



ENVIRONMENTAL OBSERVATION FRAMEWORK

Monitoring natural capital

This leaflet has been created by the UKEOF community to share knowledge and best practice for incorporating existing environmental monitoring into a natural capital management approach. It provides a general introduction to natural capital, an overview of current work on assessing natural capital assets across the UK and, using three case studies, shows how current monitoring schemes have been adapted for use in natural capital assessment.

Underpinning UK Natural Capital Approaches



UKEOF Natural Capital Working Group

What is natural capital?

Natural capital incorporates all resources within the natural environment (air, water, sea, land and below ground) including biotic and abiotic resources and associated processes (e.g. nutrient cycling, erosion, climate, evolution) and biodiversity^{1,2}. Humans exploit natural capital to enable the 'flow' of ecosystem services to provide the benefits to society necessary for survival and wellbeing³. The 'value' placed on these benefits by society and policy-makers can drive financial investment into managing the underlying natural 'capital' (fig. 1)³. Early methods for assessing natural capital and ecosystem services focused on the market value of these assets^{4,5}. However, it is now widely acknowledged that natural capital stocks deliver multiple ecosystem services that benefit society which are not all easily quantified (or monetised) and as a consequence can be overlooked⁴.

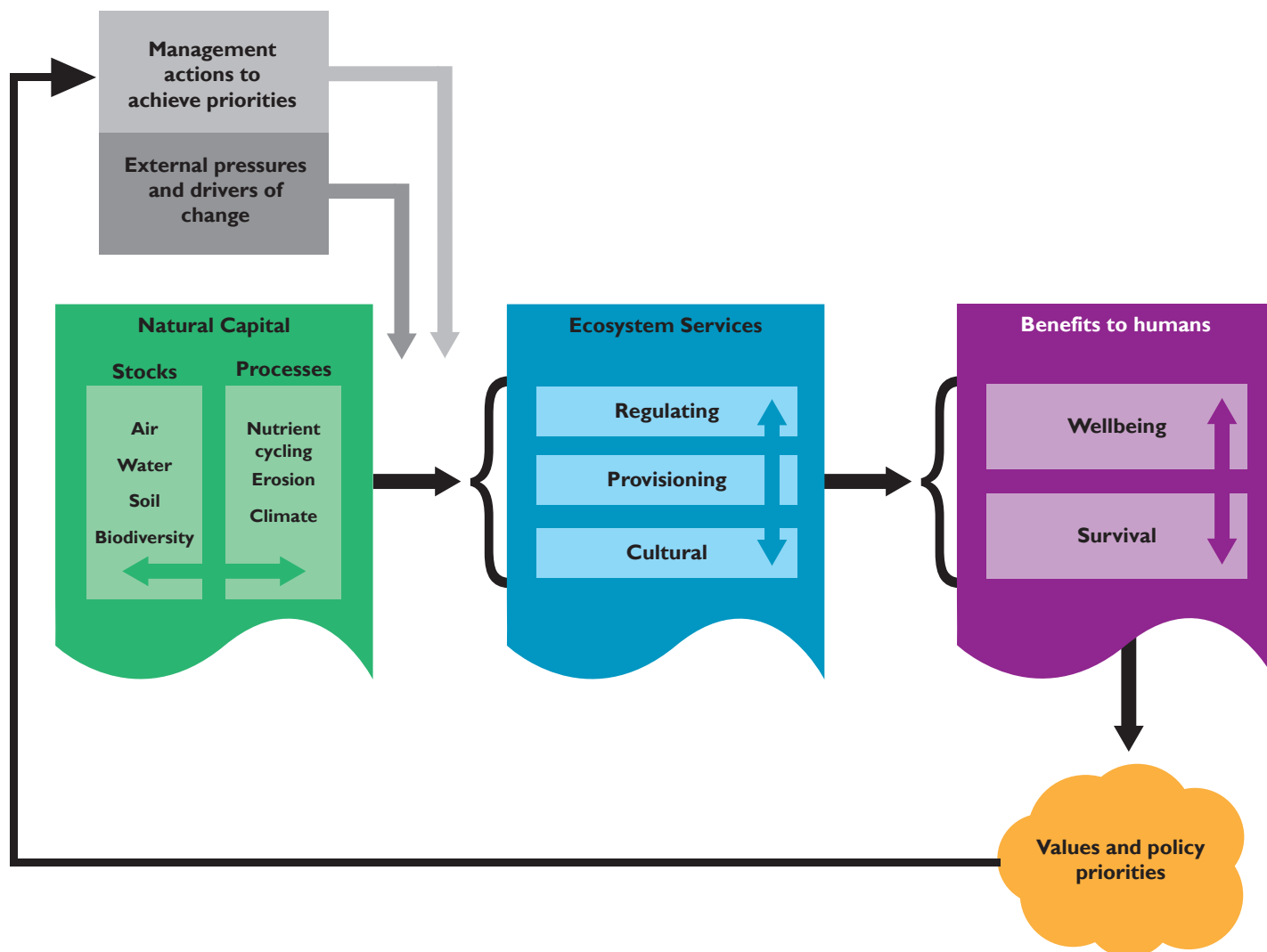


Figure 1: The flow of ecosystem services and benefits to society from natural capital stocks and processes. These benefits are 'valued' and can drive policy and management priorities leading to interventions which may prioritise some ecosystem services over others and, along with other human pressures and external drivers of change, can impact the flow of ecosystem services from natural capital

A natural capital approach

A natural capital approach to environmental and natural resource management recognises the value of the natural capital 'stock' in providing a sustainable flow of ecosystem services that benefit society^{2,6}.

Environmental observation is fundamental to the implementation of a natural capital approach⁷. It is only by knowing the condition of the current 'stock' and its spatial context that an estimation of the ecosystem services provided can be made, and their value to society established³. Similarly, monitoring how natural capital is changing over time is vital to ensuring the sustainable provision of ecosystem services and to recognising and understanding trade-offs associated with the delivery of multiple services from a single natural capital stock³. Evidence from monitoring can be used to support the implementation of robust and timely interventions if, for example, it appears that the natural capital is deteriorating beyond its capacity to replenish and continue providing societal benefits^{2,3}.

This document highlights the current use of environmental monitoring for natural capital assessments by individual countries across the UK and how existing and new datasets are being adapted to help assess the stock and monitor change of natural capital assets.

Examples of natural capital monitoring supporting policy in the UK

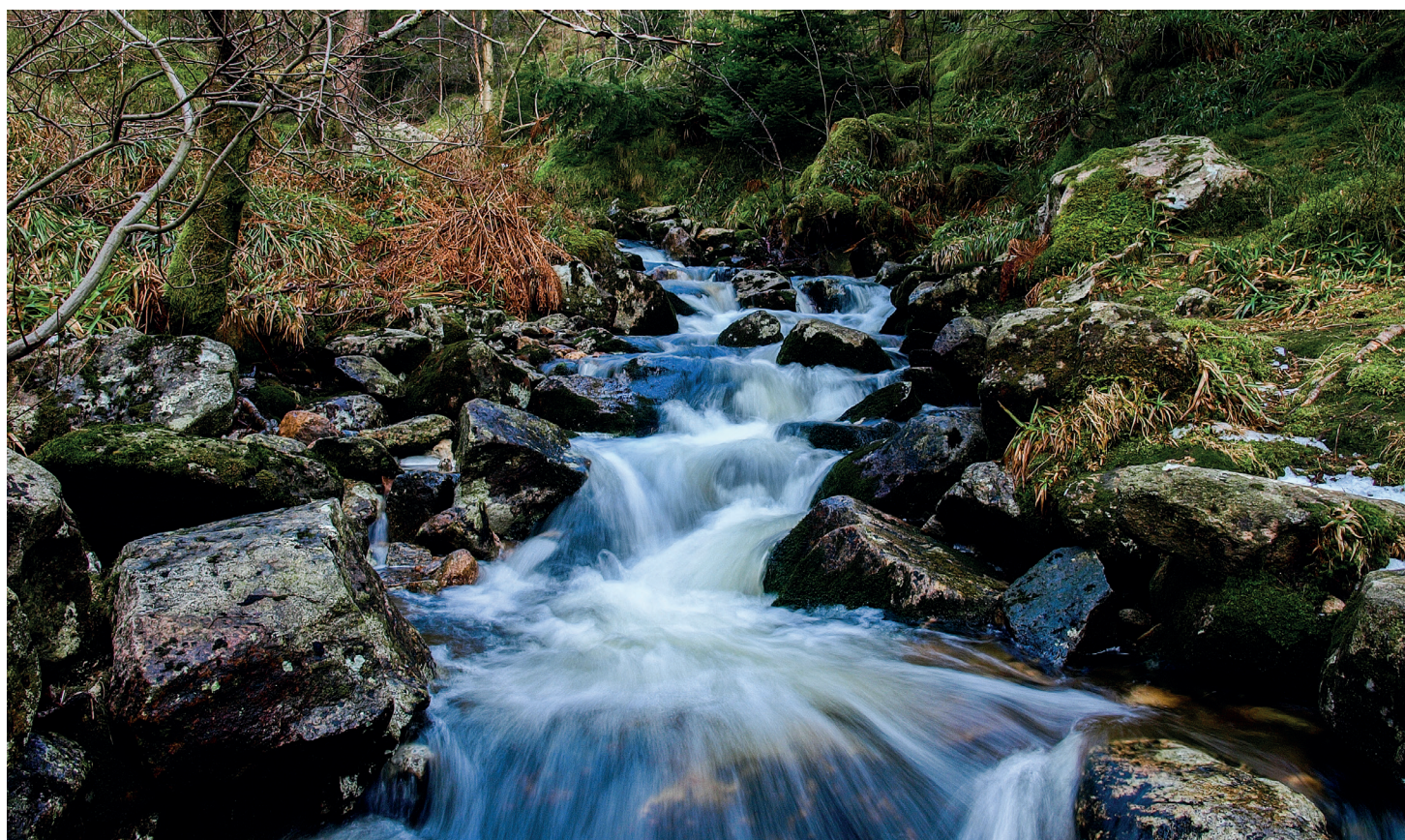
The **Natural Resources Wales' State of Natural Resources Report (SoNaRR)** (2016)⁸ was produced as a requirement under the Environment (Wales) Act 2016 and The Well-being of Future Generations (Wales) Act 2015. It set out seven well-being goals describing 'the kind of Wales we want to see' and assessed the availability of, and pressures on, the natural resources in Wales from which ecosystem services and benefits to Welsh society flow. Among other things, the report used data from ongoing condition assessments and monitoring of priority habitats and species, ranging from intertidal mudflats to mountains, moors and heaths with species as diverse as slow-worm (*Anguis fragilis*), hornet robber fly (*Asilus crabroniformis*) and long-snouted seahorse (*Hippocampus guttulatus*). Monitoring and understanding change in the habitats required by these, and other priority species, can inform policy-makers on sustainable resource use and land management.

Scottish Natural Heritage's Natural Capital Asset Index⁹ comprises measurements of relative change in extent and condition (since 2000) in seven ecosystems, using the broad habitats defined by the European Nature Information System (EUNIS)¹⁰. The Natural Capital Asset Index was developed to assess the potential benefits that could be derived from Scotland's terrestrial environment and to track changes in its potential to provide these benefits.

The index is updated on an annual basis, using data from 38 separate habitat quality indicators relevant to one or more ecosystems, these include coastal bathing water quality, woodland bird index, urban birds, and availability of greenspace. The indicators used were derived from habitat and species monitoring surveys carried out by SNH and others, including BTO, James Hutton Institute, CEH and BGS, at least biennially. The indicators monitor changes in the quality of habitats and thus the potential for them to provide benefits through ecosystem services, weighted according to their value and importance for human wellbeing in Scotland.

The 25 Year Environment Plan (YEP)¹¹ in January 2018 set out goals for improving the environment in England. A key commitment was to develop a comprehensive set of indicators, which collectively describe environmental change as it relates to the ten goals in the Plan. These indicators will make it possible to monitor progress towards the long-term vision of the 25 YEP, which uses a Natural Capital framework. The development of the 25 YEP indicators was informed by the work undertaken by Natural England's Natural Capital Indicator Project¹² (described below).

Natural England's (NE) Natural Capital Indicators Project¹² identified key indicators for measuring change in natural capital, identifying indicators for ecosystem assets (their quantity, quality and spatial arrangement) and ecosystem services flow. Natural capital assets were based on the eight broad habitat types as identified by the UK National Ecosystem Assessment (UKNEA) and natural capital logic chains were developed to show how ecosystem services flow from the natural capital assets. The project identified indicators for the key environmental properties underpinning the provision of ecosystem services. This was based on the expert opinion of 88 specialists in Natural England and the Environment Agency. Data sets (63 in total) were then identified to measure the indicators, as well as assess data gaps. The project incorporated data from existing monitoring programmes including Land Cover Map, JNCC Marine Protected Areas Monitoring, Priority Habitat Inventory, Water Framework Directive, LANDIS, and Clean Seas Environmental Monitoring. Indicators were identified for key biotic and abiotic provisioning, regulating and cultural ecosystem services, as well as services from geodiversity.



Case Study 1: Using a natural capital approach to understand the value of biodiversity within semi-natural habitats

National Plant Monitoring Scheme (NPMS)¹³

A partnership between Joint Nature Conservation Committee (JNCC), Centre for Ecology and Hydrology (CEH), Botanical Survey of Britain and Ireland (BSBI) and Plantlife, the NPMS¹³ was launched in 2015. The NPMS collects data on species abundance and community structure across a range of habitats. Volunteers survey plots across the UK within 1 km squares from a random sample with a weighting towards semi-natural habitats; over 600 squares were monitored in the first two years. Surveyors identify and record cover for 25 – 30 'indicator' species within each square.

The NPMS aims to inform a natural capital approach by providing policy-makers with information on changes in the abundance of plant species in semi-natural habitats across the UK that can be used to support environmental policy decisions. For example, UK Biodiversity Indicator C7 (plants of the wider countryside), could provide evidence on the effectiveness of agri-environment schemes and land management practices.



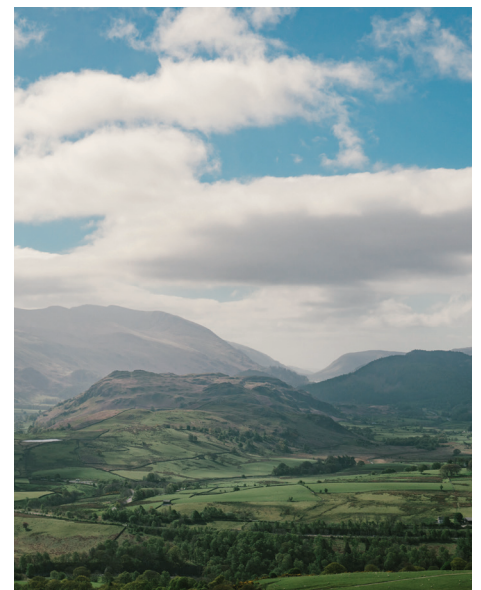
Case Study 2: Using a natural capital approach to inform sustainable land management

NE Ecosystem Services Pilot: Bassenthwaite^{14, 15}

Natural England carried out pilot projects in three areas of England aimed at demonstrating how natural capital approach could be applied to land management in upland areas¹⁴. Upland areas provide direct and easily identifiable ecosystem services including carbon storage, food, timber production, and recreation. Following the Convention on Biological Diversity's Ecosystem Approach Principles¹⁶, these pilots aimed, through participatory engagement, to enhance the provision of multiple benefits.

The project worked with partners, farmers and land managers through workshops and individual meetings to develop a shared evidence base and a map-based delivery plan. The shared evidence base included a mapped baseline assessment of ecosystem services (or their proxies) using data from a wide range of national and local sources. Seven key land management actions to enhance the state of natural capital were identified: new woodland creation; sustainable grazing; sustainable river management; restoring Scheduled Monuments at risk; improving access; managing nutrients on improved grassland; and improving biodiversity of valley habitats. The delivery plan included opportunity maps and for the seven actions, detail on why, what, where and how they could be implemented, plus an annex of farmers' views on how this could fit with farm businesses.

An evaluation of the process and impact of the pilot concluded that it had been effective at working in partnership for the enhancement of multiple ecosystem services¹⁵. It was not possible to directly measure change in ecosystem services attributable to the project. However, it was possible to measure key actions targeted at enhancing ecosystem services, including water quality, climate and flood regulation, erosion control and biodiversity. Key actions, delivered in the Pilot project area (2011-6) through agri-environment scheme options, include: 215 ha of woodland creation; 16193 ha of sustainable grazing on the uplands; restoration of 515 ha woodland, 152 ha of species rich grassland, 65 ha of fen and 6 ha of raised bog, as well as 899 ha of nutrient management on improved grassland. Lessons learnt included that evaluation should have been built into the project from the outset, enabling data to be collected throughout the project to inform the evaluation.



Case Study 3: Using a natural capital approach to inform soil management

Centre for Ecology and Hydrology (CEH) Countryside Survey (CS): Soil Carbon^{7,17}

Produced in conjunction with the Northern Ireland Countryside Survey¹⁸, the CS¹⁷ is a UK-wide audit of the condition of the countryside. The survey incorporates an extensive spatially representative field survey of 590 1 km squares across the UK alongside satellite remote sensing (SRS) technology to develop the Land Cover Map. The survey has been carried out five times, roughly once per decade, since 1978. The most recent data is available from 2007. Surveying will continue as part of integrated CEH monitoring in 2019.

Soil organic carbon (SOC) has been measured within topsoil samples (15 cm) across several surveys to provide an indication of soil health and how it is changing at a GB scale. Whilst topsoil carbon samples (15 cm) do not take full account of the carbon content of deeper soils (e.g. peat), it is the part of the soil that is the most susceptible to changes in land management; evidenced by the lower soil carbon content in arable and horticultural land. Soil carbon is important for provisioning services (e.g. food) as well as for capturing and sequestering carbon (which may otherwise contribute to greenhouse gases and climate change⁷).

Using this representative sampling framework, CEH has produced models which describe how soil carbon varies spatially according to broad habitat and underlying biophysical variables and has mapped this data for GB using the SRS Land Cover Map, as shown for England (fig. 2). The maps are based on a representative sample, rather than measurements of every habitat at every place, resulting in the models also describing the spatial 'uncertainty' associated with the model results. By using an integrated sampling framework and the alignment of SRS and field data, the CS has been similarly used for a wide range of natural capital metrics for England⁷.

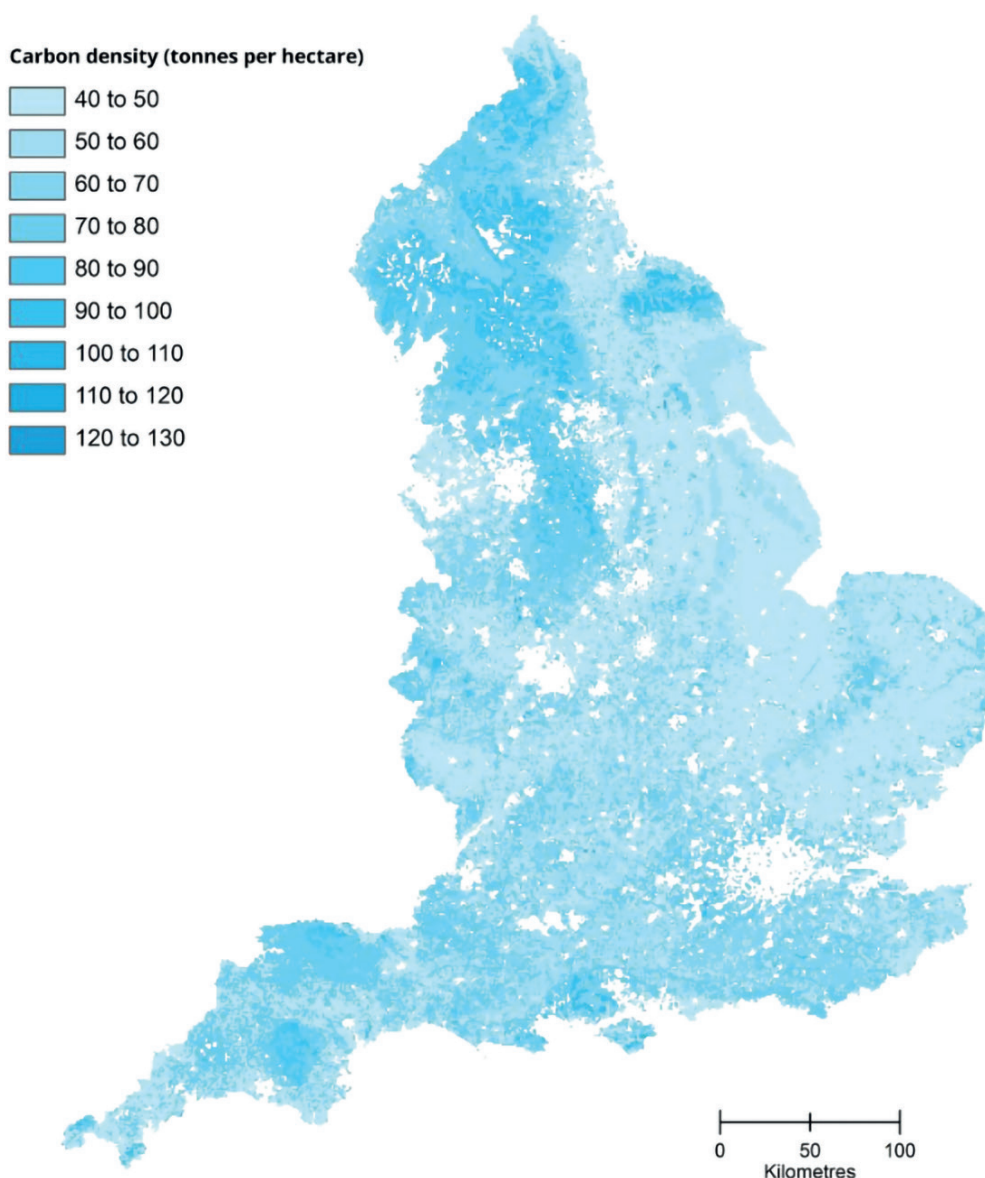


Figure 2: Mean estimates of carbon density in topsoil (0-15cm depth)

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www.ukeof.org.uk/resources/natural-capital-resources/underpinning-uk-nc-approaches-refs

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UKEOF works to improve coordination of the observational evidence needed to understand and manage the changing natural environment. It is a partnership of public sector organisations with an interest in using and providing evidence from environmental observations. Contact us at office@ukeof.org.uk

British Geological Survey; Centre for Ecology & Hydrology; Department for Agriculture, Environment and Rural Affairs (Northern Ireland); Department for Business, Energy and Industrial Strategy; Department for Environment, Food and Rural Affairs; Economic and Social Research Council; Environment Agency; Forestry Commission; Joint Nature Conservation Committee; Met Office; Natural England; Natural Environment Research Council; Natural Resources Wales; Office of National Statistics; Scottish Environment Protection Agency; Scottish Government; Scottish Natural Heritage; UK Space Agency; Welsh Government.

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