Natural Capital Indicators: Method

This evidence information note explains the method for the Natural England's Natural Capital Indicators Project. This project aims to identify key attributes for measuring change in natural capital in England, at a range of scales. It also identifies and reviews datasets for measuring the attributes. It has identified gaps where appropriate data sets have not been found.

Method

Natural Capital Logic Chains

Natural England has used a natural capital logic chain approach to consider key indicators for natural capital assets, ecosystem services, benefits and values. We have developed a logic chain that shows how ecosystem assets underpin the provision of ecosystem services and benefits to people, and that all parts of this chain are affected by management interventions, pressures and drivers of change. Other capital inputs are often needed for people to obtain the benefits from ecosystem services (a simple example is the processing of trees to produce wood products). The quantity, quality and location of natural capital assets affect the ecosystem services and benefits that it provides.

Figure 1 (**page 7**) is a simple logic chain for provisioning and regulating ecosystem services. We have produced bespoke detailed logic chains for 50 key ecosystem services from eight broad habitat types. In recognition of the important role of geodiversity in the provision of abiotic and ecosystem services, we have also produced a logic chain for geodiversity, which covers all broad habitats and services. Even these more detailed logic chains are a simplification of a much more complex and interacting natural system. We have not attempted to show these more complex interactions.

We have adapted the logic chain for the consideration of cultural ecosystem services (see figure 2, **page 7**). This enables us to capture additional qualities of places that are important for cultural services, what people are doing there, and the well-being benefits they receive. This framework has been informed by the UKNEA follow-on work (2014) considering the interaction between environmental spaces (or places), cultural practices (what people are doing there) and cultural benefits. The logic chain for cultural services also recognises that each individual's perceptions, motivations and experiences will influence what they do) and the benefits they get, from their personal interaction with the natural environment.

Broad Habitats and boundaries

The eight broad habitat types identified by the UK National Ecosystem Assessment (UKNEA) have been used for the division of natural capital assets. This approach is consistent with Office of National Statistics (ONS) national ecosystem accounts and Scottish Natural Heritage's Scottish Natural Capital Asset Index (SNCAI). We have mainly followed the boundaries defined for broad habitats by the UKNEA, adapting these where necessary to avoid duplication and overlap. The boundaries that we have used are as follows (based on UKNEA, *unless indicated in italics):*

- **Mountains, Moorlands and Heaths:** *All land above the Moorland line* plus lowland heath.
- **Semi-natural grassland:** all grassland that is not improved, *below the Moorland line* and outside of urban and coastal areas.

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- **Enclosed farmland:** cropped and improved grassland fields (outside of urban areas), plus hedges, ditches and small woodlands interspersed among them.
- **Woodland:** vegetation dominated by trees>5m in height when mature; >20% canopy cover. Coniferous woodland plus broad-leaved, mixed and yew woodland, *below the Moorland line* and outside of urban areas and small farm woodlands in enclosed farmland.
- **Freshwaters** – Openwaters, Wetlands and Floodplains: rivers, lakes, ponds, wetlands, groundwaters, as well artificial freshwaters (reservoirs, canals, gravel pits) *below the Moorland line.*
- **Urban:** urban and sub-urban contiguous areas with populations >10,000 people.
- **Coastal:** sand dunes; shingle; salt marsh; sea cliffs, coastal lagoons *and intertidal sediment (beach and mud)*.
- **Marine:** all English areas covered permanently by sea water or inundated with saline water and some stage in the tidal cycle, *excluding those habitats covered by coastal.*

Freshwater Catchments

Due to the importance of freshwater catchments for water related ecosystem services (water supply, water quality and flood protection), for these services logic chains were based on terrestrial freshwater catchments, rather than the freshwater broad habitat boundary. The water quality, water supply and flood protection catchment logic chains therefore encompass enclosed farmland, semi-natural grassland, woodland, urban, mountains, moorlands & heaths, as well as freshwaters. The only services that have been considered for the freshwater broad habitat are maintaining nursery populations & habitats and climate regulation. Separate logic chains have been produced for water quality, water supply and flood protection for the mountains, moorlands and heaths broad habitat, in recognition of the importance of upper catchments and headwaters for these services.

Ecosystem Services

The ecosystem service categories have been based on the Common International Classification of Ecosystem Services (CICES v. 4.3), again to ensure consistency with ONS, SNCAI and international approaches. CICES does not include supporting ecosystem services but defines "*ecosystem function*" as underpinning the provision of ecosystem services. For cultural ecosystem services we have also taken account of the work of the UKNEA Follow-on. Within broad habitats, the key ecosystem services, which are particularly important for each broad habitat, were based on evidence within the UKNEA. The ecosystem services for which detailed logic chains have been produced, are shown in table 1 (**page 6**).

Development of logic chain templates

To develop the detailed logic chains, 8 templates were first produced, one for each broad habitat, based on evidence in the UKNEA (and UKNEA follow-on work for marine indicators and cultural services) and Gray 2013 for the geodiversity logic chain . This approach was developed through initial work with Natural England upland specialists. The templates include sections on asset quantity, quality and location, ecosystem service flow, benefits, management interventions and other drivers of change. For regulating and provisioning services, quality attributes were based on ecological processes: hydrology & geomorphology; nutrient & chemical status; soil/sediment processes; species composition; vegetation characteristics. Climate, geology and topography were considered not to be directly affected by management interventions and indicators were not identified for these factors. For cultural ecosystem services, quality attributes were based on: nature; landscape, seascape and urban green space; culture and history, quietness, facilities, accessibility and safety. Indicators were not identified by this project for management interventions or drivers of change.

Identification of key indicators (short and long list)

The logic chain approach was used to ensure that the selection of indicators was transparent and showed clearly how an indicator is relevant and relates to changes in the system. Indicators were only identified where they could be practically used to inform management action. From the eight broad habitat templates, 50 bespoke detailed logic chains were developed for different ecosystem services. This involved adding-in attributes specific to a service and broad habitat, such as location, ecosystem service flow and benefits. Any attribute that was completely irrelevant to a particular logic chain was removed (using track changes). To identify the key indicators, three workshops were run, two with Natural England and one with Environment Agency specialists. In total 59 Natural England and 29 Environment Agency staff contributed to the project, with specialisms that included habitats, ecology, species, geomorphology, geology, landscape, access, historic environment, water quality, flood regulation, fisheries, climate change, air quality, natural capital, social science, economics and data management. In the workshops, specialists used their expert opinion to highlight on the detailed logic chains, those attributes which they considered to be key indicators for measuring change in natural capital. They also deleted any further attributes that were considered to be irrelevant for a specific logic chain. If an attribute was considered to be relevant but not a key attribute, it remained on the detailed logic chain but was not highlighted. The logic chain outputs were circulated to participants and other specialists, following the workshops to seek further input. To ensure consistency across all the logic chains, a quality assurance (QA) exercise was undertaken by two Natural England Deputy Chief Scientists. As part of the QA, short and long list key attributes were identified. A short list indicator was identified as conveying information about more than just itself. Long list indicators were considered to be important for measuring change in natural capital but were judged to be covered by the short list indicators. For the cultural services short list indicators were identified but not long list ones.

Indicators for benefits and value

Natural England economists undertook a rapid literature search to identify indicators of benefits and values. Beyond market goods such as food, this rapid literature search identified few indicators for benefits and a lack of regularly updated data sets that report on these. Although methods have been developed for calculating values for non-market benefits, again there is a lack of regularly updated data sets which report on values. This economics work was quality assured by the Natural England Principal Economist. The lack of indicators for values and benefits results in the key indicators focussing on attributes of the natural capital asset and ecosystem services flow. The attributes of the natural capital asset are particularly important for measuring change, as there is often a lag in change from the asset to the ecosystem service flow and benefits. Changes in the attributes of the asset, therefore act as an early warning system. Understanding these asset attributes is also needed to inform land management actions to enhance the provision of ecosystem services. Further work will develop the indicators for benefits and values.

Identification of data sources

Data sources for measuring change in the long and short list attributes were identified by the 88 Natural England and Environment Agency staff involved in the project. Data sets were also identified from ONS work on national ecosystem accounts, AECOM work on local ecosystem accounts and the SNCAI. Work reviewing data sets by CEH for the Natural Capital Committee 2nd State of Natural Capital Report, was also used to identify robust data sets for measuring change in the long and short list of attributes. Data sets were only included if they are regularly updated; one-off surveys or methods for measuring change were not included. Local data sets were also not included.

Review of data sources against criteria

Data sets were reviewed against a series of criteria and assigned a Red, Amber, Green (RAG) status (see table 2, **page 6**)

As the project also aims to identify indicators and data sets for measuring change at a range of scales, an additional criteria was added on relevant scale. This was not assigned a RAG status as some data sets are useful at local and others at a national scale. The following criteria were used for relevant scale: Local: < Lower Super Output Area (LSOA); Mappable at a scale > Lower Super Output Area (LSOA); National level statistic: not mappable; Point survey (for point or sample surveys).

Data gaps

Where a data set could not be identified to measure change in a short list attribute, this was recorded as a gap in data. Two levels of data gaps were identified for short list attributes: data gaps relevant to more than one habitat or ecosystem service; minor data gaps, only relevant to one ecosystem service in one broad habitat. For many attributes we had data sets that were only partial, for example covering a limited number of sites across a broad habitat. An example of this is Common Standards Monitoring, which measures a number of the short list attributes but only for Sites of Special Scientific Interest. These data sets are identified in the spreadsheet with a Red RAG status

Natural Capital Indicators Excel Spreadsheet tool

In addition to the 51 detailed logic chains, the project findings have been captured in an Excel Spreadsheet Tool. This includes the following sheets:

- **Priority attributes** - showing which part of the logic chain they are relevant to, which broad habitats, which ecosystem services and including an identification number for data sets that are relevant to the attribute.
- **Data sources** - reviewing data sources against the criteria of data availability, frequency of updates, coverage and relevant scale, and identifying a RAG status for the first three of these criteria. An identification number for each data set is used to link to the priority attributes. The name and a web-link for data sources are also provided.
- **Indicator tables** - for each broad habitat showing short and long list attributes against key ecosystem services.
- **Data gaps** - data gaps (for short list attributes) relevant to more than one habitat or ecosystem service.
- **Minor data gaps** - only relevant to one ecosystem service in one broad habitat.

Key References and links:

- Gray, J.M. 2013. Geodiversity: Valuing and Conserving Abiotic Nature. 2nd Edition, Wiley.
- Natural Capital Committee papers on metrics and indicators (and unpublished report of workshop on metrics and indicators):
  Natural Capital Committee research: developing metrics for natural capital - Publications - GOV.UK
- Office of National Statistics development of natural capital accounts:
  Natural Capital - Office for National Statistics
- AECOM Local Ecosystem Accounts for Protected Areas:
  Defra, UK - Science Search developing ecosystem accounts
- National Ecosystem Assessment and Follow-on work on cultural ecosystem services and marine indicators:
  UK NEA
- Scottish Natural Capital Asset Index (and associated unpublished papers):
  Natural Capital Asset Index

Table 1 The ecosystem services and broad habitats for which detailed logic chains have been produced

Broad Habitat	Materials from plants, algae & animals for agricultural use	Wild plants, animals, algae & their outputs	Aquaculture	Plant-based energy	Cultivated crops	Water supply for drinking and non-drinking purposes	Reared animals & outputs	Mediation of waste, toxics and other nuisances by ecosystems and Biota			Mass stabilisation & control of erosion rates	Flood protection	Pollination & seed dispersal	Maintaining nursery populations and habitats	Pest & disease control	Global, micro & regional climate regulation	Cultural ecosystem services	Geodiversity services
								Water quality	Air quality	Noise regulation								
Coastal Margins											X	X		X		X	X	Abiotic services from geodiversity, covering all broad habitats
Marine		X	X					X						X		X	X	
Urban						x		x	X	X		x		X		X	X	
Enclosed Farmland					X	x	X	x			X	x	X	X	X	X	X	
Semi-natural Grasslands	X					x	X	x				x	X	X		X	X	
Freshwaters						x		x				x		X		X	X	
Woodlands	X			X		x		x	X			x		X		X	X	
Mountain, Moorlands & Heaths						**X**	X	**X**			X	**X**		X		X	X	

X=logic chain for this broad habitat; x=catchment logic chain covering this broad habitat; **X**=logic chain for this broad habitat and covered by catchment logic chain.

Table 2 Criteria for reviewing data sources

Criteria for review of data source	**Green**	**Amber**	**Red**
Data availability	Free access	Under licence	Restricted or supplementary charge
Frequency of updates	1-5 years	6-10 years	10+ years
Coverage	Whole of England	Partial	Site specific

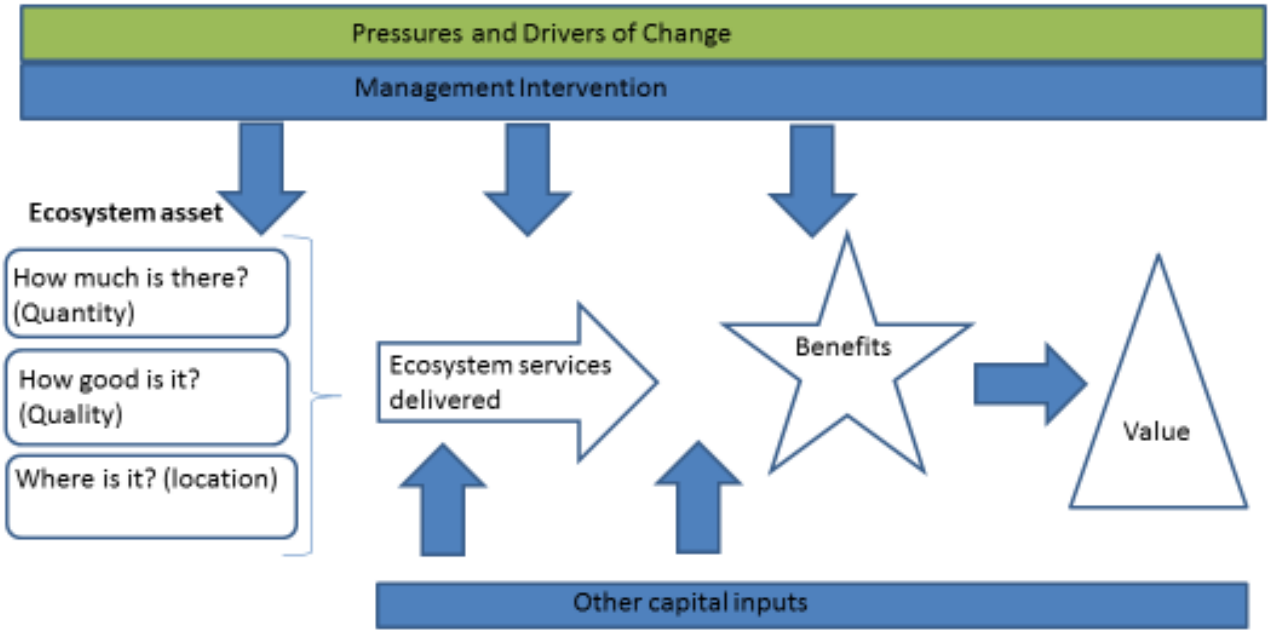

Figure 1 Natural England's natural capital logic chain

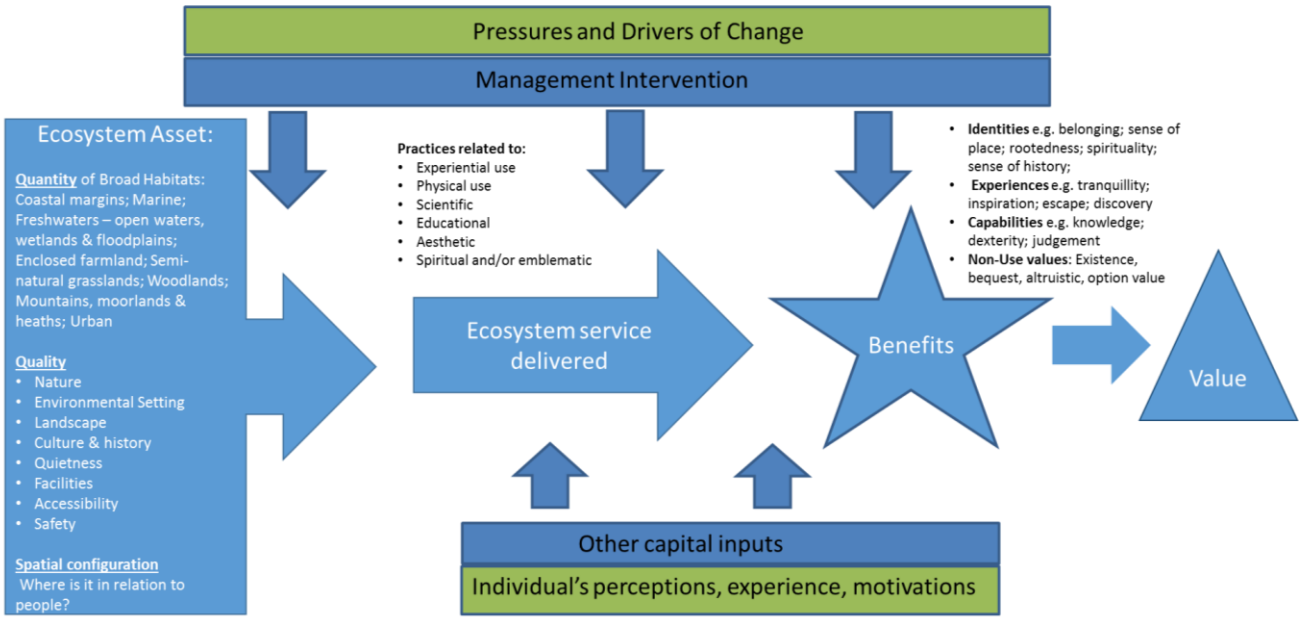

Figure 2 Natural England's natural capital logic chain for cultural ecosystem services