the actual assessment, after which scientific input will be required as part of the consultation process. Finally, the best available science and scientific information will be required to keep under surveillance the impacts of any activities. Furthermore, scientific information will be required to establish the 'thresholds' that such assessments would need to take into account. At the screening stage, the threshold is set where an activity may have more than a minor or transitory effect on the marine environment, or the effects of the activity are unknown or poorly understood. This is stronger than for UNCLOS more generally, where the threshold is where an activity may cause substantial pollution of, or significant and harmful changes to the marine environment.

iv. Capacity Building and Transfer of Marine Technologies (CBTMT) – whilst there are specific provisions for capacity building relating to MGR, the BBNJ also has a dedicated Part for Capacity Building and the Transfer of Marine Technology. CBTMT is seen as a significant non-monetary benefit and viewed as critical for bringing equity, such that all Parties have the ability to implement the Agreement. Marine scientific research (MSR) is seen as a significant contributor, highlighted by the Objective of the CBTMT section which includes developing the marine scientific and technological capacity, including with respect to research, of Parties, in particular developing States Parties. To facilitate CBTMT, a Clearing House Mechanism (CHM) will be developed through cooperation with others,

including the Intergovernmental Oceanographic Commission of UNESCO, the UN body for ocean science which was also a route providing advice to the BBNJ process.

The BBNJ agreement will place additional constraints on scientific research undertaken in ABNJ that need to be balanced with the high level UNCLOS principles of 'freedom of marine scientific research together with other freedoms of the high seas'. The way in which the Agreement is implemented internationally and domestically will determine whether fears in some sectors of the scientific community of a 'chilling effect' on marine biological research in ABNJ are realised.

Scientific advice into the process at both national and intergovernmental levels sought to mitigate unintended and counterproductive consequences - not least because the need to conduct marine scientific research in a flexible and timely manner, reflecting the dynamic nature of the ocean's physical and ecological processes, is essential to provide the very evidence to support the BBNJ Agreement's overarching aim of conservation and sustainable use of the diversity of marine life.

The Agreement comes into force 120 days after the deposit of the sixtieth instrument of ratification, and will have the machinery to implement and monitor progress, such as its own 'Conference of the Parties' (COP), a 'Scientific and Technical Body' to advise States Parties, and the Clearing House Mechanism supporting sharing of data and information. Much of how BBNJ plays out will depend on the way it is implemented. In the UK, new domestic legislation covering certain components of the BBNJ is underway to transpose international obligations into UK law, and UK scientists remain involved, continuing to provide advice on the practicalities of implementation.

Ed Hill is former Chief Executive and Alan Evans, Head of Marine Policy at the UK's National Oceanography Centre.

Case study three: Evidence and expertise

Editor's commentary

The third case study includes two comparative pieces from ClimateXChange (CXC), Scotland's Centre of Expertise on climate change.

This will be a particularly interesting case study for environmental experts seeking to share evidence or expertise with decision makers in an impactful way.

CXC is a core part of Scotland's knowledge infrastructure on climate change and has a pedigree of experience in informing the Scottish Government, as well as providing concise and productive case studies.

It is one of five centres of expertise funded directly by the Scottish Government, so the dual case studies provide a window into a novel approach to the science-policy interface, with researchers made directly available to government to answer key questions and inform policy.

Comparing the two pieces, ClimateXChange demonstrates the breadth of the research-policy relationship: in the hydrogen case study, the role of ClimateXChange was to refine research questions for researchers to answer, then science provided a detailed analysis.

By comparison, the home decarbonisation case study is an example of researchers offering a comprehensive perspective informed by international case studies.

Either way, the pieces from CXC offer a clear insight into how to have an impactful relationship with decision makers, which will be relevant regardless of the reader's existing connections.

Both case study two from the NOC and this case study handle the use of evidence by governments, so we can see some clear themes emerging.

Where case study two came from a more independent perspective and looked at the international scale, case study three comes from a centre of expertise with direct ties to government, operating at the scale of a devolved administration.

The different contexts highlight the importance of what stays the same: robust, independent expertise is a fundamental starting point, and relationships and trust are critical to making an impact.

For any environmental scientists working directly with policy makers, particularly those with a formal relationship with government, the pair of case studies from ClimateXChange are an opportunity to learn from an excellent approach to sharing expertise.

The Institution of Environmental Sciences

Case study three: Two case studies from a centre of expertise

ClimateXChange

ClimateXChange (CXC) is Scotland's centre of expertise on climate change. CXC commissions around 40 research projects per year and organises knowledge exchange events to support the Scottish Government as it develops policies on adapting to the changing climate and transitioning to net zero.

Part one: Developing the hydrogen economy

This case study provides an example of how CXC commissioned research projects and brought together researchers and policy makers to support the hydrogen economy in Scotland.

Why it is important

Hydrogen is expected to play a crucial role in Scotland's energy future. It could be used to store and carry energy, with the potential to reduce emissions in sectors and industries traditionally reliant on fossil fuels such as long-haul transport, chemicals and steel.

Hydrogen could address grid capacity issues by storing excess renewable energy, potentially saving up to £2.5bn by 2030 in extra payments to operators of wind farms.

In 2022, the Scottish Government's Hydrogen Action Plan[1] set forth Scotland's ambition to become a leading producer and exporter of hydrogen. It predicts that hydrogen will account for 15% of Scotland's energy demand by 2030. By 2045, the installed hydrogen production capacity could be five times more than in 2030.

ClimateXChange work

To advance these ambitions, CXC commissioned several studies to identify the skills and workforce needed to support the hydrogen sector, evaluate Scotland's export potential and explore options for energy storage.

CXC helped refine research questions from the Scottish Government. Studies focused particularly on green hydrogen, produced by electrolysis using electricity from renewable sources.

The studies:

- modelled the scale of economic activity in the hydrogen sector and, in consultation with key industry stakeholders and skills providers, defined skills needs in the emerging hydrogen economy
- explored the costs of producing green hydrogen in Scotland and a follow-up study compared these with costs of producing and exporting hydrogen to EU markets in other major exporting countries
- investigated whether hydrogen could be used to store excess renewable electricity through a literature review and stakeholder engagement
- assessed the value of electrolysis to manage network constraints through developing future scenarios.

Research-policy relationships

The CXC approach to project management sets clear expectations and fosters collaboration between researchers conducting the work and policy makers from the Scottish Government.

The research teams met the policy teams regularly throughout the projects. Meetings ensured that the teams discussed, and were aligned, with regard to research needs, approach to answering the research questions and emerging findings.

Researchers learned first-hand from policy teams about how their research would feed into upcoming plans and policies.

Impact

ClimateXChange has built evidence across many and complex questions on the development of Scotland's hydrogen economy. We ensured that policy makers were provided with the best, clear and timely answers, with our reports significantly influencing policy and strategic directions.

"*The ClimateXChange report on hydrogen as a storage medium was an important first step for us in developing our policy positions on energy storage and hydrogen.*" - Stuart McKay, Head of Hydrogen Policy at the Scottish Government

This study on hydrogen as a storage medium demonstrated hydrogen's utility to store energy, which prompted a deeper investigation into the viability of hydrogen storage in different geological formations

Box 3.1: Tips and links

Impact tips

- Tips for writing research proposals
- Tips for writing research reports for policy

Related reports

- Mapping the hydrogen skills landscape
- Hydrogen as a storage medium in Scotland
- Redirecting excess renewable energy to produce hydrogen
- Cost reduction pathways of green hydrogen production in Scotland – total costs and international comparisons
- Cost reduction pathways of green hydrogen production in Scotland

External publications

- Hydrogen action plan [1]
- Green industrial strategy [2]
- UK Parliament report: Hydrogen and carbon capture in Scotland [3]
- Policy Exchange report: Turning wasted wind into clean hydrogen [4]

across Scotland. This could be crucial for the energy grid's long-term storage solutions.

Findings from the study drove conversations with significant stakeholders such as the National Energy System Operator, and previously the National Grid Electricity System Operator, which is looking at a strategic network across the UK.

The study frequently informs briefings to Ministers and contributes to responses in parliamentary questions about energy storage and hydrogen use.

Overall, our research highlights hydrogen's potential value to Scotland's economy. It informed strategic documents in Scotland and wider UK, including the hydrogen action plan, green industrial strategy[2] and the upcoming hydrogen sector export plan.

Part two: Decarbonising homes: International policy lessons and impacts in Scotland

Scotland's buildings account for approximately a fifth of the nation's emissions. Decarbonising homes and buildings will play a significant part in achieving net zero greenhouse gas emissions.

Why it is important

The Heat in Building Strategy,[5] published in 2021, commits to regulating energy efficiency and reducing emissions from heating in existing homes from 2025. The New Build Heat Standard[6] prohibits polluting oil and gas boilers in new buildings from April 2024.

Given this urgency, the Scottish Government asked ClimateXChange (CXC) to gather evidence on how other countries are approaching the challenge of decarbonising heating and improving energy efficiency in homes. The goal was to draw lessons for policy and implementation in Scotland.

How ClimateXChange supported policy makers

A study investigated regulations on home energy efficiency and heat decarbonisation from other countries, regions and cities. It aimed to understand what worked or failed and why.

Given the devolved legal powers of the Scottish Government, it was important to primarily focus on the effectiveness of policies that could be replicated in Scotland. This focus helped inform how regulations might best work in Scotland. We also asked for the research to be structured around the Heat in Buildings Strategy.

The findings opened the way to further research that provided policy makers with a comprehensive body of evidence.

Follow-up CXC studies investigated personal circumstances that may make it more challenging for people to meet the requirements proposed; explored the practicality and cost of clean heating in challenging home types; and identified how compliance can be monitored.

Researchers reviewed international regulations and case studies and conducted surveys and expert interviews.

Impact

The lessons drawn from the international review have been so useful to the Scottish Government that they plan to connect with some of the countries identified in the research.

One of those countries is Italy, where the mandatory share of renewable energy for domestic hot water and electricity has increased.

"*For us at the Scottish Government, this was the first time we've had a comprehensive comparison with other countries on home energy efficiency and heat decarbonisation regulation. That is a key interest for ministers and often a focal point in policy briefings. The findings from the study provided us with a robust framework for identifying relevant international schemes.*" – Antonia Georgieva, Head of Heat in Buildings: Domestic regulations and clean heat in new buildings, Scottish Government

Furthermore, the Clean Heat Forum,[7] an international collaboration between national governments, NGOs and companies to discuss confidence in emerging policies, is considering creating a live tracker or dashboard version of the project.

The tracker will show updated information on international regulations and policies relevant to heat and energy efficiency and their effectiveness.

The Scottish Government is keen to support this given the value of understanding how clean heat interventions have helped other countries decarbonise. This value was demonstrated by the CxC project.

Fostering collaboration

Speaking about her experience of working with ClimateXChange on several projects, Antonia Georgieva said: "*Our projects with ClimateXChange have been very well managed. Their process sets clear expectations and fosters an environment conducive to collaboration, serving as a link between us and the researchers.*"

For more information about these case studies, visit the ClimateXChange website:

- Developing the hydrogen economy [8]
- Decarbonising homes [9]

Box 3.2: Further information and links

Related reports

- International heat and energy efficiency policy review
- Providing flexibility in heat and energy efficiency regulations – personal circumstances
- The suitability of clean heating options for challenging dwelling types
- An evidence review of data associated with non-domestic buildings
- Costs of zero emissions heating in new buildings
- Direct greenhouse gas emissions from low and zero carbon heating systems
- Zero emissions heating in new buildings across Scottish Islands
- Heat in buildings data for digital compliance

Related links

- Heat in Buildings Strategy [5]
- New Build Heat Standard [6]
- Clean Heat Forum [7]

Case study four: Citizen science

Editor's commentary

In the fourth case study, Ruth Calderwood from the City of London Corporation shares insights into a collaborative project between the City and Mapping for Change, Science in the City, and its successor project, Science in the City 2.

This will be a particularly interesting case study for environmental professionals grappling with two of the biggest challenges currently facing the relationship between science and policy: (1) how do we get the evidence we need under constrained resources, and (2) how do we build support with the public for environmental interventions?

Environmental issues are especially pertinent for the City of London, where air quality and climate resilience are both relevant considerations. The City commissioned a great partner in Mapping for Change, an organisation that has some expertise in community engagement and citizen science.

The case study demonstrates the success of that collaboration and the power of working with communities from an early stage, not only to support data collection, but to demonstrably increase buy-in for sustainability.

Few people would be better placed to discuss the importance of working with the public than Ruth Calderwood, Air Quality Manager at the City of London, who is also the Chair of the Environmental Policy Implementation Community (EPIC).

EPIC brings together members from across the environmental sciences to call for ambitious and deliverable policy, providing members with the insights to help them deliver on the ground. To that end, Ruth has a cutting edge perspective on the challenges for delivering policy in practice.

Case study four is an excellent starting point for environmental professionals looking into citizen science. It should easily allay concerns, demonstrating the real practical value of collaborative community engagement.

For any environmental scientists hoping to engage with communities, or considering alternative approaches to collecting data, this case study will provide a helpful and informed perspective.

The Institution of Environmental Sciences

Case study four: Citizen science and air quality

Ruth Calderwood, City of London Corporation

Background

Local authorities monitor air quality to assess compliance with air quality objectives and to measure the effectiveness of plans and programmes to reduce levels of air pollution. They also use the data as part of their duties to protect public health. Data is collected at a limited number of sites and then extrapolated using computer models to gauge what pollution levels are likely to be in areas where there is no data. The collection and analysis of data can be a costly and time-consuming process.

To establish the variability of air quality at a smaller scale, the City of London Corporation, the local authority for the Square Mile at the heart of London, commissioned Science in the City,[1] a twelve-month project led by Mapping for Change.[2]

The aims of this project were to obtain a better understanding of hyper-local air quality conditions around a large residential estate, and to raise awareness of local and wider air quality issues among residents.

A citizen science approach enabled residents to carry out grassroots data collection. This approach also allowed participants to take some ownership of the problem, benefit from the opportunity to voice support for local action and explore ways in which they could reduce their personal exposure to poor air quality.

The initial citizen science programme took place during 2013/14. It was repeated in 2021/22 so residents could measure how air pollution had changed over time.

Resident engagement

Residents that were interested in participating in the citizen science programme were invited to a launch meeting. At the meeting they were introduced to the problem of air pollution in the City; the current monitoring systems in place; the effects that poor air quality can have on health; measures in place to reduce air pollution and why the project was important.

The meeting included informal workshops to identify which locations the residents felt were the most polluted. Residents were also asked to share ideas for action to reduce pollution in the neighbourhood.

Two additional meetings with residents were held throughout the project to feedback results, maintain momentum and encourage discussion around the potential next steps. Group discussions were centred on key areas for action that residents would like the City of London Corporation to take to improve local air quality.

Two surveys were conducted; one at the start of the project and one at the end. These were in the form of semi-structured questionnaires so that both qualitative and quantitative data could be collected.

The residents were asked about their perceptions of air quality and the sources of pollution in the neighbourhood, their understanding of the health impacts of poor air quality, and whether taking part in the project had changed their opinions or their behaviour.

Data collection

To gain an insight into air quality across the residential estate, two types of monitoring were undertaken.

Static diffusion tubes were used to measure nitrogen dioxide, and portable monitors were used to measure fine particles $PM_{2.5}$. The diffusion tubes provided monthly average readings which were collated to give an annual average. The particulate monitor gave a reading every few seconds.

In 2013/14, 48 residents hosted nitrogen dioxide diffusion tubes outside their properties and additional diffusion tubes were also placed around the residential estate and surrounding roads.

Residents also collected $PM_{2.5}$ data over a period of a few days as they walked around the City.

Monitoring results

The nitrogen dioxide concentrations measured over the course of the year showed seasonal variations in line with local monitoring. Some streets had levels in excess of health-based standards, and in some cases twice the limit. The interior of the residential estate proved to be less exposed to the same poor air quality measured at street level, although residents living in the towers overlooking a very busy road were still exposed to elevated levels of pollutants, even up to a height in excess of sixty meters.

London experienced a high pollution episode for $PM_{2.5}$ during the monitoring period and residents were able to see the impact that weather conditions have on $PM_{2.5}$.

Community Participation and Awareness

One of the main aims of the project was to increase public understanding about air pollution, its causes, and effects and how concentrations vary both spatially and from day to day. This was done by adopting a bottom-up citizen science approach to monitoring air quality, using simple methods and tools, to enable participation by those interested.

The level of participation and commitment of residents to conduct this study was a testament to the relative ease of the methodology, and to the residents' concern about local air quality and willingness to engage in the wider discourse.

Most of the residents involved (92%) had not previously taken part in any kind of environmental monitoring project and the majority (94%) said that they would be happy to participate in future projects of this kind.

Some residents decided to make changes to reduce both their exposure to pollution and their own contribution to air pollution.

These included: 'greening up' their balconies with air-filtering plants; avoiding hot spot areas; reducing their use of private transport and collecting parcels rather than having them delivered.

Some residents decided to only open the windows of their flat that face inwards into the residential estate rather than a roadside

window or avoid opening windows and vents at peak traffic times.

Various suggestions were made by residents including: greening the area with more trees, plants and living walls; closing one of the roads to traffic with highest levels of pollution; introducing penalties for idling vehicles; only allowing green buses in the area; and encouraging the use of electric vehicles by promoting and installing more charging points.

Follow up action

Following the Citizen Science programme, the City of London Corporation implemented several of the initiatives suggested by the community, and used the data collected to support the proposed improvement plans.

In 2016, an application for funding was made for a Low Emission Neighbourhood (LEN) in the area. Due to the success of the citizen science air quality monitoring programme, there was a great deal of local support for the application.

The LEN delivered a range of pilot projects over three years focused on improving air quality. Following the delivery of the LEN, and the implementation of City-wide initiatives to improve air quality, levels of air pollution started to come down.

Revisiting the study

In 2021, residents were once again invited to take part in a citizen science study Science in the City Two,[3] to assess changes in air pollution since the original study in 2013/14.

The study had two aims: to demonstrate the impact of the recent air quality improvement measures that were suggested by the residents in 2014, and to raise awareness of these measures and current local air quality among the residents.

The study revealed that levels of nitrogen dioxide had fallen across the area and only one site had an annual mean which was still exceeding the UK legal limit of 40 µg/m^3.

This compared to 35 of the 65 sites which breached the UK limit in 2013/14. Residents showed a good level of understanding of air pollution at the start of the project and an awareness of the air quality improvement measures implemented by the City of London Corporation.

Further assessment

A student studying for an MSc in Environmental Diagnosis and Management at the University of London worked with residents, Mapping for Change and the City of London Corporation to produce a dissertation: Understanding citizen scientist's motivations and GIS as an educational tool to monitor air quality in the Barbican area.

The research concluded that:

- Specific motivations do dominate encouragement of citizen science engagement in air quality research, with environmental interest, gender, and age being the most prevalent
- The decline in nitrogen dioxide concentrations in the study area

comparative to historic measurements in 2013/14 are attributable to initiatives implemented as a consequence of the citizen science research study. This justifies citizen science to raise awareness, improve knowledge and policies about air quality to limit health risk from exposure.

- The use of GIS as an educational resource tool to delineate spatiotemporal variations in air quality was successful, thus, identifying the requirement for future studies to consider including technology as a motivational factor.

Case study five: Uncertainty

Editor's commentary

What happens when we don't know? In case study five, Professor Gary Kass tackles the challenge of uncertainty and how we can maintain an evidence-informed approach to policy in an increasingly uncertain world.

This will be a particularly interesting case study for environmental professionals working in areas of uncertainty, or where evidence is emerging or subject to change. With the environment facing ever-changing horizons, that is likely to account for much of the sector.

Case study five provides a narrative spanning the ways that uncertainty in climate science has been addressed across theoretical discussions in academia and practical advice, such as through the IPCC and European Environment Agency.

It aptly encompasses the relationship between research, policy, and practice, appropriately for the author. Gary is a Visiting Professor at the University of Surrey; has worked across the public sector in the Parliamentary Office of Science & Technology, DEFRA, and Natural England; and is a Vice President of the IES, its former Chair, and the Chair of its External Policy Advisory Committee.

From those perspectives, Gary can speak with authority to the ways that uncertainty manifests across each of these spheres, as well as the relations between them.

The fifth case study is therefore especially useful for those working at boundaries between different worlds, such as scientists advising policy makers or practitioners working with a range of stakeholders.

All environmental scientists need to understand how to work with - or communicate - uncertainty, so this case study provides an insightful narrative on approaches from theory and practice. It also shows how we can live in a world where we don't always know the answers for certain.

The Institution of Environmental Sciences

Case study five: Uncertainty in climate change: implications for policy

Gary Kass, University of Surrey

We are living in increasingly uncertain times; uncertainty is everywhere but we still need to make decisions under these conditions. This case study looks at how uncertainty plays out in relation to climate change. Some might characterise climate change as a 'dead cert' - that the science is now 'beyond doubt' as described by the strong consensus described in the work of the Intergovernmental Panel on Climate Change (IPCC).

Indeed, the IPCC Sixth Assessment Report made it quite clear that "It is **unequivocal** that human influence has warmed the atmosphere, ocean and land" (emphasis added).[1] And, in terms of the influence of science on policy and decision making, the current IPCC Chair, Professor Jim Skea (who gave the 2020 IES Burntwood lecture) said at the opening of the Sixtieth Session of the IPCC that "climate change science has played a pivotal part in determining the outcome of negotiations between the 198 parties to the Framework Convention [on Climate Change]".[2,3]

Yet, the IPCC recognises that, while its conclusions are unequivocal, the science of climate change is inherently uncertain. For its fifth assessment report, the IPCC established a working group on the 'Consistent Treatment of Uncertainties' which produced a guidance note that describes the relationship between the strength of the evidence and the level of consensus or agreement on this evidence; from situations of low agreement and limited evidence to high agreement and robust evidence...and all stages in between.[4]

This range generates a 'confidence scale' (from very low to very high) used when making statements in the IPCC assessments about the "validity of findings". The guidance provides a scale of 'likelihood' as a "probabilistic estimate of the occurrence of a single event or of an outcome (e.g., a climate parameter, observed trend, or projected change lying in a given range)". There is, though, some 'fuzziness' in these definitions – e.g., an outcome assessed as 'likely' has a 66-100% probability of occurring (so all other outcomes are 'unlikely').

The guidance also covers aspects of the language to be used "that conveys the most information to the reader", to aid the presentation of uncertainty. In its summary, the guidance advises authors to "communicate uncertainty carefully, using calibrated language for key findings, and provide traceable accounts describing your evaluations of evidence and agreement in your chapter."

Beyond the climate science itself, there are also huge uncertainties regarding the potential impacts of a changing climate and indeed how society might respond to these, both in terms of seeking to mitigate (reduce) emissions of greenhouse gases, and in how to adapt to changes as they emerge – and indeed how these two approaches relate to each other.

In aiding planning for adaptation, the European Environment Agency (EEA) produced a suite of guidance on uncertainty.[5] This includes a description of uncertainty, its sources, and why it is important to consider uncertainty; how to communicate uncertainty well; and how to factor in uncertainty in decision-making. There is also a collection of case studies on how Europe is adapting to climate change.[6]

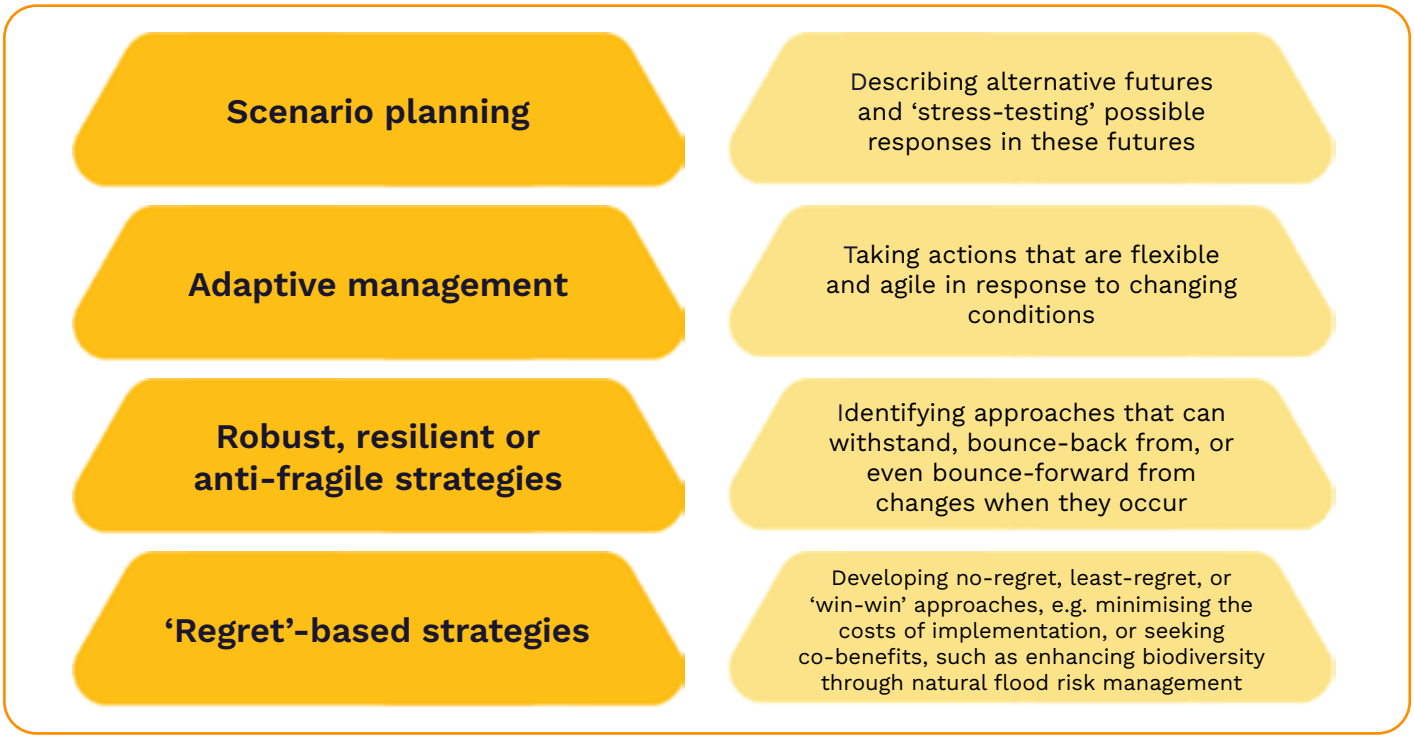
The EEA described factors that are important in considering how uncertainties affect adaption planning: time horizon and reversibility of the decision, the relative importance of climate factors for the decision, and the costs of buffering the decision against uncertain developments. Recognising the different sources, types and importance of uncertainties as they affect decision making, approaches that can be helpful in being able to get a grip on uncertainties in planning are included:

- Scenario planning – describing alternative futures and 'stress-testing' possible responses in these futures
- Adaptive management – taking actions that are flexible and agile in response to changing conditions
- Robust, resilient or anti-fragile strategies – identifying approaches that can withstand, bounce-back from, or even bounce-forward from changes when they occur
- 'Regret'-based strategies – developing no-regret, least-regret, or 'win-win' approaches, e.g. minimising the costs of implementation, or seeking co-benefits, such as enhancing biodiversity through natural flood risk management

Dewulf and Biesbroek (2018) offer a framework of **nine** types of uncertainty typically found in issues related to environmental governance.[7]

There is not space to go into these in detail, but in summary, they claim that each of the nine types of uncertainty are relevant to decision making and that each "requires a different approach for addressing it". They

Figure 5.1: Approaches to uncertainty, adapted from EEA Climate-ADAPT (2018)[5]



argue that there is no singular 'optimal strategy' for handling decisions under uncertainty, but that decision makers can (and should) select from a 'repertoire' of strategies, the choice "depending on their means, goals and position with the network, as well as experience with previous strategies about other issues in other arenas (learned experience), the outcomes of previous rounds of decision making (accumulation of strategies), and success/ failure of previous strategies attempted."

The authors also point out that much environmental decision making has tended to focus on sources of uncertainty that arise from the physical and natural world e.g. climate variability, ecosystem function, etc. But social and political sources of uncertainty are just as important – and maybe more so. Indeed, significant issues include how people perceive uncertainty, and how problems are framed e.g. as risk-avoiding or risk-seeking; and how the benefits and harms of environmental change are distributed.

It is necessary, then, to foster broadly-based interdisciplinary understandings of the sources that give rise to the different types of uncertainty, and to have access to – and the skills to use – the range of tools available to support decision making under uncertainty.

Without clarity of these distinctions, Dewulf and Biesbroek caution that "not paying attention to these distinctions may result in trying to solve the wrong problem" and that "valuable time, energy and resources might be lost by implementing strategies that do not fit with the uncertainty at hand, and, in some cases, the efforts might actually be counterproductive."

Fundamentally, there is no simple linear cause-and-effect relationship between scientific evidence and policy content, and there is plenty of evidence in literature and from practice that debunks the myth that 'good science automatically translates into good policy'.

The idea of 'good policy' is increasingly being recognised as being the result of a 'good' process of policy making, rather than in terms of the final outcomes. Thus, attention is focusing more and more on the arrangements for the design of good policy, and as part of these arrangements, approaches for dealing with the breadth of the types of uncertainties should be included.

Ideas that presuppose perfect knowledge enabling perfect control and hence perfect and predictable outcomes have diminished in favour of more 'real-world' approaches that recognise, acknowledge and embrace uncertainties.

It is noted, even by the IPCC, that many of these uncertainties cannot be reduced through additional knowledge, and there is a need to accept limits to knowledge, encourage experimentation, promote flexibility and agility in how rules are set and administered, and create multiple options and embed a more conditional approach to policy; keeping an eye open for how things are changing, and making sure options are not closed off too soon.

The IPCC Working Group 3 (WG3) Fifth Assessment Report discussed "integrated risk and uncertainty assessment of climate change response policies".[8] The authors noted that "individuals and organizations that link science with policy grapple with several different forms of uncertainty" but

also that "the desirability of climate policies and instruments are affected by decision makers' responses to key uncertainties."

The authors identified that it is not just uncertainty in the science of climate change that creates such problems, but also that uncertainty in the policy responses themselves creates further uncertainty, noting that "modelling and empirical studies have shown that uncertainty as to future regulatory and market conditions adversely affects the performance of emission allowance trading markets."

Such additional levels of uncertainty create adverse effects such as "less investment in low-carbon infrastructure, increasing consumer prices and reducing the pressure for technological development."

The IPCC WG3 report also pointed out that "one of the major determinants of popular support for climate policy is whether people have an underlying belief that climate change is dangerous." They report findings that "the portrayal of uncertainties and disagreements with respect to climate impacts was found to have a weak effect on whether people perceived the impacts as serious, but a strong effect on whether they felt that the impacts deserved policy intervention."

It is important, therefore, to pay attention to the 'politics on uncertainty'. Mehta and Srivastava (2020) recognised that "uncertainty is at the core of the climate change problem" but that climate change policy is often dominated by efforts to quantify, minimise, and control uncertainty – an approach that has been increasingly criticised as not applicable to devising meaningful policy responses, and not reflecting the realities of people at the front-line of climate uncertainty, but yet who are distant (geographically and politically) from decision making processes.[9]

The authors discuss the role of citizen and stakeholder participation and deliberative dialogue, manifested recently in climate roundtables and assemblies. Yet, a simple 'deliberative fix' would not be sufficient any more than a 'technological fix'.

The politics of uncertainty are such that those with vested interests can – and do – exploit uncertainty for their own ends. Those who wish to promote urgent action on climate change may foreground uncertainty as a dominant reason for taking precautionary action (uncertainty shouldn't hold us back) or urgent/emergency action (the house is on fire, we must act now); or promoting action in terms of 'insurance' (we must act now, just in case).

At the opposite end of the spectrum, those who wish to promote the status quo, may argue that the uncertainties are such that climate change remains 'unproven', that even if it is happening, it's not proven that humans are responsible, or that even if humans are responsible, that it is uncertain whether action would be effective. Beyond such 'denial' strategies, a 'delay' strategy would suggest that even if action is indeed necessary, it's not necessary yet, or can't be delivered as quickly as others may wish.

The idea of 'overshoot' has gained recent attention, with some arguing that even if we miss climate targets, we can always claw back later. Others counter that this relies too heavily on unproven technologies and creates and unfair burden on future generations.

Climate change illustrates well the nature and implications of uncertainty in environmental governance, policy and decision making. It reveals the range of sources and types of uncertainty, from those emerging from natural variability in physical systems to those emerging from differences in what's at stake for various stakeholders. Climate change policies are not yet settled and are subject to change themselves, generating further exacerbating uncertainties.

But in addressing such a complex and uncertain issue, climate change illustrates the range of approaches that can be applied – none is a 'silver bullet', and it is essential to understand the context and dynamics of a situation before deciding on the methodologies to be applied. Thus, mathematical modelling of probabilities has its place, but can never be sufficient – better models running on bigger computers will never solve the climate crisis!

Broader approaches such as scenario planning and adaptive management can also be used. But these 'technical' approaches must also be complemented by approaches that acknowledge and take account of social, political and economic realities, including the power imbalances and vested interests of those involved, and the issues of equity in the distribution of costs and benefits.

The precautionary principle is the key policy mechanism that enables decision making under uncertainty. It is now enshrined in UK law in the Environmental Policy Principles Statement (EPPS) and Ministers are required to 'have due regard' to these principles when making policy.[10] It remains a matter of political debate whether the requirement to 'have due regard' is sufficiently strong.

Environmental science is much more than just the biology, chemistry and physics of the environment, and climate change illustrates very clearly the need for an inherently inter- and trans-disciplinary approach, one that starts with the issues, and is oriented towards developing just and fair policies and mechanisms to address the greatest long-term challenge we face.

Case study six: Strategy & Impact

Editor's commentary

In case study six, Joseph Lewis, Policy Lead at the Institution of Environmental Sciences (the IES), provides an outline of how to take a strategic approach to engaging with environmental policy.

The case study tackles several questions often asked by those engaging with policy:

- What strategic tools can support an effective and inclusive approach to policy work?
- How can we articulate our perspective as a robust and well-evidenced policy position?
- How can we build relationships with those we want to influence?
- How can we measure our impact when dealing with intangible or subjective objectives?

This will be a particularly interesting case study for members of the IES, as well as those operating as representatives of membership organisations.

Case study six provides a narrative account of the strategic transformation of the IES's policy activities, with the intention to make them more impactful in an increasingly crowded environmental policy space.

The sixth case study will therefore be particularly pertinent for those who are seeking to establish connections with decision makers, or who are engaging with policy from outside government.

Importantly, the case study provides a good example of what you can do when you are already doing well: from the perspective of a professional body that was already successful in its policy influence, it addresses how an organisation can capitalise on its strengths and maximise the value of its existing engagement.

For any environmental professionals looking at their organisations overall strategic approach to engaging with policy, this case study may have useful insights to offer.

The Institution of Environmental Sciences

Case study six: Strategic engagement to achieve impact

Joseph Lewis, the Institution of Environmental Sciences (the IES)

Transitioning from effective responses to proactively seeking impact

Like many NGOs and membership organisations, professional bodies like the IES often engage with policy, seeking to effect change or represent the views of their members.

By spring 2020, the IES was already engaged in impactful work in environmental policy. For example, responses by the Institution to several consultations on governance had been linked to specific shifts in government policy.

Despite these successes, it had been observed by members and stakeholders that the IES was primarily reactive when it came to policy developments, rather than proactively pursuing a policy agenda that reflected the voice of science, scientists and the natural world.

This narrative-driven case study will outline the multi-year journey that successfully brought the IES to a more proactive position in its interactions with government policy making, including:

1. The process of developing internal strategy
2. How to initiate and build relationships with key stakeholders
3. Establishing evidence-informed policy positions
4. Measuring impact and driving a reflective approach

State of play in April 2020

Between 2018 and 2019, the IES responded to nine government consultations or Select Committee inquiries and contributed to 17 policy letters, primarily through the Environmental Policy Forum (EPF).[1] Some of these were successful at facilitating change, such as the Institution's response to the consultation on environmental principles and accountability for the environment.[2]

Regardless of success, some inherent limitations emerge from a primarily reactive approach to policy developments. Taking the example of long-term environmental targets, strong engagement at the consultation stage may convince a government to change the nature of specific environmental targets, but it may be too late to change the overall approach to how targets are set, and which topics are subject to targets.

Engaging at that 'agenda-setting' stage requires a proactive approach, so that policy can be influenced before details are finalised.

Additionally, as the IES policy team was primarily meeting with civil servants, research bodies, and others working in the environment sector, there were less opportunities to directly shape the overall direction of policy change.

Codifying and refining strategy

During the transition towards a more proactive approach to engaging with policy, it was essential that existing assets were

not lost. To that end, a strategic approach was necessary to identify how future policy work would operate as a whole, capturing new benefits without compromising the existing foundation.

In the first instance, the IES codified existing practices into a formal policy strategy, drawing on the 2018-2021 organisational strategy and a set of nine core principles agreed by the IES Board of Trustees. The strategy included a long-term vision for IES policy work as well as short-term objectives to help realise that vision.

Alongside the strategy, several procedures were codified for IES engagement with policy, including:

- a rationale for when the IES would respond to consultations and when it would engage in joint consultation responses instead
- a procedure for member engagement through interdisciplinary 'deep-dive' research processes on specific policy topics or challenges
- a measurable delivery plan for developing relationships with policy makers, parliamentarians, and Government Ministers
- and a series of evaluation frameworks to measure success at the strategy's execution.

Addressing strategic gaps

The process of developing the strategy helped to formalise and streamline IES policy operations, making a number of tasks more routine and efficient.

It also identified priority areas for further strategic development. The most urgent were the need for effective governance of policy activities, the development of a readily-accessible pool of expertise, and a more detailed forward view of policy activities, informed by robust horizon scanning.

To address the two former gaps, the IES decided to form an advisory committee for policy, the External Policy Advisory Committee (herein '**the Committee**'). The Committee would include:

- representatives of IES governance structures, ensuring the strategic direction of policy work aligned with the overall priorities of the Institution
- a broad pool of members to provide expertise and support horizon scanning across policy issues
- and a small number of external advisors to provide outside perspectives on IES policy work and advise on ways to increase its impact.

The Committee was first established in April 2022, following a six-month process of identifying and recruiting the best volunteers to represent diverse perspectives while covering the necessary expertise.

The Committee meets quarterly, reflecting on IES policy activities, sharing updates on developments across the environment and policy, and engaging in substantive discussions on IES work-streams or issues which could serve as focus areas for future activities.

The Committee also plays a direct role in shaping future IES work, ensuring a 'member-led' approach to the Institution's policy. In November each year, the Committee engages in an 'End of Year Review' which evaluates the actual impact of IES policy work in comparison to targets set out at the start of the year, determining whether the team's approach needs to be adjusted to become more impactful and reflecting on successes and failures.

This process results in the creation of a policy programme with a two-year forward view, which is updated each year to ensure that ongoing work is always informed by a longer-term work plan.

In each programme, the forthcoming year has an additional level of detail: for each planned activity it sets out that activity's planned outputs, intended stakeholders, and (qualitative and quantitative) targets for impact, as well as how that activity should be prioritised against other work.

Since the first programme was created in December 2020, the IES has published and carried out four policy programmes, the most recent of which also includes plans for member engagement in policy work and a programme of activities focused on training members in critical policy skills.

As a result of this two-year process of transformation, the IES's policy activities became significantly more strategic. Policy work had clear direction, both at the strategic level and through specific, measureable targets associated with every work-stream. Direct lines of accountability had been established, with processes in place to drive continuous improvement.

Developing positions

With strategic structures in place, it was possible to explore more substantive questions, including what specific issues IES policy engagement should focus on, as well as the positions of IES members on those issues.

In 2020, the IES had a short list of established positions, which each functioned as a 'lens' on environmental topics, as well as some subject-specific asks in areas where IES members had a history of engaging with policy.

While useful, they were not sufficient to take proactive stances on environmental policy in many areas of relevance and interest to IES members, so further action was needed to develop 'policy positions' which could serve as a basis for proactive engagement.

Two approaches were taken to developing those positions: to opportunistically collate positions as they arose from consultation responses, briefings, or other policy work-streams; and to identify key topics where an IES position would be useful or important, carrying out 'deep dive' research projects to develop well-evidenced policy positions in those areas.

These projects were led by working groups, drawn from different disciplines and perspectives within and outside the IES membership.

One of the core principles in their formation was that they would have a sufficient breadth of expertise and views that they could identify focus areas with the greatest multidisciplinary importance.

Box 6.1: Case Study: 'Deep dive' on evidence-informed policy making

As a worked example, the most recent process focused on the interdisciplinary use of evidence in policy. Through consultation with members and stakeholders, the IES produced a list of scoping questions and topics, then established a working group to scrutinise and discuss those topics.

The group was constituted to include members and non-members who represented academic, government, arms-length body, NGO, and consultancy perspectives, with subject expertise in air quality, nature, water quality, and other environmental specialisms.

After the first discussion, the group narrowed the scope of further research to two focus areas: consolidation of existing environmental data sources, and how to overcome four specific barriers to adopting known approaches to evidence-informed policy making.

Later in the process of research, the group interrogated outcomes from the research and guided the project towards a final output, based on discussions.

By using the group to set the project scope and then narrow its focus, the work was able to remain evidence-led while addressing the most relevant concerns from multiple disciplinary perspectives.

The processes began from a broad framing, focusing down to a specific topic or challenge, identifying key areas of action or policy change, and devising solutions. See Box 6.1 for further information.

Having spent four years building capacity for thought leadership across the IES family, a more ambitious project was proposed to establish policy positions across the most substantial areas of interest to the IES.

Ahead of the 2024 UK General Election, the IES held seven discussion events with IES communities, each representing one or more specialism of environmental science.

The discussions further developed IES positions for their given specialisms, producing a set of priorities which were consolidated into a single 'message to government': '*Transform the UK through a new Mission for Sustainable Wellbeing*'.[3]

In the first instance, this filled much the same role as a standard policy report; it provided opportunities for interaction with the new UK Government, as well as a well-evidenced position piece to inform the sector.

More importantly, the message to government fills a specific role in terms of moving the IES into a more proactive position. As policy developments arise, it is now much more likely that the IES has robust, member-led perspectives ready to be used as the basis for advocacy across specialism areas.

The result is far greater agility to seize opportunities for advocacy, while increasing (rather than decreasing) the consistency of IES messaging to policy stakeholders.

Building relationships

In line with the development of a more holistic set of policy positions, a key objective for the realignment of IES policy activities was to build a broader set of relationships across the policy making space.

Regardless of how proactive the IES became in identifying important issues and developing positions, the ability to make any impactful change would rely on having a network of policy makers who could be influenced at the right time.

In the past, the Institution's strongest relationships with government had been at the departmental level, providing expertise on specific issues to civil servants producing policy. While it was seen as critical to retain those relationships to see recommendations through at the design and delivery levels, there was a need to fill the strategic gap of relationships in previously untapped areas, particularly with legislative-side policy makers in Parliament and Ministers in government.

To support better legislative engagement, an initial scoping exercise was conducted to identify Members of Parliament (MPs) or members of the House of Lords with whom the IES would seek to strengthen relationships. The major pieces of environmental legislation being debated in Parliament at the time provided a key source of information on MPs with environmental interests.

This information was considered alongside APPG membership, select committee membership, and other public positions to create a priority list of parliamentarians to engage.

After initial rounds of engagement, the policy team narrowed the focus of engagement, identifying relevant topics on which to offer briefings to MPs. The result was a schedule of quarterly briefings on topics with both parliamentary and environmental relevance, with bespoke written briefings and 'rapid delivery' briefing meetings arranged with MPs each quarter.

While developing these relationships, the IES also identified arms-length bodies as key stakeholders for policy engagement, bridging the gap between policy design and delivery. Developing productive relationships with those organisations was prioritised, particularly for the newly formed Office for Environmental Protection.

By engaging in a productive, consistent manner with these agencies and stakeholders, the IES was able to develop connections and trust on both an individual and organisational level.

Measuring impact

Throughout the IES's journey towards a more proactive approach to policy engagement, another priority was to ensure that the strategic shift was creating work that was impactful and promoted positive change.

Measuring impact as an organisation is a perennial challenge, but especially so in the environmental policy sector.

Environmental policy is crowded with organisations and individuals seeking change, so it can be difficult to make a

voice heard, particularly for a small charity like the IES. Doubly so, it can be difficult to determine whether or not engagement was impactful:

- If change does not happen, was the evidence provided nonetheless useful in shifting perspectives?
- If change happens, but not the exact change that was requested, did the engagement lead to positive progress?
- And if change does happen, who is responsible, and would the same change have happened regardless of how the organisation engaged?

All these questions can make it difficult to determine whether policy engagement is making a difference.

Addressing these challenges, the IES implemented two solutions: a comprehensive impact framework attached to the annual policy programme, and an 'impact journey' approach to measuring the Institution's progress towards specific objectives.

As already outlined, the policy programme's impact framework encompasses a variety of time-limited impact goals, linked to specific activities and work programmes.

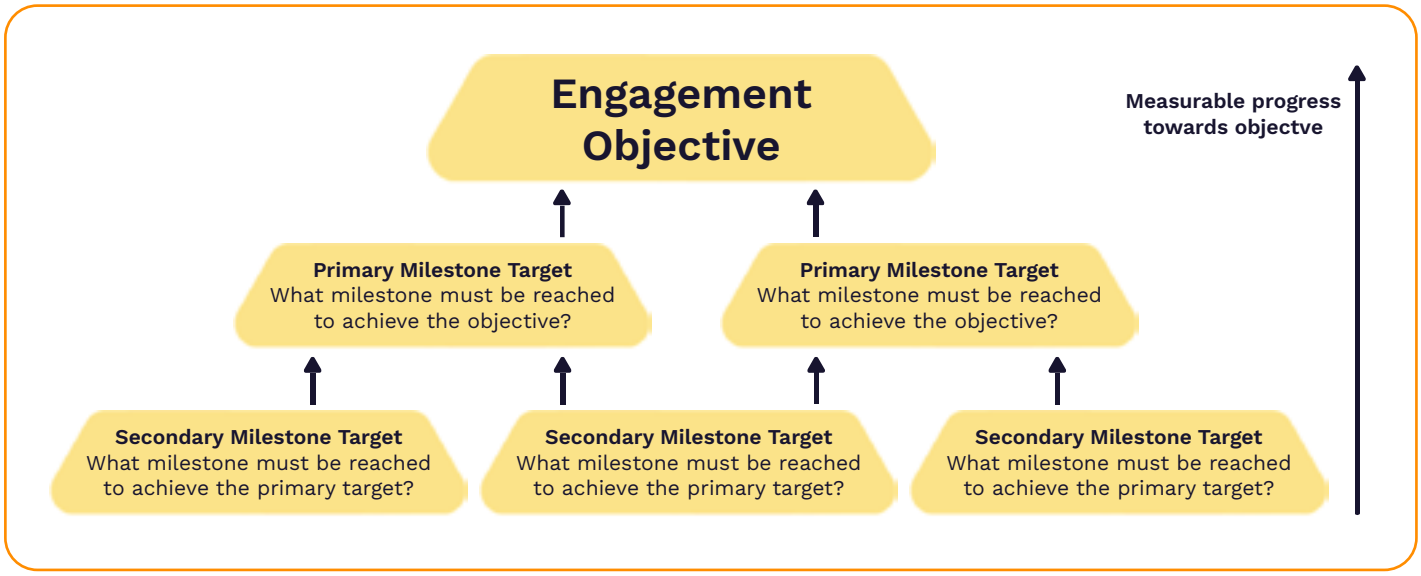
The 'impact journey' approach involves setting an overall objective and working backwards to identify the steps necessary to achieve that objective, then working backwards again as far as necessary.

By creating targets which make demonstrable progress towards the overall objective, it is easier to identify how much progress is being made towards the completion of the overall 'journey' towards impact.

See Figure 6.1 for a visual representation.

Taking the overall transition of IES policy work as a worked example of an impact journey, the overall objective would be 'to modernise IES policy activities to more

Figure 6.1: 'Impact journey' model for measuring progress towards an objective



proactively represent the voice of science, scientists and the natural world'. Following that objective, interim goals could include:

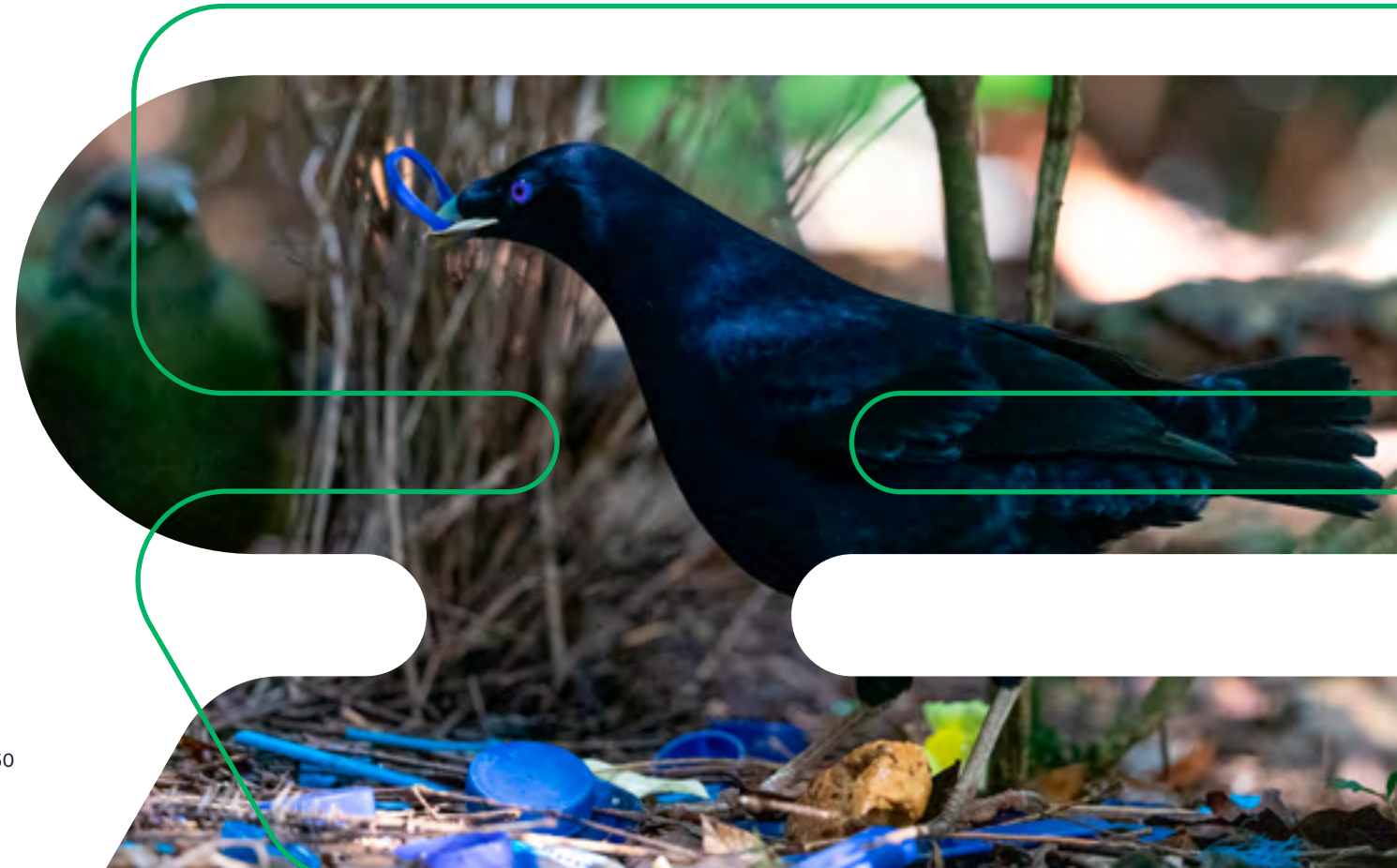
1. Improving and broadening member engagement to ensure that the organisation's understanding of environmental policy issues reflected the voice of its members;
2. Understanding how the perspectives of members relate to environmental policy and translating those perspectives into positions that can be used for engagement;
3. Developing strategies and governance that underpin policy activities so that engagement operates effectively and predictably;
4. Building relationships to allow for proactive interventions where needed;
5. Ensuring that policy activities are not just vocal, but effective at creating change.

Collectively, those interim goals represent the steps needed to reach the overall goal. Stepping back from each of them again allows for more specific actions, breaking down a challenging organisational transformation into a step-by-step process.

As the process is enacted, the organisation can assess whether each goal is being met, providing a clear means of determining impact and progress.

Beyond the impact of IES policy work in isolation, this approach also supported other endeavours.

Work by colleagues to develop the IES theory of change[4] and successive organisational strategies[5] was enriched by a



clear articulation of what IES policy work was seeking to achieve, not just in general, but at specific points over a period of time.

That process of integration was strategically useful and also provided opportunities for iteration and further development of the 'impact journey' and overall goals and objectives.

Reflecting in 2024, IES policy work is now both proactive and impactful. There are demonstrable instances where the voice of the IES has directly created change, as well as many more instances where impact has been observed through the policy programme's framework and progress towards several objectives identified as part of distinct 'impact journeys'.

Box 6.2: Summary and key messages

Relevant learnings can be gleaned from the strategic transformation of IES policy work, particularly for organisations dealing with similar challenges, such as professional bodies or small charities.

- First, **any organisation is able to transform its strategic approach**, but it requires time and mental resources to ensure change is delivered in practice. Not every intervention will create organisational change, and it will sometimes be necessary to temporarily return to a more reactive approach.
- Second, **strategy must take a leading role** in a proactive approach to policy engagement, but it requires iteration in order to remain agile and relevant. Policy work is so busy by its nature that it can be all too easy to lose track of broader strategic goals, unless they are brought upfront.
- Third, standard **processes and procedures play a key role in embedding change**. Organisational transformation necessarily needs to outlast a single volunteer, staff member, or committee, so standardising the approach is critical.
- Fourth, **there is an inherent human element to all policy work**, as well as the ways that organisations operate. Human capital trumps generic wisdom most of the time, so drawing on a broad pool of people to support policy work is essential to getting the most out of it.

Nearly five years have passed since the process of transitioning towards proactively seeking impact began. The IES has retained its core strength in reacting to policy developments while building far greater capacity for agenda setting and relationship building with decision makers.

Nevertheless, this does not represent the end of efforts to improve the ways the Institution engages with environmental policy.

Iterating on our strategic approach in response to changing circumstances remains at the heart of our mission to transform the planet and stand up for the voice of science, scientists, and the natural world.

Case study seven: Policy Implementation

Editor's commentary

The policy process does not end when a decision is made. One of the most important aspects of policy is ensuring its effective implementation, so policy delivery has increasingly become one of the biggest environmental challenges of the current decade.

In case study seven, Ellie Savage provides the first of two case studies on implementation, discussing the introduction of mandatory Biodiversity Net Gain (BNG). The case study has dual purposes: commenting on the policy itself while outlining the details of the project that allowed that evaluation to take place.

Given the nascent importance of BNG and its ubiquitous role in securing environmental improvement in England, this case study is likely to be particularly interesting to those professionals hoping to understand the implications of how the policy has been implemented in practice.

Equally, the case study is relevant beyond the bounds of BNG. For anyone seeking to research the implementation of a policy in the environmental space, this case study provides a clear blueprint for conducting an objective and well-evidenced project.

It also sheds insight into the complex and iterative relationship between evidence gathering and policy engagement, which is especially pertinent in the context of BNG, where much of the evidence base is still emerging.

In that context, the case study is enriched by Ellie's unique and innovative perspective, working in one of the few organisations set up on the boundary between local authorities, scientific expertise, and policy making.

Ellie's work with EPIC demonstrates the power of effective convening: when you bring together the right people in the right way, you can draw on their shared expertise to solve seemingly insurmountable problems.

The seventh case study is a great example of the merit of that approach. It highlights the role of collaboration, both within and outside the EPIC community, as well as the value of linking experts directly to policy makers.

For any environmental scientists interested in policy implementation, evaluative research projects, or boundary spanning collaboration, this case study is an excellent point of reference.

The Institution of Environmental Sciences

Case study seven: Lessons from the introduction of mandatory Biodiversity Net Gain

Ellie Savage, EPIC

Over the second half of 2024, the IES's Environmental Policy Implementation Community (EPIC), Environmental Impact Assessment (EIA) Community and the Association of Local Government Ecologists (ALGE) have been working on a Biodiversity Net Gain in Practice project. This case study discusses the project.

Mandatory Biodiversity Net Gain (BNG) came into force in England on 12 February 2024 for major developments and on 2 April 2024 for small sites. It requires a 10 per cent increase in biodiversity post-development, meaning that natural habitats are left in a better state than before development.

The IES & ALGE Biodiversity Net Gain in Practice project aims to establish an initial understanding of how BNG is working on the ground.

These findings will then be used to promote good practice among practitioners and advocate recommendations to policy makers.

At the time of writing the project is still ongoing, however we hope this case study provides a valuable insight into community-driven policy work at the IES that is of value to other member-based organisations.

Background

IES communities are groups of members who come together around a shared goal, shared interest or shared set of values.

They deliver events and other projects, which sometimes have significant elements of policy advocacy. These are typically supported by the IES policy team.

The IES launched EPIC in February 2024. EPIC's focus is on ensuring that environmental policy is not only ambitious, but works in practice, taking into account the experience and expertise of those delivering on the ground.

From initial reports and conversations with members, the EPIC Committee identified the implementation of mandatory BNG as an area where good environmental policy on paper might not be working in practice.

EPIC joined with the EIA Community and ALGE to establish the BNG in practice project, delivered by a working group of BNG experts, including consultants, developers, local authority ecologists and planners, EIA professionals and environmental lawyers.

Why a BNG in practice project?

Mandatory BNG is an ambitious and world leading policy that aims to transform the planning system in England to work for, instead of against, nature enhancement and recovery.

However there have been longstanding and widespread concerns around its implementation, despite significant work done by DEFRA, the Planning Advisory Service and others to prepare local authorities prior to the policy coming into force.[1]

Since the project formally started in July, the mandate for action has strengthened, with reports that loopholes in the policy are being exploited on a mass scale.[2]

In addition, the new Labour Government's planning reform and house building agenda meant that it was increasingly urgent that BNG works as it should, to ensure the upcoming wave of developments deliver for nature.

On why ALGE joined the BNG in practice project, Iain Boulton, Vice-Chair of ALGE said, "*we believe that the challenges local planning authorities have in applying and delivering BNG can be overcome, but it needs a concerted effort. This project allows us to work with environmental scientists to find and advocate for the answers as well as appreciate the challenges.*"

Project Process

Policy work at the IES typically includes producing evidence from our most valuable resource - our members. This unique perspective is then communicated to policy makers, with the IES maintaining strong links in government departments, public bodies such as Natural England and the OEP, and local government.

Community-driven policy work follows a similar structure. The BNG in practice project includes three phases of evidence gathering: a survey, a workshop, and 1-1 interviews.

Policy advocacy started during the evidence gathering phase to communicate initial findings and build interest, with policy advocacy set to begin in earnest once the final output has been produced (see **Figure 7.1**).

Figure 7.1: BNG in practice: project process and relationship to policy advocacy

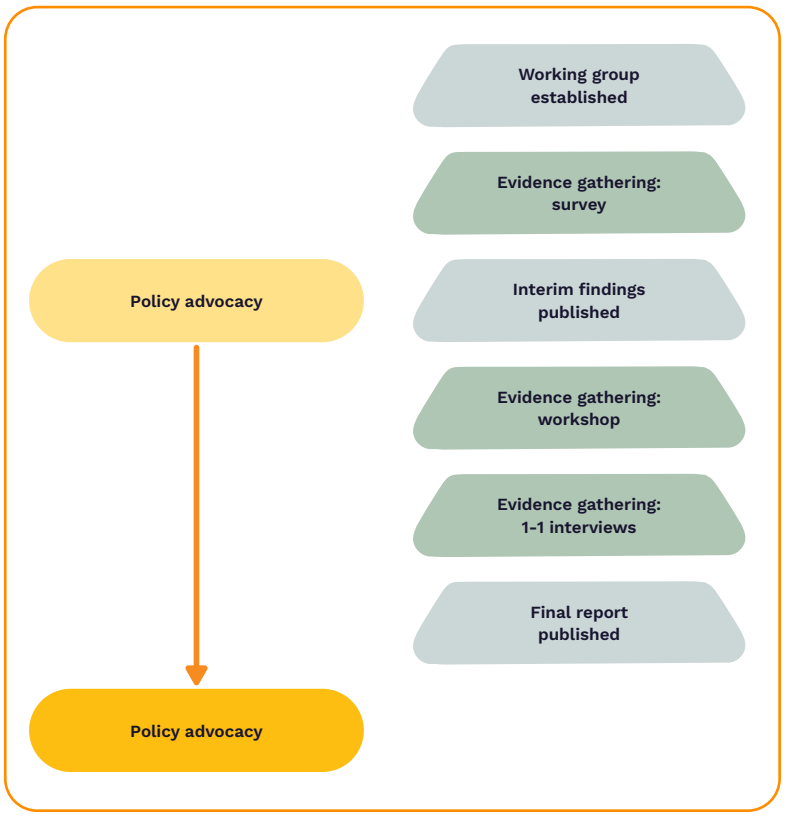
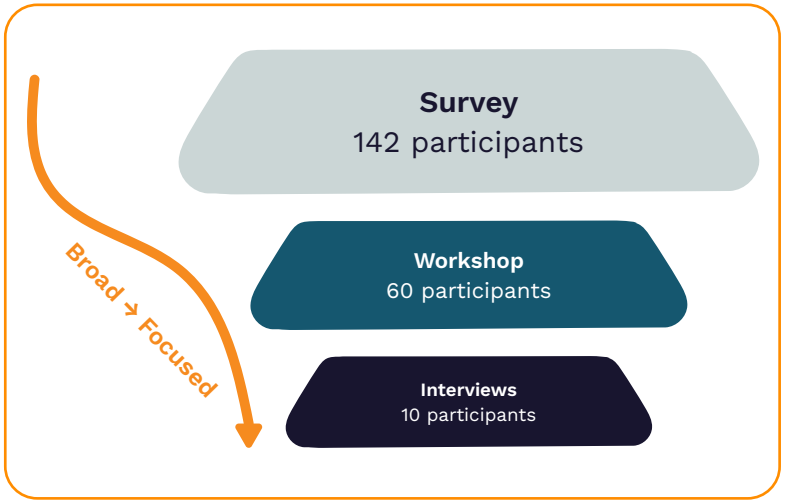


Figure 7.2: BNG in practice project: evidence gathering processs



Evidence gathering

The evidence gathering process started off very broad, with a large pool of survey respondents answering 20 questions on a variety of areas within BNG.

As the project progressed, the evidence gathering process became more focused, with questions being refined through a workshop and then a set of 1-1 interviews, as the key challenges became clear (see **Figure 7.2**).

Establishing a broad picture: BNG survey

The first part of the project was the distribution of an online survey, running between 1 and 26 August 2024.[3]

The survey had a strong response rate, with 142 responses, of which 89 per cent came from IES or ALGE members. Most respondents worked in planning (23 per cent), ecology (19 per cent) and environmental consulting (19 per cent). The survey included questions on how well BNG was working in practice, a request to rate potential challenges and a discussion of possible solutions.

The survey results indicated that BNG was working reasonably well for most practitioners. However, there were also some significant issues raised:

- More biodiversity gain information needs to be produced at the planning application stage
- Some on-site BNG is at risk of not providing significant environmental benefits, and stricter regulation and guidance need to be provided
- The off-site BNG market is facing serious delays with the need to speed up Local Planning Authority (LPA) approvals
- LPAs also need more capacity for monitoring and enforcement, which are critical if BNG is to achieve its aims.

The survey results were published in the 'Counting on Net Gain' edition of the environmental SCIENTIST journal in September 2024.[4]

At this stage, they were also shared with key stakeholders, including Natural England, the OEP, and Green Alliance to build interest ahead of the final report at the end of the year.

Drilling down: workshop and interviews

The survey results were discussed and interrogated at a BNG workshop at EPIC's Autumn Conference on 10th October. The workshop included breakout sessions on each of the key challenges identified in the survey: the position of the gain plan, on-site gains, off-site gains, monitoring & enforcement, and stacking with other environmental schemes.

Policy engagement and advocacy continued throughout this stage, for instance with BNG Project Lead at the IES Ellie Savage providing comment in the media on DEFRA's statement that the policy was 'working as intended'.[5]

Following the survey and workshop, the group has been conducting interviews with key stakeholders throughout November and December. This has allowed them to drill down into the outstanding questions and potential solutions that have come out of

the survey results, but also working group and workshop discussions.

Questions included:

- What BNG relevant information do you ask developers to submit pre-determination, and what do you think is best practice?
- What is your experience with using the DEFRA Biodiversity Gain Plan?
- Do you think the self-build, custom build and/or *de minimus* exemption is working as intended?
- Do you think encouraging LPAs to provide fractions of units to small sites would help with the issues small sites are having with BNG?
- Should we be encouraging a risk-based approach to monitoring for non-significant on-site gains?
- Should there be a BNG regulator?
- How can we speed up off-site agreements?
- What level of penalty is needed to release developers to maintain gains?
- What should the strategic significance multiplier be?
- How should the funding from statutory credits be used?

Policy advocacy

In February 2025, marking one year since mandatory BNG came into force for major developments, the working group will publish a report summarising the findings of the project, highlighting good practice for practitioners and recommendations for policy makers.

The group will also speak to the report's publication at a BNG symposium event. This will be just one part of the jigsaw of emerging evidence on how BNG is working in practice, but we hope an important one.

The report will be shared with key stakeholders such as DEFRA and Natural England, as well as local authorities and NGOs. The group will request a meeting with DEFRA and Natural England officials to discuss the report and recommendations in detail.

Box 7.1: Key messages

Key messages from this case study are:

- Professional bodies are able to provide unique and valuable evidence to policy makers through their members' knowledge, skills and experience.
- The evidence gathering process should start by casting a broad net and then work to become more focused, as key questions and areas become clear.
- Policy work can be member-led as long as they are supported by policy professionals and safeguards are in place. Members can be very effective policy advocates; policy makers want to hear from practitioners and experts with experience.

The results may also be of interest to those in the devolved administrations and further afield who may be considering a similar statutory BNG policy.

On the need for advocating the project's findings, William Wilson, environmental lawyer and member of the BNG working group, said: "*Having done the kind of careful work that EPIC has undertaken on the operation of Biodiversity Net Gain, it makes sense to have an implementation plan, to bring it to the attention of policy makers, opinion formers and decision takers.*

Governments have plenty of people bringing them problems. There should always be opportunities to present carefully considered and well-informed proposals for improvements."

About EPIC

EPIC was launched in February 2024. It builds on the previous work of Environmental Protection UK (EPUK), after it merged with the Institution of Environmental Sciences.[6]

EPIC aims to understand the challenges around delivering environmental policy, to document and share good practice, and to act as a forum and centre of excellence for local authorities and others delivering environmental policy on the ground.

The EPIC steering committee sets the overall direction, assisted by an advisory group. Various working groups and forums take on specific issues and workstreams.

EPIC members get a wide range of benefits: a quarterly newsletter, with relevant news and updates on the latest EPIC workstreams and opportunities; webinars, workshops and conferences, available free or at reduced rates; support on implementation skills and good practice; briefings and reports on environmental delivery challenges. Members can also help shape EPIC briefings and reports by joining working groups and responding to consultations.

Joining EPIC is free to anyone who is a member of the Institution of Environmental Sciences.

We are aware that EPIC's work is particularly useful for environmental staff in local authorities, and that local authority budgets are often constrained. Because of this, free EPIC membership has also been extended to local authority environmental professionals.

Join online via the IES website.[7]

Case study eight: Policy delivery

Editor's commentary

Case study eight offers a second perspective on policy implementation. Where case study seven concerned a policy that was in the process of being implemented for the first time, this case study takes a longer-term view of how a policy has been delivered in practice.

In case study eight, James Longhurst looks at Local Air Quality Management (LAQM), providing a narrative on the LAQM process and its rationale, followed by an analysis of how LAQM has functioned in practice.

The local dimension of air quality management is especially pertinent, given that both the causes of air pollution and many of the potential solutions have an inherently local dimension to them.

Professor Longhurst is well-placed to provide incisive commentary on the topic, informed by Bristol's process of implementing LAQM, as well as the leading research of the University of the West of England (UWE) on air quality and LAQM.

This case study is likely to be particularly interesting to professionals investigating long-term policy implementation questions, particularly the challenges that can emerge for delivering policy at a local scale.

The eighth case study considers LAQM in a broad context, from policy objectives at the initial design stage through the Air Quality Strategy, the real-world concerns around particular air pollutants, and the practical considerations for local authorities operating under constrained resources.

As a result, the narrative case study provides a very holistic view of policy implementation and its challenges, which is likely to be of value to anyone interested in delivering policy, whether on air quality management or otherwise.

The Institution of Environmental Sciences

Case study eight: The missed opportunity of Local Air Quality Management: A personal view

James Longhurst, Emeritus Professor Environmental Science, University of the West of England

"*Clean air is an essential ingredient of a good quality of life. People have the right to expect that the air that they breathe will not harm them.*"

The Primary Objective of the Air Quality Strategy is "*to make sure everyone can enjoy a level of ambient air quality in public places which poses no significant risk to health or quality of life*".[1]

Introduction

The Local Air Quality Management (LAQM) process is an integral part of national air quality policy and strategy. It is a process that on its legal incorporation in 1995 had great promise. LAQM promised a new approach, one deliberately interventionist and one designed to both identify and remediate areas of poor air quality.

At the local level a two-step process of Review and Assessment followed, where necessary, by the development and implementation of an Air Quality Action Plan (AQAP) would lead to effective and efficient improvements in local air quality.

Nearly 30 years on, it is clear that the promise of improved air quality through LAQM has failed to deliver the expected benefits. What LAQM has done, and continues to do, well is to diagnose areas of poorer air quality and to spatially delimit such areas as Air Quality Management Areas (AQMA).

This process of Review and Assessment has given us a new spatial geography of air pollution at a finer resolution than hitherto available.[2] However, the second part of LAQM is the AQAP. This is where the promise of change has most obviously failed to deliver on the need for improved air quality despite national air quality objectives setting out the timescale for achievement of policy objectives. How and why we got to this position is the focus of this short policy case study.

The Local Air Quality Management process

The requirement for LAQM was first set out in Part IV of the Environment Act 1995, sections 82 to 88.[3]

The Act set the requirement for a national Air Quality Strategy (AQS) and established a two pronged approach to managing air quality, a national framework for action within which nested local actions designed to focus remediation on areas of intractable local air pollution otherwise not amenable to national actions.

The Environment Act has been amended in 2021 but the general intent and approach set out is broadly similar to the 1995 Act.[4]

The first AQS in 1997 set out the seven principles upon which air quality management would operate.[5] These were:

- the application of sound science to decision making
- human health effects based assessments and control actions
- cost-effectiveness of actions to control issues of concern
- proportionality of response to identified problems

- sustainability of the control action
- application of the precautionary principle in the assessment of the problem, formulation and implementation of the control measures
- subsidiarity, the application of assessment methodologies at the appropriate spatial scale

The latter principle, subsidiarity, was particularly important in terms of the scope, scale and effectiveness of actions by local authorities undertaking their LAQM duties.

In support of the Strategy, the Government published policy and technical guidance setting out in further detail the expectations for national and for local action. How these principles have guided decision making since 1997 in part explains the failure of LAQM to deliver on its initial promise.

Air Quality Objectives

At the onset of LAQM the expectation was that there might be a small number of areas of high pollution, so called hot spots, and these most likely would be found in the major conurbations. In order to identify such areas local authorities were charged with reviewing and assessing local air quality against a set of national air quality objectives.[6]

These objectives set permitted concentration levels, specified the measurement period and set a date that the objective would be achieved. The objectives only applied in areas where the public might reasonably be expected to be exposed to air pollution. Thus, local authorities assessed local air quality only in areas of potential public exposure.

The Air Quality Objectives are described as policy objectives and achievement was reserved for central government. A local authority undertaking their LAQM duties was required to work towards meeting the objectives. There was no legal requirement upon them to achieve the objectives.

For most of the pollutants for which an Air Quality Objective had been set there were few instances where an objective was exceeded according to the results of Review and Assessment. However, for NO_2, PM10 and in some case SO_2, substantial hot spot challenges were identified and an AQAP was required.

Whilst the AQS has been updated and amended in 2000, 2007 and 2023 with separate strategies being developed for the devolved administrations in Scotland and Wales as well as for London, the general approach has broadly remained similar to that set out in the first AQS. Each amendment led to new policy and technical guidance being produced to guide local authorities in their LAQM duties.

Throughout this period local authorities across the UK space reviewed and assessed local air quality, where relevant exceedances of objectives were identified AQMAs were designated and AQAPs produced.

Air Quality Management Areas

The initial expectation that a small number of AQMAs might be needed was a substantial under estimate.

By 2004 more than one hundred local authorities had declared one or more AQMAs for NO_2. By 2008, 52% (259 authorities) had one or more AQMAs, by 2021 68% of local authorities had at least one AQMA (note: the number of local authorities in the UK has changed over the period of LAQM).[7]

Many of these AQMAs have been in existence for long periods of time, in some instances for two decades or more.

As each AQMA requires an AQAP, designed to bring the air quality in the AQMA back with the value specified by the relevant Air Quality Objective, it is clear that managing local air quality is a problem that has proved strongly resistant to the current policy prescriptions for management. These are not the localised hotspots first envisaged in the mid-1990s but rather seem to be a local manifestations of a systemic national problem.

Bristol's AQMA illustrates the challenge faced by LAQM. An AQMA was first declared in May 2001 for NO_2 and PM10. The target date for NO_2, set in the Air Quality Objectives was 2005 and for PM10 the end of 2004. Bristol's AQMA was amended in 2003, 2008 and again in 2011, PM10 was removed from the designation but the concentration of NO_2 continues to be above the objective more than 20 years after the first designation of an AQMA and the requirement for an AQAP coming in to force.[8]

In addition to the continuing AQMA designation Bristol after many delays, now has an operational Clean Air Zone, (CAZ) covering part of the AQMA, yet another attempt at spatial management of air quality without the tool kit necessary to manage effectively the emission sources at the local level.

The balance sheet of LAQM

So what has nearly three decades of LAQM revealed?

- The requirement for an AQMA is much more widely dispersed across the UK than first anticipated
- AQMAs are present in a wide range of local authorities, both rural and urban
- AQMAs are present in small villages, towns and larger cities
- Street canyons are a common feature of many AQMAs
- AQMAs have substantial spatial variation, with examples varying in size from a single junction to covering the whole of a city
- LAQM has enabled a new spatial and temporal geography of air pollution to be developed through the consistent application of an effective Review and Assessment process
- Air Quality Objectives are no more than "*policy intentions*" and not legally-binding
- The evidence for AQAPs improving air quality is not very strong
- Local authorities lack the legal powers, resources and often the institutional willingness to undertake actions that

enhance public health in the longer term but are unpopular in the shorter term

- Hence AQAPs were and are strong on good intentions but rather weak and ineffective on hard policy implementation
- AQAPs rarely bring forward targeted and achievable measures that are likely to be effective in addressing intractable problems mostly but not exclusively, caused by transport systems or PM emission sources
- Implementing the AQAP often appear to have been given little political priority within local authorities
- It is hard to identify very many clear cases where AQAPs have been effective and improved air quality to the extent that the AQMA has been revoked

When considering the quotes at the head of this paper from the 2000 version of the AQS, can we say that LAQM has delivered the right to clean air promised by the AQS? Has the risk of exposure in public places been reduced? I don't think we can.

Through Review and Assessment, we have a better understanding of where poor local air quality exists and thus the risk to the public.

Unfortunately the measures necessary to improve poor air quality, to the extent that AQMAs are revoked and the UK space achieves the relevant Air Quality Objectives applying in England, London, Scotland or Wales, are not being implemented. Thus public exposure to elevated concentrations of specific air pollutants remains nearly two decades after the NO_2 and PM10 objectives should have been achieved.

The future of LAQM

Against this backdrop and after some 14 years of declining local authority budgets what might the future hold for LAQM? England's Chief Medical Officer in his 2022 report speaking about air pollution said "*We can and should go further to reduce air pollution – and it is technically possible to do so*".[9]

The amended Environment Act[4] and the subsequent Policy Guidance[10] applying to England, does give some hope that the deficiencies of the LAQM process are both recognised and addressed.

The Act sets out measures to enable English local authorities to take more effective, co-ordinated actions to achieve their air quality objectives and deliver improvements to public health, and tackle emission from domestic burning, a source PM10.

LAQM Policy Guidance, PG22,[10] sets out the expectations for, and requirements of, local authorities in respect of their LAQM duties. It covers English local authorities but excludes London Boroughs where LAQM guidance is provided by the Mayor of London.

"*All layers of local government have legal duties to act to address elevated concentrations of local air pollution.*"[10]

"*All levels of local government are expected to commit to taking the actions necessary to ensure that local air quality objectives are secured.*"[10]

Unfortunately 'to address' is not the same thing as achieving the objectives and the commitment to taking action might be easily met by the simple publication of an AQAP. What matters is the rigorous implementation of the measures present in a well formulated and calibrated AQAP.

Budget pressures on local authorities

After such a long and continuing period of downward pressure on local authority budgets and with high profile authorities such as Birmingham and Nottingham effectively bankrupt, do local authorities have the staff capacity and capability to discharge their LAQM duties?

To conceive and execute their LAQM responsibilities, local authorities require an effective regulatory framework and a well-trained and efficient enforcement capability.[11] Both must be present to deliver effective environmental protection.

Enforcement is the necessary adjunct to the regulatory powers at a local authority's disposal and is a visible sign of intent and a means of changing cultures.

Yet in many authorities the enforcement capability has been substantially reduced. Unsurprisingly enforcement action has dropped dramatically in local authorities as budget cuts have led to staff cuts and capacity and capability to act is reduced.[11]

The resource challenges facing English local authorities in staffing and budgets are stark and increasing with many more local authorities facing extremely difficult budget positions. In such circumstances will LAQM be seen as a core duty when considered against the high profile statutory requirements of social services and education?[11]

Can national and local actors together provide the financial, technical and human capital at pace and scale to meet the challenge of reducing, if not removing, the greatest environmental risk to public health in the UK? Only time will tell.

Concluding comments

The impact of austerity on capacity, capability and willingness to act cannot be overestimated. Yet local authorities may well face new challenges as they assess the impact of their net zero ambitions on their LAQM duties. This might identify new concerns arising from a changing atmospheric chemistry in a warmer world or reveal new areas of public exposure as their population adapts to a warmer world.

One area requiring further attention is the environmental justice implications of LAQM. The inequality in exposure to air pollutants is considerable with the poorest in society often most exposed to the highest concentrations of air pollutants but responsible for a much smaller share of emissions.[12]

For LAQM to deliver on its promise, local authorities require the resources and powers to enable them to address the problems that they have identified through Review and Assessment. Making achievement of the Air Quality Objectives a statutory duty for an authority whose Review and Assessment requires an AQMA is a first step.

Refinancing of local government is a necessary condition for staff capacity and capability to be enhanced to a sufficient level for LAQM duties to be undertaken effectively and efficient and the health of the public protected.

Recognising that the long term solutions to poor air quality are to be found in a meaningful integration of environmental and public health protection into policies and practices for Spatial Planning, Economic Development and Transport Infrastructure Planning is a pre-condition for longer term air quality improvement. These solutions then need appropriate resourcing.

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Case study nine: Evaluation

Editor's commentary

Evaluation is a fundamental part of the policy process, particularly in the environmental context. Case study nine is a robust overview of the approach taken by Logika Group as it led a team of specialists from different companies in a particularly relevant example: England's Environmental Improvement Plan (EIP).

The case study is especially pertinent because it speaks to both the importance and the challenges at the heart of policy evaluation.

Evaluation is vital because it tells us whether all our effort and expended resources have achieved their expected goals. In the context of the environment, where we are often dealing with urgent issues and long timeframes, effective evaluation can make all the difference.

It can also come with significant challenges, which the Logika case study ably addresses. In particular, environmental policy decisions can be difficult to evaluate, as they are bound-up in social and natural systems which are interlinking and complex.

In case study nine, Logika Group sets out an approach to dealing with these issues in some of the most complicated and sensitive circumstances. In that context, the case study provides a window into evaluation which may be useful across specialisms or issues.

Logika Group is a group of companies in the environment sector with expertise across consultancy, policy, and economics. Given the group's links across different specialisms, it was aptly placed to work on the complex task of evaluating the EIP.

This case study is likely to be interesting to any environmental professionals seeking to engage in policy evaluation, but particularly those dealing with complex systems or the environmental challenges emerging from them.

Throughout the case study, Logika demonstrates the importance of technical expertise from environmental specialists, as well as a range of tools that can support policy evaluation, even in the face of rampant complexity.

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Case study nine: Evaluation and the 25 Year Environment Plan

Rebecca Wells, Logika Group

Introduction and context to the 25 Year Environment Plan

The 25 Year Environment Plan (25 YEP), published in 2018, was a comprehensive strategy aimed at improving the natural environment over a quarter of a century.[1]

Its overarching goal was to leave the environment in a better state than we found it. It laid out what the UK Government will do to improve the environment within a generation, including ten environmental goals covering air, water, natural capital and more.

The plan emerged in response to growing concerns about environmental degradation, climate change, and the loss of biodiversity, aligning with international commitments, such as the Paris Agreement on climate change and the UN Sustainable Development Goals.

The governance structure for the plan's implementation includes regular progress reviews and updates to ensure accountability and adaptability to emerging environmental challenges.

Following the publication of the Environment Act in 2021,[2] the 25 YEP must be evaluated and updated on a 5-yearly cycle. EIP23 represents the first update to the 25 YEP. The case study will illustrate that this policy context is complex. This makes the evaluation of policy complicated, yet essential.

The following case study will use this process to answer the fundamental question: **why, and how, should we evaluate environmental policy?**

The importance of evaluation in the complex context of the 25 YEP and EIP23

Evaluation is an essential step towards better policy making. It gives objective, evidence-based insights into the impact and effectiveness of policy, as well as its value for money.

This allows policy makers to assess whether the strategies and actions outlined in a policy or programme are achieving their intended outcomes. It helps to identify successful initiatives or components that can be expanded and underperforming ones that need adjustment or replacement, ensuring that resources are used efficiently, and environmental benefits are maximised.

In addition, evaluation helps to keep delivering bodies accountable through analysis of the success of an intervention,[3] promoting transparency and public trust and support.

Transparent evaluation processes also facilitate stakeholder engagement, providing opportunities for public input and collaboration, which can lead to more informed and widely supported policy decisions.

Evaluation is important for environmental policy because the context is dynamic, with new challenges and scientific insights emerging continuously, meaning interventions are often complex.[3]

Furthermore, unexpected environmental crises, advancements in green technology, or shifts in public behaviour and attitudes can all impact a policy or programme's execution. Environmental policies can also impact, alter, and in some cases, be inconsistent with each other.[4]

Insights gained from evaluation processes can inform future policy development, helping to refine and improve environmental strategies within the scope of the 25 YEP and for future initiatives.

The supplementary evidence report of the 25 YEP highlights the importance of evaluation for DEFRA.[1] It states that robust evidence should inform and develop a policy context aligned with a natural capital approach to environmental policy making.

Evaluation therefore is a crucial step to help policy makers navigate the challenges that may arise when assessing the value of nature and the price of its protection, and how to anticipate managing and responding to them, ensuring that environmental policies remain effective and impactful over the long term.

Another review conducted by the UK Centre for Ecology and Hydrology (UKCEH) in

Table 9.1: State of the evaluation landscape as of 2023 in relation to the 10 goals of the 25 YEP

	25 Year Environment Plan Goals									
Evaluation type	**Clean air**	**Clean and plentiful water**	**Thriving plants and wildlife**	**Reducing the risks of harm from environmental hazards**	**Using resources from nature more sustainably and efficiently**	**Enhancing beauty, heritage and engagement with the natural environment**	**Mitigating and adapting to climate change**	**Minimising waste**	**Managing exposure to chemicals**	**Enhancing biosecurity**
Economic	1	1	2		13	1	2	1	2	2
Impact	2	7	21	2	11	9	2		2	7
Mixed	2	7	8	1	6	4			1	
Process			4	3	7	4				1

Table 9.1 illustrates the number of evaluations conducted for each of the 10 goals of the 25 Year Environment Plan, sorted by type and coloured to indicate intensity. Source: UKCEH and OEP.[5]

collaboration with the OEP found that there had been an uneven amount of resource and funding dedicated to each of the ten goals of the 25 YEP (**Table 9.1**).[5]

The review conducted by UKCEH and OEP illustrates the overall importance of evaluation of the 25 YEP as a coherent unit rather than only as individual policy areas.

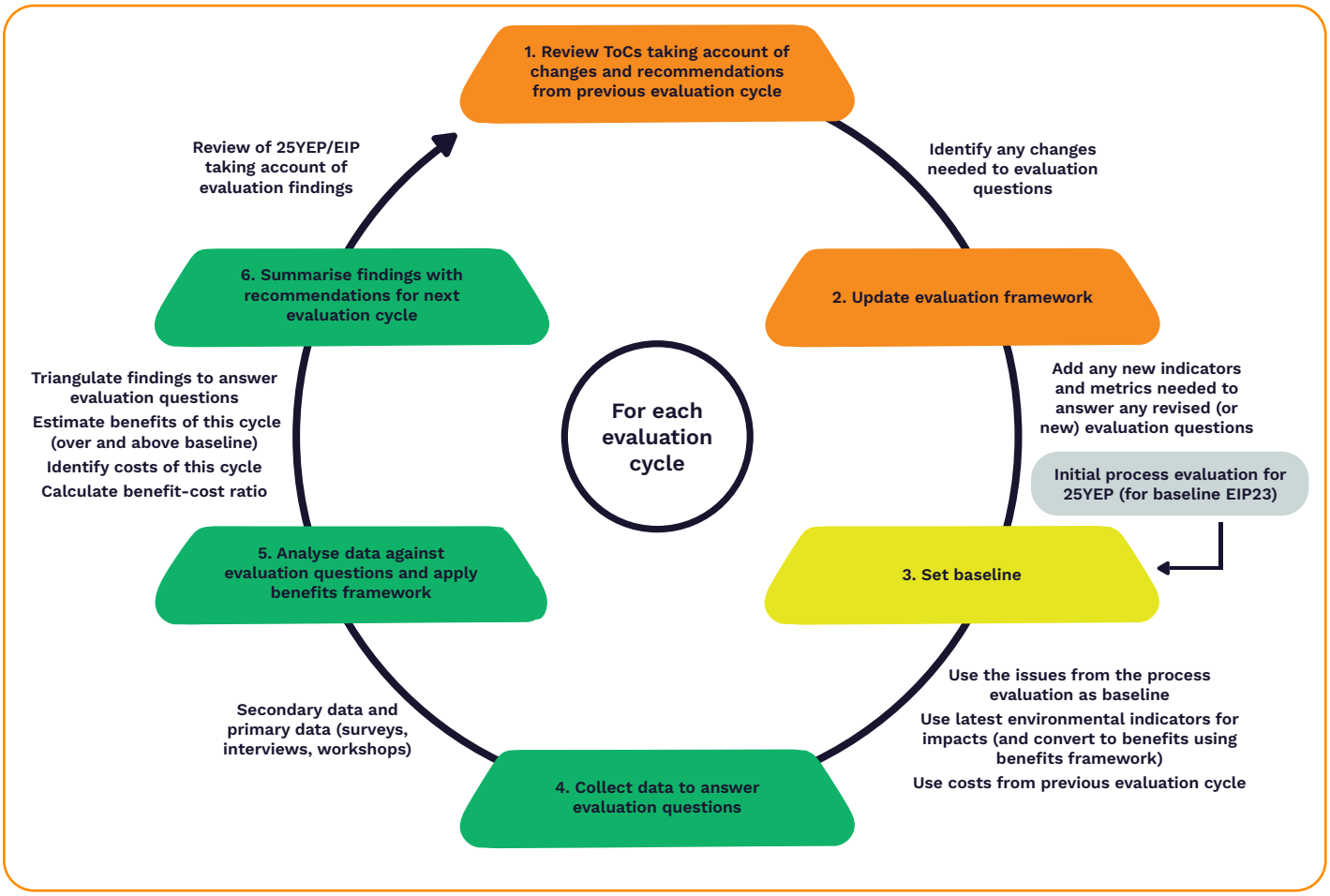
The evaluation undertaken by Logika was not a result of this finding, though it illustrates how the evaluation of the 25 YEP needed to cover 10 goals, cross-cutting areas, and the overarching combination of those goals at the overall environment scale.

To reflect this, data collection and analysis had to draw on individual goal monitoring and evaluations but also focus on the combination and interaction of goals encouraging use of systems thinking.

25 YEP: the evaluation process

To address the evaluation task, Logika developed a unique methodology to reflect

Figure 9.1: Tasks for each evaluative cycle of the 25 YEP until 2043



the complexity of the evaluation associated with the 25 YEP. The project was set up by dividing the work between two Workstreams (WS1 and WS2).

WS1 drew on a collation of existing evidence to assess actions taken since the publication of the 25 YEP and whether the natural environment had changed since. To achieve this, close collaboration with DEFRA was required to answer the specific questions related to any change in scope of the 25 YEP since 2018.

Key sectors and actors were mapped out including those representing regulatory bodies, and those in the private sector (e.g. water companies, property developers, energy production etc). A high-level Theory of Change (ToC) was developed to understand causal pathways and whether the plan was working as intended.

WS2 used these findings to evaluate if the plan had worked as intended so far and set up a framework for future evaluations. This part of the evaluation was a process evaluation task which set up an evaluation framework for future iterations of the evaluative process (**Figure 9.1**).

The evaluation framework was developed based on Magenta Book guidance.[6] Three types of evaluation were required for the plan. These included:

- **Process evaluation:** to understand how the interventions have been implemented and what can be learned from how they have been delivered;
- **Impact evaluation:** to understand the effects that the interventions have had and to explore what difference the plan has made as well as how and why it has led to those effects; and
- **Value-for-money evaluation:** to understand how efficiently and effectively the plan intervention has been implemented and therefore, whether it offers a good use of resources.

A theory-based approach to evaluation was also adopted. This is because the plan covers the whole environment, with no counterfactual that would support an experimental approach.*

Theory-based approaches focus on the extent of changes and the reason why the changes occur, including the effects of wider contexts on the realisation of those changes. They are best used in complex policy landscapes.

The evaluation approach involved four key streams of action:

1. Test the Theories of Change
2. Explore interactions between multiple outcomes i.e. explore how policies are working together to deliver each goal and the overall vision
3. Work with and gather feedback from stakeholders
4. Set out a synthesis approach, combining findings from secondary sources (i.e.

* However, some evaluations have been identified that were completed at or around the timing of publication of the 25YEP, or that relate to early interventions such as the natural capital pioneers. These do provide some information for a counterfactual in terms of the state of the environment (and policy context) in 2018 that can form a baseline from which changes after publication of the 25YEP can be assessed.

different studies) and primary sources to track the delivery and monitoring of the plan

Stakeholder engagement and feedback was a key priority throughout the process. The process evaluation was supported by at least one interview with DEFRA Policy and Evidence teams per goal area. Insights from interview became key data points to assess the process evaluation questions.

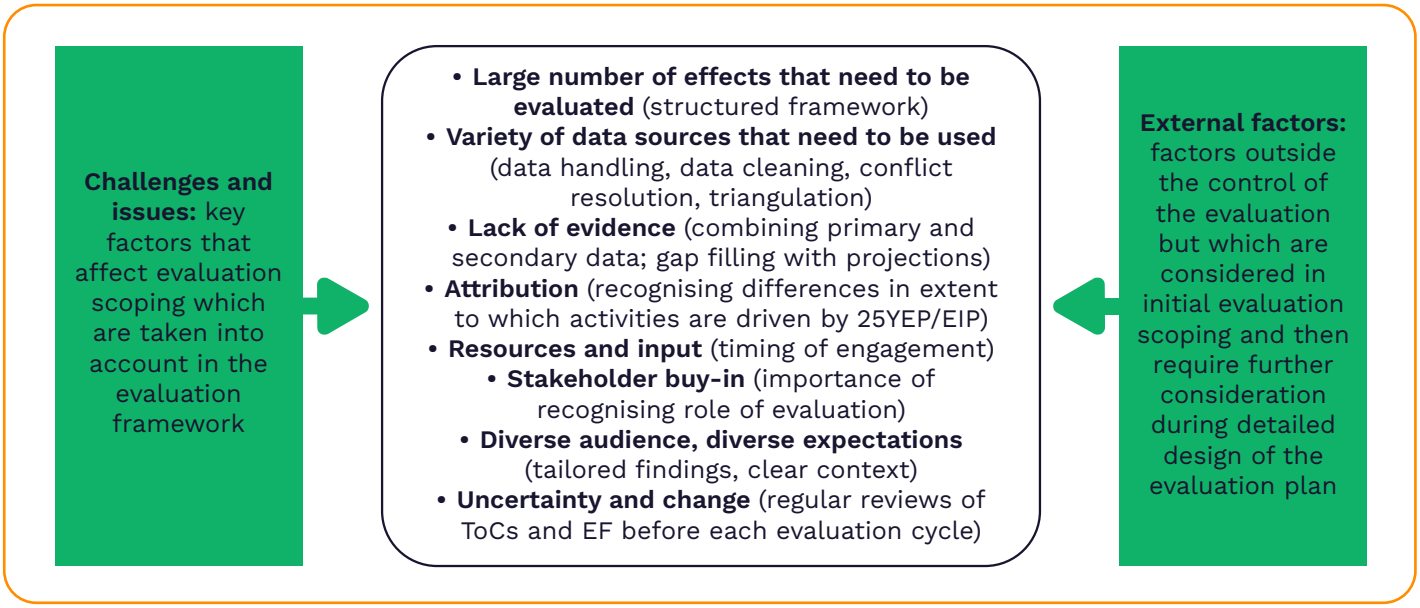
Interview findings were triangulated with an online survey sent to DEFRA colleagues. These data sources were supported by qualitative secondary data sources to develop a framework matrix to enable key information to be extracted from the various sources in a consistent manner, while still maintaining a link with the source data.

The role of evidence in this process was vital, and evaluation questions were answered using at least three different data sources.

For some questions, data sources included external stakeholders, literature, as well as the evidence generated and expert knowledge from the team, using the report from WS1 and the ToC narratives to answer questions including but not limited to:

- What is being delivered meeting the level of action required to deliver the 25 YEP goals?
- What further actions are needed?
- Are there sufficient enablers in place to ensure the right actions are taken?

Figure 9.2: Visualisation of the challenges and factors affecting complex evaluations, with particular relevance to the 25 YEP



Challenges associated with developing a complex evaluation framework in the context of the 25 YEP

The issue of scope for the review arose very early in the process. Policy development, especially across a whole government department, is dynamic.

While comprehensive, the 25 YEP as originally published is in effect a snapshot of the priorities and priority actions on the environment. The overarching ambition expressed within the 25 YEP, "*to leave our environment in a better state than we found it*", has remained constant but the detail beneath that has developed and changed. Since the 25 YEP's original publication, several strategies have been adopted, such as the Clean Air Strategy,[7] which expands the definition of their relevant 25 YEP Goal.

These challenges highlight the complexity of environmental policy evaluations. The sheer diversity of the goals makes it hugely difficult to know what is attributable to the 25 YEP and what would have happened anyway. There is a similar issue with valuing the benefits of the plan. Not knowing what may or may not happen in the future in the environmental policy making sphere makes it hard to accurately assess how far off track it might be.

As with other complex systems, many impacting forces could 'pop up' later down the line. This was a key challenge with presenting the 25YEP evaluation (**Figure 9.2**). The plan is so long term that knowing what may happen within the policy landscape up until 2043 is almost impossible to ascertain.

Indeed, the UK Government's environmental strategy is concerned with a Green Recovery following COVID-19, a framework that was developed following an unprecedented global pandemic.

Conclusion

Ultimately, the production of the EIP23 was mostly the result of internal work done by DEFRA and the separate evaluations conducted by Logika and the OEP provided inputs for this. Evaluation, from both Logika and the OEP however, contributed to a new revised plan with better interim targets and a solid delivery plan.

Evaluation of environmental policy is imperative to ensure goals are being achieved within and despite of a complex, dynamic and ever-changing context.

The importance of testing the 25 YEP in this way provides a mechanism to ensure that the Government is planning on, and taking steps towards, protecting the environment in the right way. Or in other words, a way that is based on scientific evidence including insights into the feasibility of options informed, at least in part, by key stakeholders who work at the forefront of the environmental policy sphere.

The role of evidence and expert insight shaped the development of the evaluation framework set out by Logika Group. Ensuring these insights are built into the structure of how the 25 YEP and its iterations will be evaluated in the future is essential to ensure that the policy remains, and becomes more, effective, efficient,

relevant, coherent and plausible for those tasked with implementing it.

The importance of evaluation reestablishes the crucial importance of relying on science and evidence-based insights to inform future policy development.

By ensuring that policies are continuously improved, considering new and unprecedented influences they may face, evaluation can ensure that the Government is held accountable by providing transparency on progress towards policy goals. This is vital; since it also provides transparency on how public money is being spent in the context of delivering the UK's environmental goals and objectives.

Conclusion

How can we speak up for science and nature?

Engaging with environmental policy will never be simple. As environmental challenges become more ubiquitous, policy discussions will become increasingly crowded and difficult to penetrate.

Despite that challenge, the case studies in this collection provide cause for optimism: the message is clear that there is no substitute for the expertise that the environmental sciences are able to provide.

The case studies demonstrate how effective expert voices can be when they are properly leveraged, with a range of clear and adoptable techniques and guidance for engaging with every stage in the policy process.

One of the key themes of the collection is trust. When expert voices are trusted to speak honestly and authoritatively about the environment and its implications for decisions, they are far more effective. When the advice we share is based on robust and credible evidence, it builds that trust.

Equally, relationships matter, as they are pivotal to generating that trust. We cannot lose track of the human element of the policy process, even as we take an objective stance supported by the evidence.

The challenge for environmental professionals engaging with policy over the next decade will be to grow that trust, cultivating positive relationships built on robust and reliable evidence.

Throughout these case studies, readers will have found opportunities to enhance their own engagement with the policy process, either by adopting techniques and best practice, or by drawing on the strategic insights of what works (and what doesn't) from the learned experience of the case study authors.

Supported by the lessons we can teach each other, we have all the potential to continue that forward progress throughout the next decade.

This collection is only one example of the Institution's work to create and sustain a knowledgeable, skilled, diverse, and trusted environmental profession engaged in the transformation to a sustainable society.

With that vision in mind, it is our hope that we can accelerate society's response to environmental challenges, acting together as we take the voice of science, scientists, and the natural world and put it to the task of crafting a better world.

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"Expertise is not an abstract concept: it is something that people have and that communities can share."

Image credit: Alastair Johnstone / Climate Visuals

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