Natural England Research Report NERR082

# Nature Networks: A Summary for Practitioners

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**Humphrey Crick, Ian Crosher, Chris Mainstone, Sarah Taylor, Andy Wharton, Pippa Langford, Jonathan Larwood, Jane Lusardi, David Appleton, Peter Brotherton, Simon Duffield & Nicholas Macgregor**


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# Executive Summary


1. This summary for practitioners aims to provide a quick reference guide to support the development of Nature Networks. It is based on the extensive review of evidence presented in the *Nature Networks Evidence Handbook* by Natural England (NERR081; Crick *et al.* 2020). The guide's focus is on the creation of Nature Networks on land rather than at sea, though there are aspects of the approach that will be relevant to the marine environment.

2. We outline 10 principles of nature network design, derived from the review of evidence. These explain how the planning of resilient nature networks should aim to reflect how habitats and associated species are naturally provided for by the geography and geology of the landscape, and consider how this can benefit local communities and the wider public. In particular, there are benefits to be derived from developing a 'network way of thinking' rather than concentrating on sites in isolation.

3. A detailed review of ecological evidence allows us to provide a suite of 'rules of thumb' that provide detail about how to make a network of sites for nature 'better, bigger, more and joined' (as outlined originally by Lawton *et al.* (2010) in their *Making Space for Nature* report to the UK Government).

4. In general, the direction of travel for nature conservation, when designing nature networks, is from a highly managed countryside to one in which conservationists restore and work with natural processes and embrace dynamisim.

5. As a part of working with natural processes at a landscape scale, it is important to understand how the geology and soils contribute to an area's ecological functioning and provide valuable ecosystem services. Their active inclusion in nature network planning can help improve a nature network's contribution to nature-based solutions, particularly to build resilience to future climate change.

6. Implementation of a nature network can be enhanced by working effectively with the planning system, and with land-owners through encouraging the use of agri-environment schemes (particularly for wider-countryside species) and green infrastructure development (particularly within urban areas).

7. Finally, we provide a brief synopsis of a range of map-based models and tools that can provide useful support for decision-making during the planning and implementation of nature networks.

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# 1 Designing Nature Networks: creating resilient landscapes for people and wildlife

This summary aims to provide a quick reference guide to support the development of Nature Networks. It is based on the extensive review of evidence presented in the *Nature Networks Evidence Handbook* (NERR081) by Natural England. The guide's focus is on the creation of Nature Networks on land rather than at sea, though there are aspects of the approach that will be relevant to the marine environment.

The overarching ambition of the Defra 25 year environment plan is 'Over the next 25 years we must safeguard the environment for this generation and many more to come' (Defra 2018). The plan highlights six key objectives, one being that 'we will achieve a growing and resilient network of land, water and sea that is richer in plants and wildlife'. The Nature Recovery Network envisaged by the plan will build on the *Making Space for Nature* report (Lawton *et al.* 2010) which recommended the development of a 'resilient and coherent ecological network' in England to help counter habitat loss, habitat fragmentation and loss of habitat quality due to a range of pressures including land use change, the intensification of agricultural management, disturbance, pollution, nutrient enrichment and climate change.

An **ecological network** can be understood as a number of core, well connected, high quality areas of well-functioning ecosystems, together with those parts of the intervening landscape that are 'wildlife-friendly' and which, collectively, allow wildlife to thrive. As well as having a primary role of supporting abundant wildlife, a **nature network** should also enhance natural beauty and conserve geodiversity and opportunities should be taken to deliver benefits for people, such as flood alleviation, recreational opportunities and climate change adaptation and mitigation. These joint aims, for nature and people, are at the heart of Nature Networks and they are inter-dependent: networks for wildlife that also deliver benefits to people also tend to be more valued by people. Thus they are likely to receive greater investment and protection by society and consequently provide more for nature and be more sustainable in the long term.

In this *Summary for Practitioners*, we outline a set of ten principles that can help guide the design of a nature network. After considering the key attributes of the place where the network will be located (landscape, geology, soils, hydrology, biodiversity and the ecosystem services it can support), we then provide some straightforward ecologically-based rules of thumb to help practitioners when thinking about the core sites within a network, the surrounding landscape and how to help improve connectivity. Finally, we provide a brief summary of the available decision-support tools that can be helpful in the planning and delivery process.

# 2 The principles of nature network design

The following ten principles provide a summary of how to design nature networks in an integrated way, to benefit biodiversity and people. To be successful, the planning of nature networks should aim to reflect how habitats and associated species are naturally provided for by the geography of the landscape, and consider how this can benefit local communities and the wider public. This will be essential not only for providing resilient habitat networks for species, but also more robust and valued landscapes for people, where natural capital[1] and the benefits of ecosystem services are recognised, valued and invested in, over the long term.

1. **Understand the place: Recognise where the nature network will sit,** in terms of how the natural characteristics of the area generate conditions for different habitats and how the cultural landscape character has evolved and is valued. Identify what the area is special for, from a national and local perspective, how nature has changed and the potential for its restoration. This assessment should include biodiversity and ecosystem function, geodiversity, landscape and the historical environment. Understand where people live and work and how ecosystems provide benefits to them. This enables us to identify priorities and opportunities, and to be sympathetic to the current character of the landscape, while not being constrained from accommodating what the future might hold.

2. **Create a vision: for your nature network and be clear about your objectives**: specify what the ultimate goals are for the network, identify the spatial scale, and the environmental and societal aspects that are important.

3. **Involve people: People both benefit from and create nature networks:** plans should engage and be created with the community; recognising that landscape and the ecosystems that support habitats and species, also provide **multiple benefits** to people.

4. **Create core sites:** Core sites are the heart of nature networks; these are places that sustain thriving wildlife populations that may expand across the network. It will often be best to **build core areas of nature networks by enlarging, connecting and improving existing high quality wildlife sites,** to make well-functioning ecosystems. However, on occasion, it will be appropriate to fill gaps in a network by creating core sites where little wildlife currently remains. Within landscapes, working with **functional ecological units** will provide the building blocks to support abundant and diverse wildlife and ecosystem services.

5. **Build resilience: Enhance the resilience** of landscapes, ecosystems and their ecosystem services through **restoration that reinstates natural processes,** accommodates desirable change, improves low quality habitat and includes areas that provide buffering from the causes of current and potential future environmental degradation**.** Take opportunities to deliver nature-based solutions to climate change and reduce external pressures (such as diffuse pollution).

[1] Natural capital is defined as the elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions (Natural Capital Committee 2017)

6. **Embrace dynamism:** Remember that in a natural state, **ecosystems and landscapes change and are inherently dynamic;** allow natural processes to operate whenever possible, as they will aid restoration of ecosystem function and enhance the sustainability of conservation efforts.
7. **Encourage diversity:** Nature networks need to include **a diverse physical structure**, influenced by the underlying geodiversity, to accommodate the widest variety of opportunities (niches) for species**. Biological complexity and landscape diversity** are important to facilitate resilience. Such diversity is best founded on the restoration of natural environmental processes where this is possible, overlain by vegetation management regimes that encourage further diversity.
8. **Think 'networks':** rather than individual sites. Networks need to be **planned at multiple spatial scales and address multiple issues**. Joined-up actions across adjacent landscapes help to deliver integrated outcomes, and ensure that the network acts as a coherent whole for all species (especially for those that live in the wider countryside), ecosystems and people within the area.
9. **Start now but plan long-term:** Identify the locations that can deliver a coherent nature network, but prioritise those locations that provide the best opportunities **for action now**, while developing longer term solutions.
10. **Monitor progress: evaluate actions** and **adapt management** in the light of results to achieve long-term aims at local and national scales.

More detail about the key features of each of these principles can be found in Appendix 1.1 of the full handbook.

# 3 The ecology of nature networks

The *Making Space for Nature* report provided a simple mantra summarising the main actions needed to develop a resilient, coherent ecological network: we need 'more, bigger, better and joined' wildlife sites. That is, we need to improve the condition of our existing sites; we need larger sites that are more resilient to environmental shocks and which should be buffered from external pressures; we need to fill the gaps in our existing network by establishing more sites; and these sites should be better connected, to allow interchange between sites and to allow species to redistribute themselves in response to a changing climate. Here, we build upon these principles to provide further 'how to' advice. Integral to these principles is the notion that building networks through the restoration of natural ecosystem function provides the most comprehensive and resilient outcomes for biodiversity whilst generating the greatest natural capital benefits.

We have reviewed the scientific literature to identify a number of **rules of thumb** to help practitioners design their nature networks. The aim is to help prioritise the aspects identified by Lawton *et al*. (2010) and to provide some definition to the questions of how to make sites better, how big should they be, how and where more sites should be placed, and the best ways to improve connectivity. We found that both evidence and theory suggests that the hierarchy of importance is as is shown at the top of Table 1 (which is in accord with the hierarchy set out by Lawton *et al.,* 2010). However, we have split 'joined' into two, because evidence suggests that providing 'stepping stones' and improving the 'permeability' of the matrix are usually more important than providing physical corridors through which nature can disperse.

**Table 1** Rules of thumb for the design of nature networks, building on the principles in Lawton *et al.* (2010)[2]

| **Better site quality** > | **Bigger sites** > | **More sites** > | **Stepping stones & permeable matrix** > | **Corridors** |
|---|---|---|---|---|
| • Encourage natural processes<br>• Encourage habitat mosaics<br>• Create more niches for more species – use 'ecosystem engineers' and welcome ecological disturbance.<br>• Increase messiness (variation of physical structure within sites).<br>• Restore missing biodiversity by increasing niches or by reintroduction<br>• Maintain rare species<br>• Encourage climate colonists<br>• Reduce edge effects by buffering sites and encouraging graded ecotones to 'soften the edge'<br>• Buffer sites with at least a 50-100 m buffer strip, possibly up to 500 m wide<br>• Maintain ecological continuity of management to protect soils | • Big enough to encourage natural processes – include sufficient area to ensure functioning ecosystems<br>• Provide space for ecosystem dynamism, supporting mosaics and to encourage succession<br>• Reduce edge effects by decreasing the edge:area ratio<br>• Join habitat fragments; choose the ones that will create the biggest site<br>• Restore degraded habitat surrounding the site.<br>• Enlarge sites to >40 ha (or >100 ha for wide-ranging species) | • Add larger sites in preference to many smaller sites<br>• Target areas of unprotected irreplaceable habitat or with a long ecological continuity of un-intensive land management<br>• Target areas with complex or additional topography & geomorphology and with a potential to be climate change refugia<br>• Target areas of important habitat potential in the surrounding area.<br>• Target degraded areas with potential for high ecosystem service delivery.<br>• Ensure connectivity is good for new sites. | • For poorly dispersing species, sites should be < 1 km from each other and < 200 m apart for highly specialised species within a habitat<br>• Expand sites towards existing habitat to reduce space between patches.<br>• Increase the cover of semi-natural habitat in landscape to at least 20%<br>• Reduce the intensity and increase the diversity of landuse in the surrounding countryside<br>• Stepping stones should provide appropriate resources to avoid becoming ecological traps | • Natural corridors are better than human designed corridors<br>• Use linear landscape features<br>• Ensure corridor habitat matches that in core sites<br>• Minimum width of corridors = 100 m, preferably wider |

[2] Please note that the figures quoted are guidelines only, based on currently available evidence and should be used with due regard to local circumstances. In this table, 'Site' does not necessarily mean a designated site, but an area of contiguous wildlife habitat.

When applying these rules of thumb to the design of nature networks, it is also important to take account of the following:

- Central to the development of a sustainable nature network is the inclusion of **Large Nature Areas** where priority is given to the conservation of biodiversity. These are areas that will provide the sources of biodiversity that brim over into the rest of the nature network, and will provide important areas for ecosystem service provision. In general, the bigger and the more naturally functioning, the better. They should aim to cover at least 5,000 to 12,000 ha.

- The **intervening 'matrix' of habitats between core sites is also important**, both for the species that use it as their primary habitat, but also to facilitate dispersal between core sites.

- The many individual species that make up ecosystems have different requirements and are influenced differently by external factors and pressures. It is therefore necessary **to have clarity about the species the nature network is intended to support** so that their complete life-cycles and inter-generational needs can be taken into account when designing the network.

- To make core wildlife sites 'Better' is to make them '**Big Enough, Messy, Complex and Dynamic'**. Restoring natural ecosystem function is the best means of achieving this.

    - 'Big enough': Core sites need to be big enough to be able to function well ecologically, with natural hydrological processes and rich food webs, so that they are more resilient.

    - 'Messy': sites that are physically messy, with mosaics of habitat, and a diverse structure that provides more niches for species and refuges in times of environmental stress (e.g. drought).

    - 'Complex': sites with a complex and rich biodiversity and full food webs, as these will be more resilient to external shocks and environmental stresses.

    - 'Dynamic': well-functioning ecological networks are dynamic and may involve shifting mosaics of habitat types at a range of spatial scales.

- **Climate change refugia** should form key parts of ecological networks as they are likely to improve resilience for species within landscapes.

- **Rare, long-distance dispersal events** are likely to be important for many species, so receptor site quality and quantity is therefore very important.

**Whenever possible, work with natural processes and give them enough space to operate**. This requires consideration of hydrology, nutrients, soil and sediment processes, factors that control vegetation growth and species composition (Mainstone *et al.* 2018).

Taking all of these together, the general directions of travel for nature network establishment are summarised in Fig 1, below.

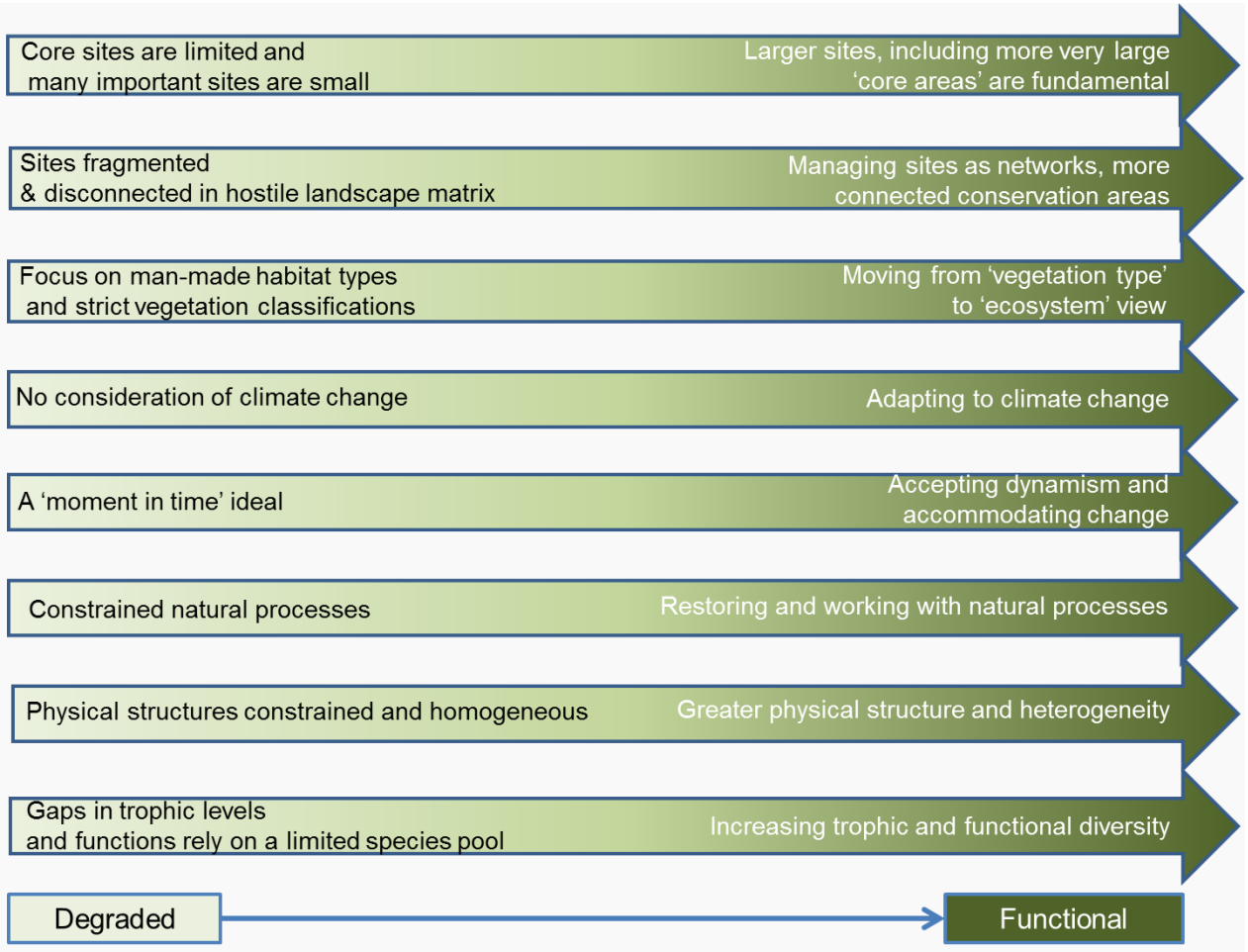



**Figure 1** The direction of travel for ecological components of a nature network

# 4 Understanding the place

When developing a plan to implement a nature network, it is important to consider the constraints and opportunities provided by the landscape, geology, soils and the socio-cultural context of the area. Taking account of these up-front helps to secure the longer-term sustainability of the network by making it more likely to be valued by people, while also ensuring that opportunities for the network to conserve aspects of nature beyond biodiversity (such as geology) are not missed. Often win-wins for the conservation of these different components are possible, but if trade-offs need to be made it is better to understand these and make them explicit from the start.

Landscapes are a result of the way that different components of our environment – both natural and cultural – interact and are perceived by us. As such, they encapsulate the natural beauty that people treasure and that nature networks should seek to enhance (Fig 2). This is not about preserving landscapes in aspic, but rather to understand how people perceive the landscape and to facilitate local support for the changes that establishing a nature network may involve.

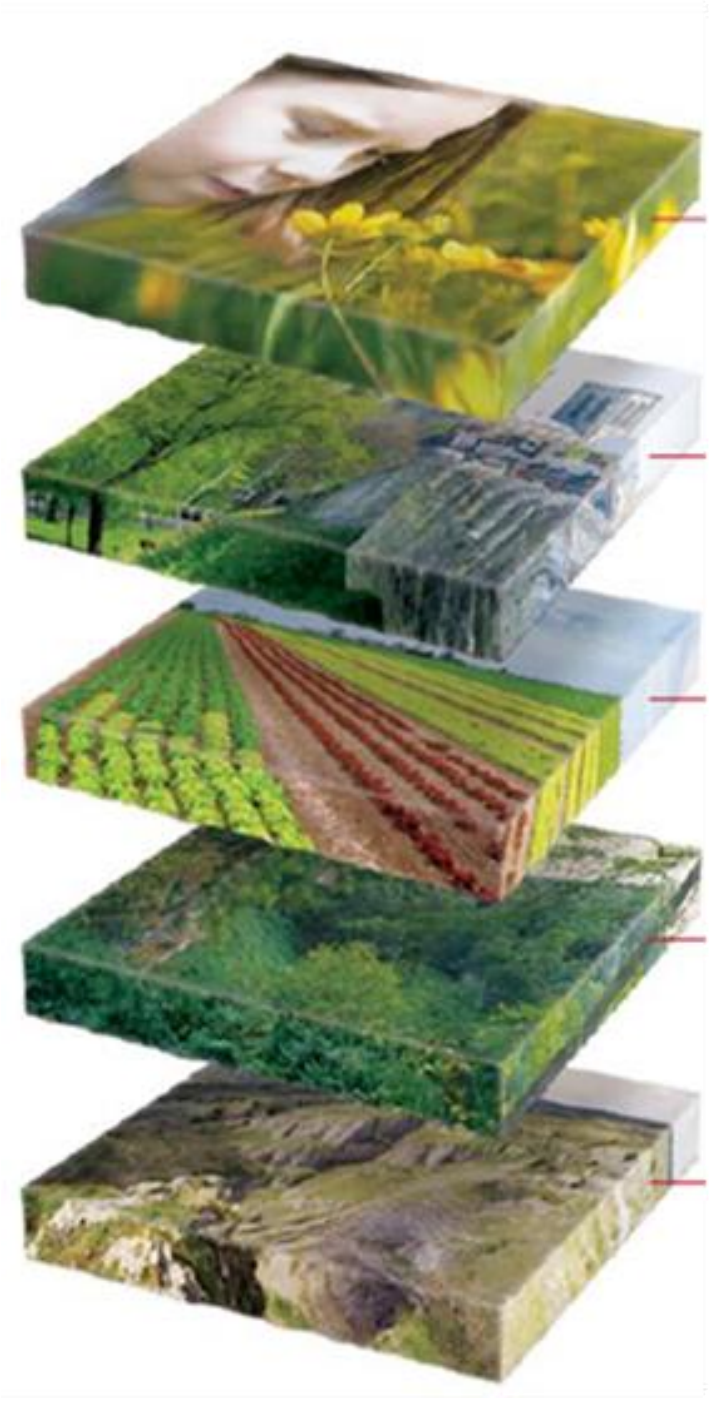
Conserving landscapes also involves conserving our precious historical environment assets. These include archaeological sites, historic landscapes such as battlefields, designed landscapes, historically important farmsteads, green lanes and footpaths. It is often the historical aspects of our landscape that give it its meaning and provide its narrative, but can also provide benefits for wildlife, for example the veteran trees in parkland. They give us a feel for how people used and travelled across the land, and they often give a strong traditional and locally distinctive character to the landscape - a sense of place.

**To safeguard and enhance the beauty of our natural scenery** and improve its environmental value, we need to be able to identify the key features of landscape that contribute to its beauty. Key tools that are available to help with this are outlined in Natural England's *Summary of Evidence: Landscape* (Natural England 2015) and include:

- **National Character Area profiles**[3] which provide descriptions for 159 areas of different landscape characteristics (which follow natural lines in the landscape rather than administrative boundaries). These cover the whole of England and each profile includes a description of the natural and anthropogenic drivers for ongoing change, a broad analysis of each area's characteristics and ecosystem services, and an integrated Statement of Environmental Opportunity that informs where environmental gains may be delivered.

- **Landscape character assessment** (LCA) is the process of identifying and describing variation in character of a landscape. It explains the unique combination of elements and features that make a landscape distinctive, by mapping and describing character types and areas. It also shows how the landscape is perceived, experienced and valued by people (Tudor 2014).

[3] https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles (Accessed 14/5/2019)



**Experience**: landscape is more than the sum of physical features that make up our environment. How we perceive the landscape can have an important influence on how we use or value its character and resources.

**History**: all landscapes in England have been shaped by human activity throughout history. It is therefore important to understand past land use patterns, the extent to which they have survived and how different stages have contributed to the character of today's landscape.

**Land use**: includes all the various uses that people make of the landscape such as settlement, farming and field enclosure, energy production and forestry. The character of the landscape is particularly influenced by the present day pattern of these features as well as their historical legacy.

**Biodiversity**: the variety of plants and animals in the English landscape has been influenced by us over thousands of years. The types and abundance of wildlife can play a significant role in shaping the character - and in some cases the function - of each particular landscape.

**Geodiversity**: includes the diversity of rocks, minerals, fossils, landforms, processes and soils. Underlying geodiversity and natural processes such as weathering, erosion and deposition define and shape the character and functioning of our surrounding natural environment and landscapes. Geodiversity directly influences the distribution of habitats, land use and settlement patterns, and our wider experience of the natural world.

**Figure 2 The different components that make up a landscape**

**Geodiversity** is a defining part of the natural world. It represents the diversity of rocks, minerals, fossils, landforms, geomorphological processes and soils which collectively underpin the way our landscapes look, and defines how the natural environment functions (Gray *et al.* 2013). Geodiversity is an important part of a nature network as it has a direct influence on the diversity of habitats and species, is a natural capital asset and provides a range of natural processes essential to functioning ecosystems, and wider ecosystem services that include carbon capture and natural flood regulation.

To better understand geodiversity, and the opportunities that it presents for a nature network, geological and soil maps (available from the British Geological Survey) provide a detailed illustration

of the underlying geology and soil type. Designated sites, including geological SSSIs, National Nature Reserves and Local Geological Sites, are a key resource that should be incorporated into the nature network, and there is a significant geological knowledge (across the geological community, geological groups and societies) that is available to help the successful delivery of a nature network.

**Soils** form as a result of the interaction between the underlying geology, and the vegetation and its decomposing organic matter. They are good markers of previous habitats and land use, and help to define what ecosystems can be restored. As soils develop structure, they carry out complex interactive processes, mediated by soil organisms, including cycling of carbon, fixation of nitrogen, and mediating the flow and quality of water. These processes are fundamental to many ecosystems, their services and most land use activities. Soils are diverse in their structure and function and have been categorized by the properties of soil layers (known as horizons) and by the nature of the parent material from which they are derived. This diversity reflects differences in soil-forming conditions, but also reflects more recent vegetation and land management that influence both structure and ecosystem functions. A total of 698 soil types (series) have been described for England and Wales (Avery 1980; Clayden & Hollis 1984).

Soils are habitats for many thousands of species, ranging from bacteria, fungi, protozoa, and microscopic invertebrates to mites, springtails, ants, worms and plants. It is estimated that more than 1 in 4 of all living species on earth is a strictly soil-dwelling organism (Decaens *et al.* 2006). Soils are thus an important component of any nature network, in their own rights. However, they can also provide added value to nature networks through their ecosystem services, including water purification, water storage, flood alleviation, carbon storage and growing crops, biofuels and timber.

Finally, consider the suite of **ecosystem services that nature provides to society** within the landscape. A place-based assessment of ecosystem services provides understanding of the current and potential benefits provided by the natural capital in an area and how they relate to people at different spatial scales (see Sunderland *et al.* 2020). The data sets provided by the Monitor of Engagement with the Natural Environment (MENE) survey[4] are a particularly useful source of information about how people experience the natural environment in England. They provide data that shows how use of the natural environment has changed since 2009, at a range of different spatial scales and for key groups within the population (Natural England 2019).

When considering ecosystem services, it is also important to identify opportunities for delivering nature-based solutions to future climate change (taking account of both adaptation and mitigation action – see Natural England & RSPB's (2014, 2020) *Climate Change Adaptation Manual*). The *Ecosystem Approach Handbook* (Porter *et al*. 2014), provides a useful step by step guide to planning for the provision of multiple ecosystem services by landscape scale partnerships.

[4] https://www.gov.uk/government/collections/monitor-of-engagement-with-the-natural-environment-survey-purpose-and-results (accessed 5/12/19)

# 5 Developing and implementing the nature network

Having reviewed the place and considered the ecological aspects of nature network development, a holistic plan that integrates the needs of nature, natural processes, geodiversity, people and landscape needs to be developed. This should be **underpinned by a vision** that outlines overall direction for a landscape, created **through participatory engagement** and discussion with key stakeholders (see section 1.3 of the Nature Networks Evidence Handbook). Biodiversity targets should be considered within the framework provided by the concept of **Favourable Conservation Status**, which aims to ensure thriving populations and their habitats sustainably into the future (see section 3.5.1 of the NNEH).

Implementation of the network will often require the development of a partnership of local interests which will take on the different aspects of the project. It will be important to make sure that the partnership uses the local planning system to its fullest extent, as it can provide helpful levers to facilitate the development of the network. The National Planning Policy Framework provides numerous requirements on local authorities that support nature network development, including the use of **green infrastructure**; the concept of **Net Gain** is also a potentially powerful tool (see section 3.2 of the NNEH). Also important are **Agri-environment schemes,** which provide opportunities to work with farmers and landowners to support nature network development. '**Farm clusters**' are a particularly useful mechanism to improve landscape-scale collaboration (section 3.3. of the NNEH).

Finally, it is important to put in place a system of monitoring and evaluation to measure the progress and success of the development of a nature network, and sufficient resources in the long-term to undertake this (see Appendix 1 of the NNEH for more information). It is essential that this is planned up-front, not bolted on at a later stage. The monitoring and evaluation framework developed to review the progress of the Government's Nature Improvement Areas provides a good model for how this might be implemented to assess nature network development (Collingwood Environmental Planning 2015). This is based on guidance provided in the Magenta Book (HM Treasury 2011), and distinguishes:

- Inputs – such as the resources being invested, such as finance, time, people;
- processes & activities – such as area of habitat created, length of footpaths prepared;
- outputs – the immediate results achieved;
- outcomes – the short-medium term results (1-3 years); and
- impacts – longer-term results achieved after 3+ years.

A number of evaluation tools are also available and one such is PRISM, specifically designed to help conservation practitioners with the practical approaches and methods that can be used to evaluate the outcomes and impacts of small/medium-sized conservation projects (Dickson *et al.* 2017). Overall, PRISM is useful because it aims to help practitioners go beyond just measuring actions & outputs, but to begin to evaluate outcomes and impacts.

# 6 Map-based models and tools for planning nature networks

In the Nature Networks Evidence Handbook we have provided a review of some of the most useful tools that are available to help conservationists to plan and design nature networks. These tools are mainly those to do with the ecological aspects of nature network development, covering aspects such as climate change adaptation, connectivity and fragmentation, ecosystem services and systematic conservation planning. For each tool (Table 2) we have discussed:

- Aims and audience
- The approach, methods and limitations
- The spatial scale over which it can be used
- Its potential for use in combination with other tools
- Data requirements
- Transparency, interpretability, consideration of uncertainty and quality assurance
- Intellectual property rights, data access and operating system requirements
- Strengths, weakness and examples of its use.

**Table 2** Brief overview of ecological network tools and their benefits

| Model/ Data | Key benefits |
|---|---|
| **National Habitat Networks Maps for England** | Highlights key areas to create and restore habitats and reduce fragmentation, based on the potential of the land to support those habitats. |
| **National Biodiversity Climate Change Vulnerability Assessment (NBCCVA)** | National scale habitat vulnerability analysis<br><br>Structural habitat fragmentation assessment |
| **Climate change refugia maps** | Shows the location of climate change refugia nationally. Areas where climate is relatively stable under climate change and so identifies areas where species might be able to persist under climate change. |
| **Species Risks and Opportunities maps** | Based on GB-scale climate envelope models for 3500 species of a large number of taxa |
| **Condatis** | Assesses long distance migration probability by measuring flow through the landscape, so helps identify places which are important for landscape connectivity. |
| **Forest Research least-cost network approach** | Maps ecological networks by identifying habitat patches and the potential connectivity between them, taking into account the permeability/resistance of the surrounding landscape matrix. |
| **Rangeshifter** | Assesses species movement across a landscape, based on habitat suitability, dispersal ability and aspects of population dynamics |
| **Habitat Potential maps** | Provides indication of the potential for an area to support specific habitat creation. Shows areas of lost habitat that need to be restored. |
| **Carbon storage and sequestration maps** | Identifies areas which provide climate change mitigation by the natural environment based on soil carbon |

| | |
|---|---|
| **Natural England & CEH Natural Capital maps and Natural England natural Capital Atlases** | Maps of natural capital and associated ecosystem services |
| **Natural Capital Assessment Gateway** | A web-based gateway to local natural capital assessments and ecosystem services mapping projects |
| **Zonation & Marxan** | Spatial prioritisation software that identify areas of importance for biodiversity conservation, with the ability to take into account synergies and trade-offs with other environmental attributes |

# 7 An overview of the process of designing a nature network

The various stages in Nature Network design are summarised in a generalised flow chart (Fig 3) which shows the logical stages that might be followed by a partnership wishing to develop a nature network in their area. Further detail about the issues identified in each step can be found within the larger Nature Networks Evidence Handbook.

**Figure 3 Stages to be undertaken in Nature Network design and delivery**

**Step 1: Evidence gathering to develop an initial vision for the nature network**

1. Understand the place and assess what aspects of nature are special about an area or have been degraded or become threatened
    a. Landscape character & beauty
    b. Geology & soils
    c. Natural processes (e.g. hydrological, geomorphological)
    d. Biodiversity
        i. Identify existing and potential core sites for biodiversity
        ii. Identify opportunities for expansion and joining up existing areas and for improving their natural functioning
        iii. Review matrix (land between core sites)
            1. Identify important species and habitats
            2. Identify opportunities to improve connectivity
    e. Ecosystem services
    f. Historical environment
    g. Socio-cultural context (e.g. traditions, affluence, life-styles etc.)
2. Assess what aspects of nature could be restored or created, taking into account current and potential national importance
3. What opportunities are there for new or enhanced ecosystem service provision
4. Think in a network way rather than about individual sites

**Step 2: Identify and involve stakeholders in refining the vision**

1. Develop a stakeholder map based on land ownership and ecosystem service provision and usage
2. Hold a workshop to review the initial vision and to refine it
3. Use a variety of tools to present relevant data
4. Identify opportunities
    a. For ecosystem restoration and habitat creation
    b. For restoring natural processes
    c. For new and enhanced ecosystem service provision
5. Use participatory approaches to engage with the wider community to encourage support and to refine the vision further

**Step 3: Prepare final vision**

1. Agree ultimate goals for nature network
    a. Biodiversity goals
    b. Natural capital goals
    c. Ecosystem service goals
    d. Landscape character and cultural heritage
    e. Other societal goals, such as access to the countryside
2. Agree constraints and opportunities
    a. Ecological issues e.g. soil types, likely climate change impacts, natural processes
    b. Landscape issues e.g. cultural expectations
    c. Cultural issues e.g. population make-up
3. Agree areas of uncertainty including aspects requiring a search for compromise
4. Agree size of area over which the network will be designed
5. Identify links to wider networks
    a. Including how it contributes to national and regional needs
6. Develop a suite of targets against which progress can be assessed

**Step 4: Develop a project team for the delivery of nature network vision**

1. Develop an organisational and governance structure
2. Identify leads (teams) for each key aspect of the project
3. Teams to develop aims and objectives for their component of the project
4. Project teams work together to ensure an overall integrated plan
5. Implement plans
    a. Start immediately, but think long-term

**Step 5: Building the Nature Network**

1. Build resilience
    a. What are the pressures?
    b. Think about social resilience
2. Design the nature network using the suite of rules of thumb
    a. Make sites better
        i. Big enough, complex, messy, dynamic
        ii. Enhance natural processes
        iii. Develop buffers where possible
    b. Make sites bigger
    c. Create new sites
    d. Improve connectivity
    e. Improve quality of resources for wildlife in the wider countryside

**Step 6: Implement the plans**

1. Work with the planning system
    a. National Planning Policy Framework in England
    b. Net Gain
    c. Green Infrastructure
2. Working with farmers and landowners
    a. Use of agri-environment schemes where practicable
    b. Benefits of farm clusters
3. Detailed ecosystem management
    a. Tailored to improving and using natural processes, working towards rewilding where appropriate
    b. Tailored to specific habitats

Step 7: Undertake monitoring and surveillance to allow evaluation of nature network

1. Develop a programme to monitor progress that takes into account local and national objectives
2. Refine implementation plan as it progresses in the light of evaluation (adaptive management)
3. Undertake management interventions scientifically to grow the evidence base.

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