

Science on Natural England's National Nature Reserves (NNRs)

A 5-year strategic plan from 2024 - 2029

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Natural England

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Abbreviations

EDSIP - Evidence Digital Systems Improvement Programme

LTE – Long-Term Experiment

LTMN - Long-Term Monitoring Network

NCEA – Natural Capital Ecosystems Assessment

NNR - National Nature Reserve

PSRE – Public Sector Research Establishment

SEE – Science, Evidence and Evaluation

SSSI – Site of Special Scientific Interest

Black-a-tor Copse National Nature Reserve
Credit: © Natural England/ Paul Glendell

Introduction

Science has always been carried out on Natural England's National Nature Reserves (NNRs). NNRs were first declared in England in 1952 under the National Parks and Access to the Countryside Act of 1949. Their statutory purpose was to serve (1) conservation and enhancement of biodiversity and geodiversity, (2) science, and (3) recreation. Science is therefore well represented on NNRs and has been since the earliest designations. Projects include citizen science, student research (PhD, MSc, undergraduate), Natural England research and statutory monitoring (Site of Special Scientific Interest (SSSI) condition monitoring, habitat/species monitoring, Long Term Monitoring Network (LTMN)) as well as studies by external researchers, including several long-term experiments (LTEs).

At the time of writing, there are 219 NNRs in England. Of these, 134 are managed by Natural England either alone or in conjunction with organisations from 70 other approved bodies. Natural England's NNR estate comprises around 55% of the total area of all of England's NNRs (c60,000 ha). They have been managed for the benefit of people and nature over an extended period, and are geographically spread across the country, containing a range of habitats, species, and geology. More than 90% of the NNR area is designated SSSI (comprising 5.5% of England's total terrestrial SSSI area), but the proportion of non-SSSI land is increasing, exemplified by the recent purchase of two substantial non-SSSI areas. It is also a government target to undertake 25 significant NNR declarations by 2027 ([Defra 2023](#)). These new, extended or amalgamated NNRs, in particular those which include areas without SSSI or Natura 2000 designations, will provide excellent opportunities for scientific experimentation to understand processes and management in the restoration of functioning ecosystems.

Science and monitoring have always been an important part of the function for NNRs. This strategic plan therefore does not start with a blank slate. Instead, it intends to better coordinate the science and monitoring that already happens on reserves to ensure it produces high-quality evidence that addresses priority questions and themes in the environmental sciences. The science and monitoring on our NNRs needs to be used and should have impact. To achieve this, it needs to be accessible in ways that have not been possible to date. This will benefit NNR teams with better communication of management methods that work on the ground, the wider organisation with a broader evidence base to draw from and those outside Natural England that need robust environmental evidence on which to base decisions and implement recovery of our natural ecosystems.

Scope

The strategic plan for science on Natural England's NNRs concerns only those reserves managed and co-managed by Natural England. NNRs managed solely by approved bodies are beyond the scope of this strategic plan. It contributes to the high-level NNR Science Framework and the NNR Strategy that guide the management of all NNRs in England (see Annex 1).

The scientific research within Natural England, including Natural England-managed NNRs, is steered by the Science, Evidence and Evaluation (SEE) Strategy ([Natural England 2020](#)). The SEE Strategy, therefore, feeds into and guides this strategic plan. This strategic plan also contributes to the 3-year Monitoring Strategic Plan ([Natural England 2023a](#)). The science in local and national NNR Strategies will be directed by this strategic plan (see Annex 1).

Purpose

The purpose of this strategic plan is to improve the quality of science and monitoring, its communication and coordination on Natural England's NNRs. It establishes a long-term vision for NNR science, provides goals for the next 5 years and outlines actions needed to achieve them.

This plan contributes to the SEE Strategy goals to ensure Natural England is an evidence-led organisation. Natural England's NNRs are an immense asset. They should be used to generate strong environmental evidence that the organisation can use when delivering advice and making decisions. This evidence should be shared, whenever possible, so external conservation and environmental practitioners can use it to efficiently aid nature recovery, geoconservation practice and improve people's interaction with nature. NNRs are places to test and establish innovative ideas, understand nature recovery in a changing world and gather data on big questions in environmental science. Using and sharing the resulting evidence base will strengthen partnerships and Natural England's reputation as an organisation that produces, manages and uses reliable, high-quality evidence.

The NNR Management Standard ([Natural England 2023b](#)) sets out the key principles and expectations for NNR management. The Standard includes expectations for research on reserves, sharing of evidence and data and working with partners to achieve shared outcomes. This strategic plan will enable these expectations to be more effectively met through provision of support and guidance to NNR teams from within Natural England's Chief Scientist Directorate.

Vision for NNR science

Natural England's NNRs will excel as 'outdoor laboratories'. They will provide facilities for high quality research and monitoring outputs and significantly contribute to land-based environmental science (biological, geological and social). They will provide a time series of data to monitor and track environmental change and people engagement with nature within our protected sites. They will be venues for scientific innovation, best practice, and learning.

NNRs will be places to show science leadership by undertaking innovation, providing and sharing the best available evidence, ensuring collaboration with partners and capability building across the organisation.

Natural England's NNRs will be:

- The first sites considered for Natural England research and monitoring.
- Visible and valued as assets for environmental and social science by conservation bodies, land managers, government, academia and research institutes, other organisations, and local people.
- Able to provide significant contributions to Natural England's evidence-base which will improve outcomes for people and nature (biological, geological and social).
- A recognised and visible part of the research landscape, with evidence and data produced on them catalogued, shared and published.
- An integral part of Natural England's transformation into an evidence-led organisation (SEE Strategy).

Goals and actions

To achieve the vision for NNRs, this strategic plan has defined three goals that will be addressed over the 5-year period.

Actioning goals will be prioritised by phase, however there will be flexibility in delivery to benefit from any emerging opportunities for collaboration that would support any of the objectives within the plan. Prioritisation is necessary due to available resource, but as science and data collection on NNRs will continue over the next 5 years, focussing on one phase will not prevent scientific and monitoring outcomes from being realised in other areas. Phases and prioritisation have been designed to ensure progress made towards reaching initial goals will make subsequent ones easier to achieve.

The goals and actions/projects are explained in the following section.

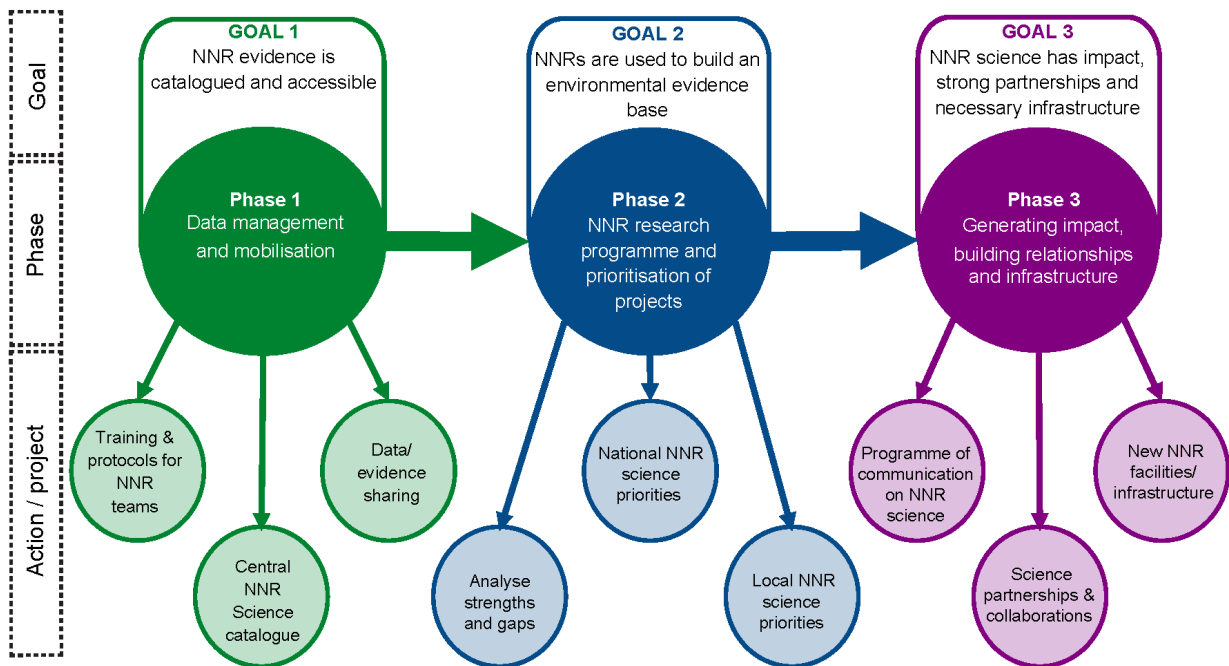


Figure 1. Goals are prioritised in delivery by phase. Each goal and phase has its own associated actions or projects that will achieve the outcomes in the 5-year Strategic plan

Goal 1 – NNR evidence is catalogued and accessible

To achieve the aims of the SEE Strategy and be an evidence-led organisation Natural England needs continued access to robust data on which to base decisions. Considerable scientific activity has taken place on Natural England's NNRs since they were first established in 1952. As a result, they hold an archive of data and research outputs that continues to grow. However, these mostly remain local to NNR bases so the value to the wider organisation and partners is restricted. There are exceptions. Notably, the Long Term Monitoring Network (LTMN) has many high value datasets available online for anybody to access under open license terms.

The first goal of this strategic plan is to centralise the NNR archive and share as much as possible, to comply with the organisation's Open Data position.

This will enable the wider organisation, other government departments, NGOs, academics, citizen scientists and the interested public access to the evidence it holds. Making evidence from our NNRs openly accessible will enable learning and more effective land management for nature and people.

As part of the SEE Strategy and Evidence Digital Systems Improvement Programme (EDSIP) Natural England is working towards ensuring data and evidence is managed and mobilised in accordance with organisational policy. Centralising and sharing the NNR archive will contribute to this. It has its own challenges as much of the data gathered on reserves comes from third parties (academics, volunteers, citizen scientists and lay societies). We will learn from data mobilisation work in Natural Capital Ecosystem Assessment (NCEA) to develop or adapt protocols that ensure NNR data can be ethically and legally shared and managed throughout their lifecycles.

Centralising and sharing NNR science and data will contribute to the identification of gaps and strengths in evidence. It moves NNR science into compliance the organisation's strategic aims. It will also enable quick use of data by researchers, policy and decision makers, and others interested in the natural environment for an evidence-based nature recovery.

Key outputs of goal 1:

- **Protocols and training for NNR teams to simplify compliance with data management and mobilisation**
- **A user-friendly, maintained and managed up-to-date central catalogue of NNR data and research**
- **Publication of NNR priority areas of the science archive, where possible**

1) Centralised cataloguing

The first step in centralising and sharing the NNR archive is to audit the research records held on Natural England's NNRs. An audit is already underway (commenced Feb. 2023 to update an audit in 2013) and will enable an overview of NNR research and analysis of its strengths and gaps.

A central catalogue needs to include the records from the audit as well as function as the single place new NNR science and monitoring projects are documented. It should be possible to access the catalogue from across the organisation. Consideration should be given to catalogue design for the benefit of users, including the needs of NNR managers that will input information. End products need to be user-friendly and consider the use automated systems in processing, where possible. The catalogue must also be actively managed and maintained by appropriate asset owners.

2) Protocols and training for NNR teams

Protocols and training for NNR teams need to be provided to ensure they know how and where to store evidence as new projects arise. They will also be provided with links to central data management teams so that any challenges or arising issues can swiftly be resolved. Cataloguing systems and protocols should be designed with NNR managers in mind, to allow ease of use in busy schedules. They should also consider that NNR managers may be key users of the catalogue and consider visual representations, for example, using dashboards and visualisations to enable quick access to an overview of the work carried out on NNRs, providing incentive for continued use.

3) Sharing NNR data and research

Working in line with legal and policy requirements on data retention, sharing and data protection and where ethical reasons allow, NNR data and research outputs in the central catalogue will be shared and open access by default. Where possible the goal is to share publicly to comply with Defra's QFAIR data principles and data sharing policy to ensure that information is Quality, Findable, Accessible, Interoperable and Reusable. This will use existing repositories (e.g., MAGIC Maps, Access to Evidence, Natural England Open Data Geoportal, NBN Atlas). Evidence from NNR interventions showing what works and doesn't work on the ground will be published so that they can be used by conservation practitioners. Where data legal or ethical reasons restrict publication, they will be published in appropriate repositories for internal use (e.g., Natural England Maps, Evidence Projects Database). Records in the NNR archive will be examined to identify priority areas and criteria for publication to guide the mobilisation process.

Goal 2 – NNRs are used to build an environmental evidence base

Natural England's NNRs have hosted considerable research and data collection throughout their existence, but much of this is *ad hoc* in approach. Usually, researchers contact individual reserves deemed suitable sites for their own projects. While this has yielded many valued outputs, the science that happens on reserves does not necessarily address priority areas where evidence is needed.

Goal 2 is to ensure that research on NNRs is targeted at building a robust environmental evidence base to inform decision making.

Natural England's NNRs are 'our' assets that should be used to provide key national capabilities for environmental research and monitoring. They have facilities that can support data collection (staff, equipment, buildings) and any hazards are known so effective health and safety controls can be put in place. They sit at the heart of England's protected sites network and are managed for nature conservation. Learning from well-designed experiments, observational studies and monitoring on NNRs supports nature recovery, both within site boundaries and elsewhere.

Questions and themes of priority interest will be those that support national nature recovery objectives as identified by government policy, recognised in Natural England's objectives and vision, with direction provided by the SEE strategy. We will encourage experimental and standardised approaches to ensure the science on NNRs is robust and of high-quality. At a reserve level these will need to meet local management requirements and enable evidence-based responses to changing conditions on the ground. For example, climate change poses challenges for NNR management, and it is important to ensure our practices are as effective as they can be. We will also continue to facilitate external research projects and programmes on NNRs, which can be incentivised to cover priority areas.

Coordination of scientific activity on NNRs by those with scientific expertise will enable their better use as a series of sites rather than disconnected, individual reserves. Projects will be commissioned to address evidence needs and enable swift responses to funding opportunities arising within priority areas.

Key outputs of goal 2:

- **An NNR research programme with a list of priority projects/questions**
- **Increase in commissioned projects using Natural England's NNRs in research and monitoring**
- **More external research on NNRs incentivised to address priority questions**

1) Analysis of NNR evidence strengths and gaps

The audit and cataloguing of the NNR records archive in [Goal 1](#) (including LTMN data, LTE data, other archived data) will provide an overview of the research and monitoring that has taken place on NNRs. Monitoring on NNRs is important to gauge environmental change over time and to report on the condition of features for all protected sites. Along with formal research, systematic and *ad hoc* data records, there is a large archive of monitoring data from NNRs. Once a full catalogue is compiled, records and data can be analysed to identify areas where there is a wealth of knowledge; the strengths in NNR evidence. Analysis of NNR research records will also highlight evidence gaps where future work should be focused.

2) National evidence needs

Evidence needs nationally can be divided into:

- (a) Efficacy of the NNR designation and how well they serve their purposes
- (b) Evidence priorities where NNRs are suitable as sites for data collection

The Priority Themes outlined in the NNR Science Framework (draft, as of Nov 2023) will be a starting point to refining specific questions of key relevance to reserves. NNRs should be used to pilot new technologies and methodologies and to expand monitoring schemes (e.g., BioScan), providing valuable information about NNR ecosystems and helping to build reference databases. NNRs will not be suited to address all questions (e.g., on agricultural methods etc.), but they should be considered first for suitability as research sites.

NNR priority research and questions will need to be coordinated and maintained as current to ensure Natural England can swiftly commission work, take advantage of funding opportunities as they arise and efficiently use NNRs as a series. This will be carried out by individuals with scientific expertise within Natural England, which will also allow better use of NNRs in funding applications using the Public Sector Research Establishment (PSRE) status. Consideration of suitable incentives (e.g., small pots of funding) is also needed to encourage uptake of external research and monitoring on priority questions.

3) Local evidence needs

Reserves will have their own needs for evidence to deliver effective management on the ground. Each year NNRs draw up management plans that can detail the research and evidence needs for their reserves. These will be specific to the habitats, species, geology and broader landscape of the site. Changing pressures will influence research and evidence needs and there should be flexibility allowing priorities to adapt if new needs arise.

Goal 3 – NNR science has impact, strong partnerships and necessary infrastructure

NNR science needs to be communicated widely to ensure evidence is used and impact is generated. There is a lack of readily accessible information about what NNRs offer to researchers as a series of sites (e.g., habitats, species, geodiversity, infrastructure, and other resources). This hinders large projects and collaborations that would produce robust scientific outputs with high impact from getting started.

Goal 3 is to generate impact from the science on NE NNRS, through building partnerships, infrastructure and communicating high-quality research.

The shared research and monitoring archive from [Goal 1](#), along with the priorities for NNR science defined in [Goal 2](#) will be widely communicated to ensure usage of and impact from NNR science. This will be part of a proactive communication programme across varied platforms to showcase NNR science and bring together information necessary for those considering scientific projects on reserves. This will raise the profile of Natural England as an organisation that produces and uses robust scientific evidence.

Building collaborations and partnerships with academics and researchers with expertise in NNR priority areas will be important in driving forward projects that address big science questions. To achieve this, NNRs will be used as assets to secure funding through Natural England's Public Sector Research Establishment (PSRE) status. New and strengthened partnerships will also allow development of citizen science projects and promote NNRs as a resource for citizen science activity.

NNR scientific priorities, and the Monitoring Strategy ([Natural England 2023a](#)), will define whether reserves need additional infrastructure to carry out experiments, studies or monitoring. This may be permanent instruments/resources, or mobile equipment. The current Big Build Programme contributes to this through the provision of laboratory spaces.

Key outputs of goal 3:

- **New and strengthened science partnerships**
- **Impact through proactive communication of NNR science, use of NNRs as a series of sites and collaboration**
- **Infrastructure to enable high quality, robust research and monitoring**

1) NNR science communications programme

Our NNRs are an asset that the public can interact with. Part of the NNR function is to provide connection between people and nature. As such, NNRs could be a flagship for Natural England science, as they are in public view. Communicating NNR science will be carried out through a proactive, multi-channel programme of communications. This will lay out information on NNR resources (e.g., lab/office space, scientific equipment, existing datasets/records from [Goal 1](#), habitats etc), priority research areas from [Goal 2](#) and ways to approach collaborating with Natural England on projects. We will work with programmes and digital strategies in Natural England to complete this.

2) Building science partnerships & collaborations

Nurturing relationships with partners will enable Natural England to stay involved at the forefront of new environmental science and strengthen its reputation as an organisation that produces and uses robust evidence. Existing links with external researchers will be built on, and new links will be sought to ensure Natural England can target priority scientific themes, test new methods to monitor the natural environment and pilot new technologies.

Along with Natural England's impact through real-world application of nature recovery and conservation and policy influence, NNRs are an immense asset when applying for external funds through the PSRE status. We will use this to address the larger scientific questions on NNRs and further develop science partnerships with collaborators. Natural England's NNRs are also an ideal place to train the next generation of ecologists and conservationists. Working with universities will enable better uptake of these opportunities by students so they are well equipped in field skills and high-quality data collection methods.

2) Infrastructure and equipment for research and monitoring

To be valued as a resource for science, NNRs need to house the necessary infrastructure and equipment. Both in terms of buildings to support staff and visitors and scientific instruments that will support specific monitoring and experimental approaches. The NNR Big Build Programme that is refurbishing and constructing infrastructure and due to complete in 2025 on many Natural England NNRs will contribute to this. In the past there have been funding opportunities for research equipment that NNRs have not been responded to due to a lack of information on what is needed for upcoming projects. We will address this to ensure quick responses and build the necessary tools to carry out priority scientific work.

Delivering the NNR science strategic plan

An implementation plan is being developed to deliver the goals in this strategic plan. Evaluation will be embedded into delivery to ensure that, as an organisation, we learn and improve as a result of the changes we make. Projects and programmes of activity will be developed as part of the implementation plan to ensure that the outcomes of this strategic plan are met.

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Annex 1

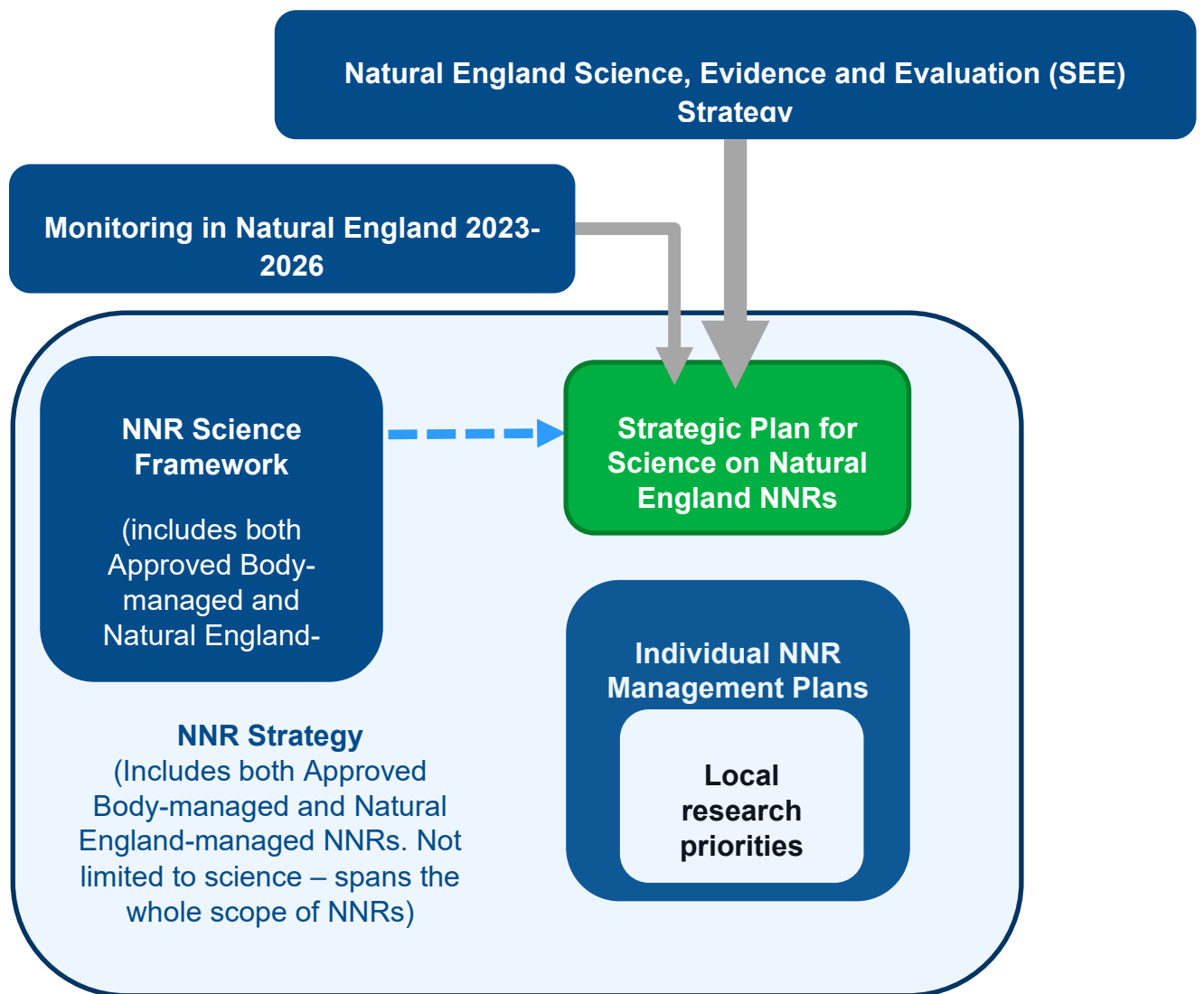


Figure 2. Where the Strategic Plan for Science on Natural England NNRs sits with other relevant Natural England strategies, plans and frameworks



Moor House - Upper Teesdale National Nature Reserve
Credit: © Natural England/Allan Drewitt

About Natural England

Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

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