NatureScot
Scotland's Nature Agency

**NatureScot**

**SCIENTIFIC ADVISORY COMMITTEE**

**DISCUSSION PAPER**

# NatureScot’s science and evidence needs

## Purpose

1. This paper seeks advice from the Committee on our proposed approach to communicating our science and evidence needs.

## Action

1. SAC members are asked to:

* note the aims of why we want to set out our science and evidence needs;
* comment on our proposed approach for setting out our science and evidence needs;
* advise on how to promote this effectively to external bodies.

## Preparation

1. This paper was prepared by Alex Mackay and is sponsored by Eileen Stuart.

## Background

1. NatureScot has a range of evidence needs to support the advice we give to Ministers and others, to ensure we maintain long-term monitoring of protected sites, priority habitats and species and in order to inform the management of our protected areas on land and sea and the development of nature-based solutions and landscape scale nature restoration.
2. Being able to articulate our science and evidence needs has several benefits:
   1. It is useful for external partners to be able to see what our priorities are so that they can understand where the gaps are and where they can potentially support these needs, through collaboration and partnerships.
   2. It is also useful for potential funding partners to see what our needs are, so that they can get in touch with us to help build mutually beneficial research projects.
   3. There are also benefits of being able to share a summary of our needs internally, so that our staff understand these priorities across the different parts of NatureScot, to avoid any duplication, allow better collaboration and be able to advocate to our partners with a shared understanding of our science and evidence needs.
3. During the previous Corporate Plan, a [Strategic Evidence Needs](https://www.nature.scot/doc/naturescots-strategic-evidence-needs) document was prepared which set out the organisation’s science and evidence priorities. This was well-received by some external organisations, but wasn’t particularly well used internally, potentially due to a lack of reinforcement through the project planning process.
4. Within the Science and Evidence Leadership Programme we have discussed whether we need to update the Strategic Evidence Needs document or do something different. From these discussions, it was felt that it would be useful to have two different mechanisms in place:
   1. Firstly, a Strategic Evidence Needs document similar to the previous version, that highlights the importance of science and evidence to our work which would be aligned with our Corporate Plan and be revised during each Corporate Plan cycle. The document would set out why we have science and evidence needs, how we go about meeting those needs and what our current evidence needs are, all framed around our Corporate Plan and the new Scottish Biodiversity Strategy (SBS) and Delivery Plans.
   2. Secondly, content on our website which illustrates our current research in an engaging way. This would be updated every six months to ensure it is current and provides the opportunity for capturing new and emerging areas of research that may arise that are not captured in the evidence needs document e.g. as in the case of Avian Flu a few years ago.
5. It was decided that we should focus our efforts on the first document, given that we are halfway through our Corporate Plan period. Annex 1 includes an early draft of what the high-level document might look like. It includes contributions from different delivery leads across NatureScot as well as the SBS knowledge gap information that was brought forward for the Board/SAC meeting in February.

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**Annex 1 - NatureScot’s Science and Evidence Needs**

**Introduction**

NatureScot is Scotland’s Nature Agency. We are responsible for protecting and restoring nature, and inspiring everyone to value our natural world.

Our Corporate Plan, [A Nature-rich Future for All](https://www.nature.scot/sites/default/files/2023-05/Corporate%20Plan%202022-2026%20-%20A%20nature-rich%20future%20for%20all%20-%20Accessible.pdf) sets out our priorities from 2022 to 2026 which will help turn around the nature crisis and achieve net-zero carbon emissions in Scotland.

There are three priorities within our Corporate Plan:

* **Protecting Nature** by expanding protected areas, regulating species management, and delivering effective planning advice on land and at sea.
* **Restoring Nature** through a new biodiversity strategy, restoring peatlands, aiding nature’s recovery and transforming farming.
* **Valuing Nature** so that the many benefits it provides to society can in turn attract public, private and social enterprise financing for both protection and restoration.

The Plan sets out targets to achieve these priorities which will be met by 2026 and further action to take us to 2030 and fully achieve these three outcomes.

The new Scottish Biodiversity Strategy will be published in 2024 and sets out a clear ambition for Scotland to be Nature Positive by 2030 and to have restored and regenerated biodiversity across the country by 2045.

The strategy identifies six objectives, with associated actions that will deliver the ambition to halt the loss of biodiversity in Scotland.

1. Accelerate restoration and regeneration
2. Protect nature on land and at sea, across and beyond protected areas
3. Embed nature-positive farming, fishing and forestry
4. Protect and support the recovery of vulnerable and important species and habitats
5. Invest in Nature
6. Take action on the indirect drivers of biodiversity loss

**How will science and evidence help us achieve a nature positive future?**

The success of our Corporate Plan and the Scottish Biodiversity Strategy involves the delivery of a large number of actions by NatureScot and our partners. As we work through these actions, we need to ensure that the decisions we are taking are well informed and evidence based. As advisors to the Scottish Government and others we need to provide robust information, that is underpinned by sound science and evidence.

In order to do this, we need to:

* maintain our monitoring of protected sites, priority habitats and species, to ensure we have current data to inform decisions and the advice we provide. For example, assessing the impact of climate change and assessing the value of conservation interventions.
* develop monitoring frameworks that allow us to measure the success or otherwise of adaptive management as we scale up our nature-recovery work through landscape-scale restoration, urban nature-based solutions and the use of living labs.
* ensure we are taking advantage of emerging technology to help us make vital decisions for how we manage our land and seas for nature in Scotland.
* understand the motivations and behaviours of all parts of society and ensure that we are working with local communities and communities of interest to secure a nature-positive Scotland.
* keep abreast of the latest research findings from around the world.

In determining what our evidence needs are, we need to evaluate what are the important knowledge gaps and uncertainties. Alongside knowledge gaps we often have differing views on issues, where knowledge may be contested, or misunderstood. In some cases this may be something that engagement can address but it may also be where compelling evidence communicated in a particular way can change mindsets and associated behaviours.

These differing knowledge gaps are summarised below:

* Absence of Knowledge (i.e., no, or minimal, knowledge available)
* Uncertain knowledge (knowledge available, but insufficient to derive clear conclusions)
* Differing viewpoints or interpretations of knowledge (contradictory knowledge; contested knowledge – framings)
* Confident knowledge but low awareness/not widely understood (knowledge is robust and well established, but not widely understood or appreciated)

In addition to assessing knowledge gaps and associated evidence needs, we will take account of these differences and be clear with our stakeholders, why we are taking a particular approach and why we have arrived at our decisions.

We will also be open about instances where we need to apply expert judgement, where evidence is unavailable, will be too expensive or take too long to gather for the necessity of decision-making. This approach is applied in other industries where there is an incomplete evidence base. This expert judgement may come from our internal experts or from independent advice to NatureScot e.g. the Scientific Advisory Committee or Expert Panel.

**How do we gather our evidence?**

We gather evidence in a variety of ways. We carry out our own evidence reviews and data analysis as well as commissioning our own research to inform our work. Increasingly we work with [Doctoral Training Partnerships](https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.ukri.org%2Fwhat-we-do%2Fdeveloping-people-and-skills%2Fnerc%2Fnerc-studentships%2Fresponsive-training%2Fnerc-doctoral-training-partnerships-dtp%2F&data=05%7C01%7CMichelle.Flynn%40nature.scot%7Cecd11fc6f69a468299d108dbeb342dca%7C074028c0e165499999ad31603ad73bac%7C0%7C0%7C638362381558414417%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=BGCcN4gRUD4u0SjlPKxIjNd71ZXpn2mcFE9nkRZG1so%3D&reserved=0), UKRI funded Centres of Excellence and other funding programmes including Horizon Europe in partnership with other organisations.  The [MASTS](https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fmasts.ac.uk%2F&data=05%7C01%7CMichelle.Flynn%40nature.scot%7Cecd11fc6f69a468299d108dbeb342dca%7C074028c0e165499999ad31603ad73bac%7C0%7C0%7C638362381558414417%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=2DToOMob68qpmpB2YVMZJ8gzDbtoCWpnVrm1U3wYHbU%3D&reserved=0) and [SAGES](https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fsages.ac.uk%2F&data=05%7C01%7CMichelle.Flynn%40nature.scot%7Cecd11fc6f69a468299d108dbeb342dca%7C074028c0e165499999ad31603ad73bac%7C0%7C0%7C638362381558414417%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=bc9x0yf%2B7rriZskSA4yVdi5eqphs%2B3lsA3J8QLJq7PM%3D&reserved=0) offer key collaborative research opportunities and in addition we work with Masters students each year offering a range of real world research questions for them to investigate.

For many of these projects NatureScot offers expert staff time to help steer the development of projects and programmes. This support in kind, helps ensure that projects are designed to meet Scotland’s priority evidence needs for nature recovery and climate change adaptation. The outputs help inform our advice to the Scottish Government and others, and support the development of our priority areas of work, such as 30x30, nature networks, nature-based solutions, landscape-scale and peatland restoration, wildlife management, renewables, marine protection, investment in nature and influencing societal behaviour change.

**What are our current evidence needs?**

Below are a number of evidence needs that support the delivery of our corporate plan and the Scottish Biodiversity Strategy. They are grouped under our three Corporate Plan priorities, Protect, Restore and Value Nature.

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| **Protect Nature:** by expanding protected areas, regulating species management, and delivering effective planning advice on land and at sea |
| **Protected Areas** |
| How do we test the assumption that removal of pressures from an area of land will increase the ecological health and biodiversity interest of that area of land? |
| What are the broader benefits that protected areas provide (i.e. beyond 'nature' - e.g. Carbon storage and sequestration, climate change mitigation and adaptation, other 'people' benefits)? |
| How can we assess the effectiveness of ecological connectivity projects? |
| How will the make-up of our Protected Area suite change over time under different intervention scenarios? |
| What are the most effective tools and methods we have to positively influence motivations of landowners and managers to be part of 30x30? |
| In conjunction with the use of Innovative Technologies, how can we help to drive forward approaches to improve the accuracy and detail of Earth Observation techniques to support our decision-making? |
| What are the impacts of holistic land-management scenarios on the future protected area suite and the wider landscape, e.g. reductions in grazing pressure? |
| What are the impacts of climate change versus the impacts of human activities to help us prioritise management interventions? |
| How can we ensure that our future approaches to monitoring of protected areas inform appropriate interventions? |
| Our approach to protected areas is shifting from purely feature-focussed, often single-species interests. How can we quantify the benefits to allay concerns? |
| How do we embrace the continuous evolution of new technologies and data sources and utilise them in agreed metrics, indicators and reporting requirements? |
| Can LIDAR data be used to determine habitat type and condition within EUNIS categories? |
| How can we use our protected areas to communicate and broaden/increase understanding of the impacts of climate change on nature, and the benefits to both people and nature from actions to adapt and increase resilience? |
| How do we celebrate the contributions that Protected Areas and their owners and managers, deliver to society? |
| **Invasive Non-Native Species** |
| What are the impacts that INNS have on ecosystems, their resilience and the ecosystem services they provide in Scotland? |
| What do we need to develop and how do we optimise effective tools for detecting INNS, particularly when present in low numbers e.g. eDNA, camera trapping, detection dogs and acoustics? |
| What are the next tranche and impact of climate induced plant and animal pathogen and pest invasion? |
| **Deer Management** |
| How do we model and map the scale, scope and extent of the cull to reduce damage? |
| How do we improve understanding of relationships between deer densities and impacts and how this relates to habitat responses? |
| **Species Monitoring** |
| What will the impact be of the projected pattern of climate change for vulnerable species and habitats, so that we can identify those that are a priority for action? |
| What are the population and distribution data for elasmobranchs in Scottish waters? |
| What species do we need to monitor (to establish if biodiversity loss is still occurring)? |
| What species are a priority for (i) the assessment of impacts, (ii) detection, surveillance, monitoring and (iii) control methods (to assess where the greatest knowledge gaps are)? |
| What is the effect of beaver restoration (and mitigation) on other conservation interests particularly Atlantic salmon? |
| How do we manage in protected sites, now that Atlantic Salmon are classified as endangered? |
| What are the implications of stocking applications on Atlantic Salmon which are designed to support fisheries rather than for conservation, and increased pressure to control predators? |
| What are the practical and ethical issues around new novel and contentious approaches to species management, e.g., molecular tools such as gene drives? |
| What are the impacts of muirburn on a range of biodiversity e.g. small mammals, reptiles, or amphibian? |
| What are the impacts of muirburn on a range of species and habitats including different species of sphagnum and other peat forming species? |
| **Woodland Management** |
| What set of standards and principles for increasing the biodiversity potential of production woodlands do we need that can be universally agreed? |
| **Development Planning** |
| What are the habitat restoration and enhancement (with peatland as a high priority) measures that can then be applied to Policy 3 on biodiversity in the National Planning Framework? |
| What is the effectiveness of renewables application restoration/enhancement measures on peatland? |
| What is the effectiveness of peat re-use on renewables schemes and what can be done with excavated peat? |
| How can we promote better shared understanding where evidence is contested? E.g., push-back from the aquaculture sector on the application of precautionary principle in development casework? |
| **Marine Planning and Management** |
| What are our future marine monitoring approaches - incorporating technological advancements & AI processing/application - aligned with agreed metrics, indicators and reporting requirements (incl. data repositories)? |
| How do we develop effective green/blue financing - supportive funding streams, evidenced, integrated data flows, delivering on agreed priorities (locations, features, and reporting priorities etc.)? |
| How do we support policy development (incl. flexibility) to maximise nature/biodiversity positive outcomes - strategic compensation, exchange mechanisms, adaptive management, cumulative effects, coastal resilience and adaptation, resolving restoration conflicts - with an appropriate risk appetite? |
| How do we develop clear and effective communications around coastal and marine environment status, benefits, and future needs (links to natural capital/ecosystem services etc.)? |
| How do we protect spawning and juvenile congregation areas, and for species which are integral components of the marine food web? |
| How do we develop and test new approaches to marine biodiversity monitoring, including through pilots? |
| How do we improve our very limited understanding of impacts of bottom contact fishing gear on marine sedimentary carbon stores? |
| How do we get a better understanding of the pressure -impact relationships and gain good spatial data on fisheries activity (especially intensity)? |
| How do we improve our limited knowledge of high-risk areas and/or gear types for fisheries bycatch and entanglement of sensitive marine species (includes understanding and trialling of mitigation)? |
| Improve knowledge on sources, pathways and impacts of pollutants, plastics, biotoxins and noise on aquatic species. |
| How do we ensure data can be made accessible at appropriate scales and resolutions to understand and aid decisions around sea fishing? |
| **Restore Nature:** through a new biodiversity strategy, restoring peatlands, aiding nature’s recovery and transforming farming. |
| **Peatland Management** |
| What is the effect of peatland restoration on downstream water quality and resulting impacts on public drinking water or the ecological status of water bodies? |
| What is the effect of peatland restoration on regulating water flow within catchments and resulting benefits in terms of natural flood management? |
| How can peatland restoration help to reduce wildfire risk and the management of risk on degraded sites? |
| What is the effect of peatland restoration on biodiversity and the development of key indicators to measure peatland biodiversity? |
| What are the social and economic benefits that arise from restored peatlands? |
| What is the effect of restoration in reducing Greenhouse Gas emissions from degraded peatlands and supporting long-term carbon sequestration? |
| **Transforming Agriculture** |
| How do we achieve a common understanding of the distribution and condition of priority habitats managed under agricultural land use, including those that have potential to be restored? |
| How regenerative agricultural principles can be applied within different farming and bio-regional contexts in a Just Transition context? |
| What are the economics of food and drink production in Scotland? |
| What are the climate and nature activities and outcomes achievable by farmers and crofters within predominately rough grazing areas and what constitutes fair reward for the public values these generate? |
| What are regenerative farming principles and how do they contribute to achieving maximum sustainable output of a farming business? |
| **Value Nature: so that the many benefits it provides to society can in turn attract public, private and social enterprise financing for both protection and restoration** |
| **Inspiring people to connect with nature** |
| How do we define and measure greenspace quality and nature richness in urban areas? |
| How do we develop the evidence base on policy, procurement and funding drivers and barriers for implementation of blue and green infrastructure and path networks in practice (SBS urban; right to a healthy environment, recreational management)? |
| How do we collect and use quantitative and qualitative data to track and understand changing public behaviours and attitudes including nature connectedness (includes current surveys)? |
| How do we collect and use data to inform access and recreational management? |
| How do we gain a better understanding of effective community engagement and coproduction in landscape scale working and nature-based solutions? |
| What are the best strategies for increasing nature connection and hence positive action? |
| How do we apply the Just Transition principles in practice to help address the indirect drivers of biodiversity loss? |
| How can we best describe and quantify the contribution of nature to well-being? |
| What are the implications for plans for nature protection and recovery if we want communities to be engaged and co-produce action for nature? |
| How important is nature connection in influencing positive attitudes, behaviours and action for nature? |
| How do we develop and promote understanding of relevant practice in embedding understanding of nature in educational settings to build ecological literacy and connection with nature for young people? |
| **Investing in Nature** |
| How do we develop a coherent spatial plan which targets effort and investment at the right locations? |
| How do we assess ecological potential, benefits (environmental, social and economic) and feasibility at a landscape scale? |
| How do we assess quality/magnitude of opportunity? |
| How do we develop a national spatial overview of restoration activity? |
| How do we develop codes and standards to enable investment in ecosystem services including Natural Flood Management and attenuation of flows to reduce drought risk? |
| How do we develop accepted and robust measures of biodiversity, ecosystem health and provision of ecosystem services that can be used to verify outcomes? |
| How do we set the price of ecosystem services: cost based (avoidance of future costs/damages to businesses/society/communities, pest control) value based (carbon sequestration, biodiversity uplift, community benefits)? |
| How do we measure return-on-investment for particular management/policies related to INNS and pathogens, including better monitoring to demonstrate the benefits of interventions? |
| How do we gather knowledge of international impacts on biodiversity from trade and supply chains to monitor and report on their global impacts? |
| What should a nature positive measure of GDP look like? |
| **Skills for Nature** |
| What are green skills and jobs and what are their value to the Scottish Economy? |