National Natural Capital Atlas: Mapping Indicators

Second edition
October 2021

Natural England Commissioned Report NECR285

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NATURAL ENGLAND

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National Natural Capital Atlas: Mapping Indicators

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Second edition

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Further information

This report can be downloaded from the Natural England Access to Evidence Catalogue: http://publications.naturalengland.org.uk/. For information on Natural England publications contact the Natural England Enquiry Service on 0300 060 3900 or email enquiries@naturalengland.org.uk.

Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

This natural capital atlas maps the state of our natural capital in terms of its quantity, quality and location. Enhancing the state of the environment is essential for both people and planet. This is because our wellbeing and prosperity relies on the benefits that we get from nature. The 25 Year Environment Plan aims to improve the state of the environment within a generation; we need to create resilient ecosystems where both people and planet are able to thrive.

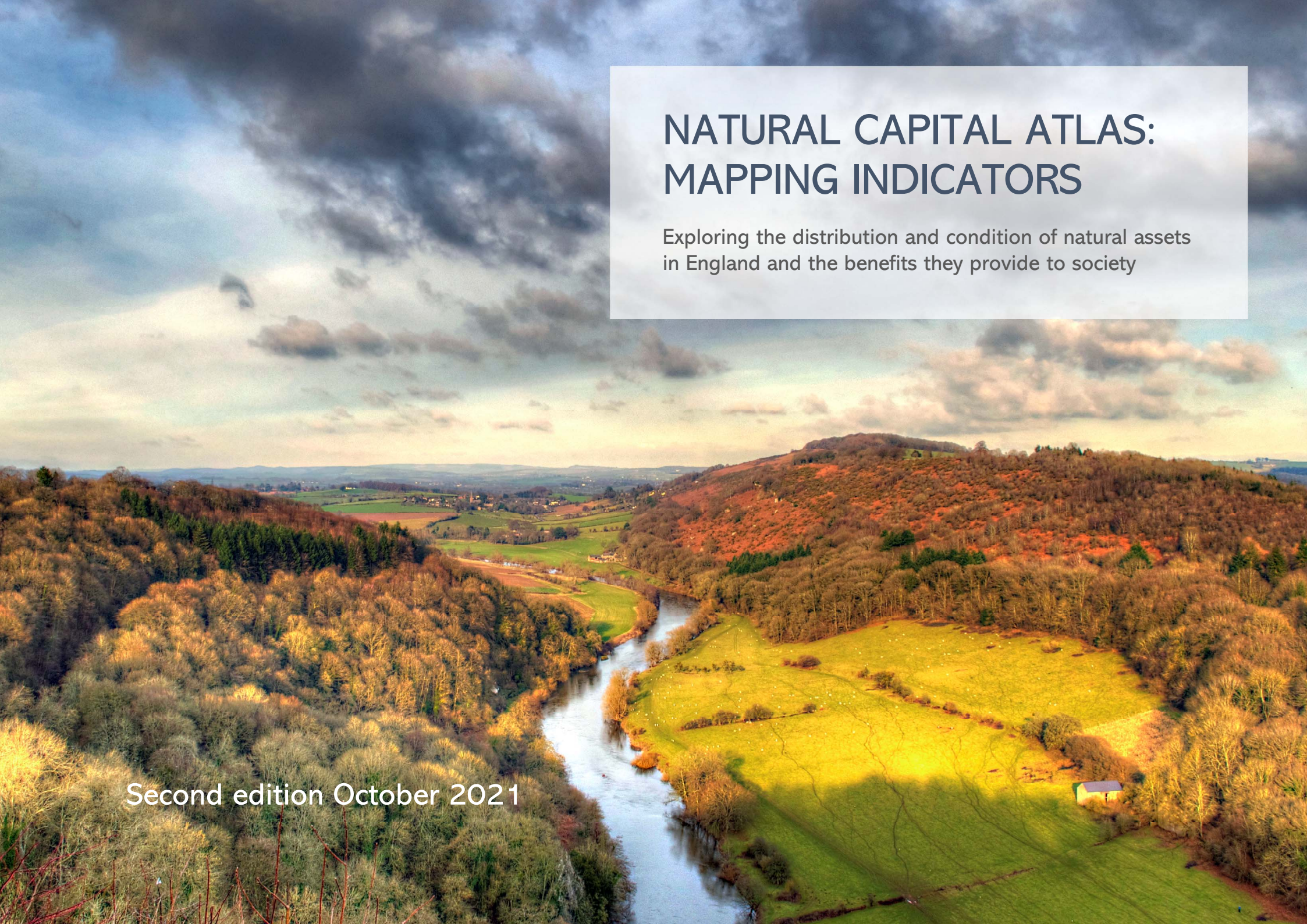
Understanding the state of our natural environment is the essential first step to improving it. Natural England's Natural Capital Indicators[1] are designed to inform our understanding of the state of our natural assets. These indicators measure the quantity, quality and location of ecosystems, and the flow of ecosystem services from them. The indicators highlight which properties of the environment are important for delivering which ecosystem services and benefits. Understanding the state of natural capital is essential to enable the sustainable provision of multiple benefits, now and into the future.

This Natural Capital Atlas has trialled using the Natural Capital Indicators to create a baseline assessment of the state of our natural capital in England. The project investigated the data sources which were highlighted in the Natural Capital Indicators report, and also identified new sources. Where nationally available data was found, maps and tables display indicators for the quantity, quality and location of ecosystem assets, and the flow of some ecosystem services.

As well as a baseline against which to measure change, this Natural Capital Atlas can be used to understand which ecosystem services flow from different ecosystem assets across England. The atlas shows where there are both strengths and weaknesses in the quantity and quality of ecosystems. This can inform opportunity mapping of where to enhance existing natural capital and where to target its creation for the provision of multiple benefits.

The second edition of the National Natural Capital Atlas: Mapping Indicators has been updated to include some clarification notes at relevant points through the document regarding catchment services. These services (water supply, regulation of water quality and flood protection) are associated with freshwater but are provided by the land across the wider catchment. There have also been some minor alterations to supporting text and images through the document. However, it should be noted that all the maps, and therefore the underlying geospatial data, have not been updated.

[1] LUSARDI, J., RICE, P. WATERS, R.D. AND CRAVEN J. (2018). Natural Capital Indicators: for defining and measuring change in natural capital. Natural England Research Report, Number 076



NATURAL CAPITAL ATLAS: MAPPING INDICATORS

Exploring the distribution and condition of natural assets in England and the benefits they provide to society

Second edition October 2021

NATURAL ENGLAND

This document is an output from the Natural England Natural Capital Baseline Assessments project (NE180921-0946-026), delivered by Westcountry Rivers Ltd.

First published in February 2020. Second edition published October 2021.

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Project Overview

England's varied natural environment, its ecosystems, geodiversity and landscapes, provides people with a wide range of services, upon which human wellbeing depends. These services include food, clean water and air, the regulation of climate and hazards such as flooding, thriving wildlife and cultural and spiritual enrichment. Large areas of broadleaved forest, such as the New Forest in Hampshire, coastal habitats such as the mudflats and saltmarshes of Norfolk, as well as small pockets of greenspace in towns and cities all provide a range of services and benefits vital to our health and wellbeing.

This atlas takes an in-depth look at the distribution and condition of these valuable natural assets in England. Using a range of indicators it illustrates, through maps and tables, the state of our natural capital and highlights how it provides benefits to people. It is important to remember that the natural assets in your place are part of a complex natural and cultural system, however, this atlas is a great starting point upon which to build a comprehensive natural capital evidence base to support decision making.

Project Background

Natural capital recognises that nature provides a wide variety of benefits and value to people, society and the economy and is a fundamental part of the Government's 25 Year Environment Plan (Defra, 2018). In 2018, Natural England published 'Natural Capital Indicators: for defining and measuring change in natural capital'. This report identified key properties of the natural environment vital for the long-term sustainability of these benefits, which can act as indicators of change.

Natural England developed an innovative, systematic approach to identify attributes of the natural environment underpinning the provision of ecosystem services. This approach took account of the expert opinion of nearly 90 specialists in Natural England and the Environment Agency. From this list of attributes, indicators for measuring change were selected and prioritised into short list and long list indicators. Principles were established for defining robust indicators, stating that they should be; transparent, relevant, meaningful, knowable, actionable and scalable. Datasets that could potentially be used to map these indicators were also identified.

Key Aims

This project and natural capital atlas follows on from Natural England's Natural Capital Indicators Project. It aims to apply and test the indicators and datasets previously identified by producing a natural capital atlas at both national and local scales. The demonstration site for the local assessment is the Sherwood National Character Area. We aim to learn from the production of this report and will use these lessons to improve future atlases

The tree diagram (right) shows how natural capital assets support the provision of ecosystem services, benefits and value. The roots of the tree show how aspects of asset quality are critical to the provision of ecosystem services. The roots also show that geodiversity underpins the ecosystem assets and therefore the ecosystem services and benefits they can provide. It is important to remember that this diagram, and natural capital frameworks more generally, are a simplification of how nature works in practice.

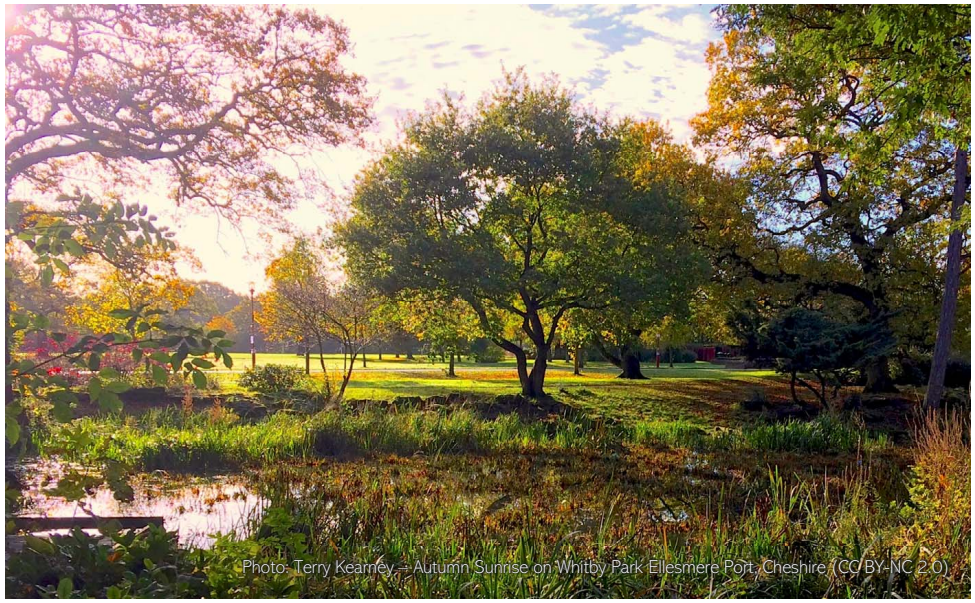
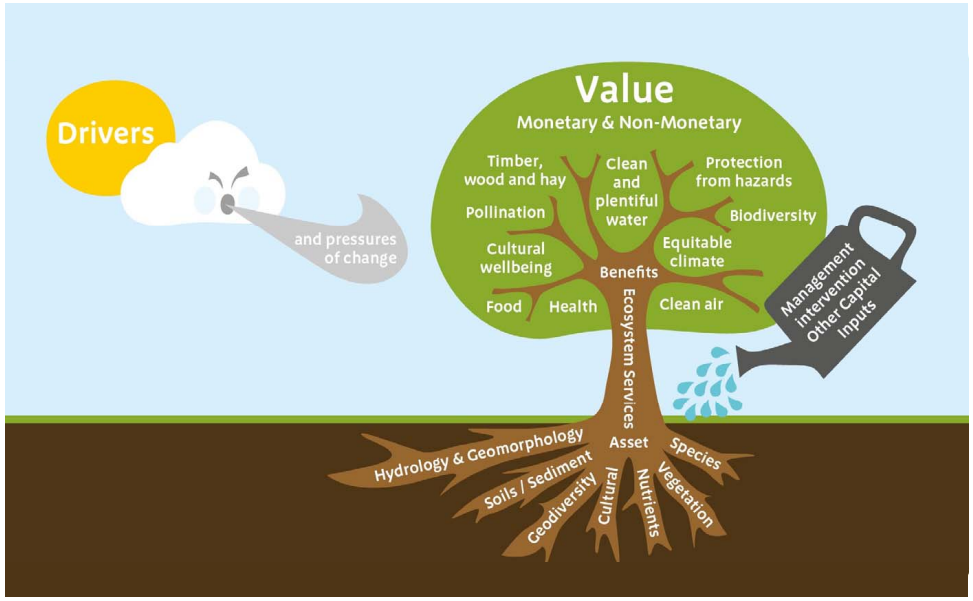


Photo: Terry Kearney – Autumn Sunrise on Whitby Park Ellesmere Port, Cheshire (CC BY-NC 2.0)

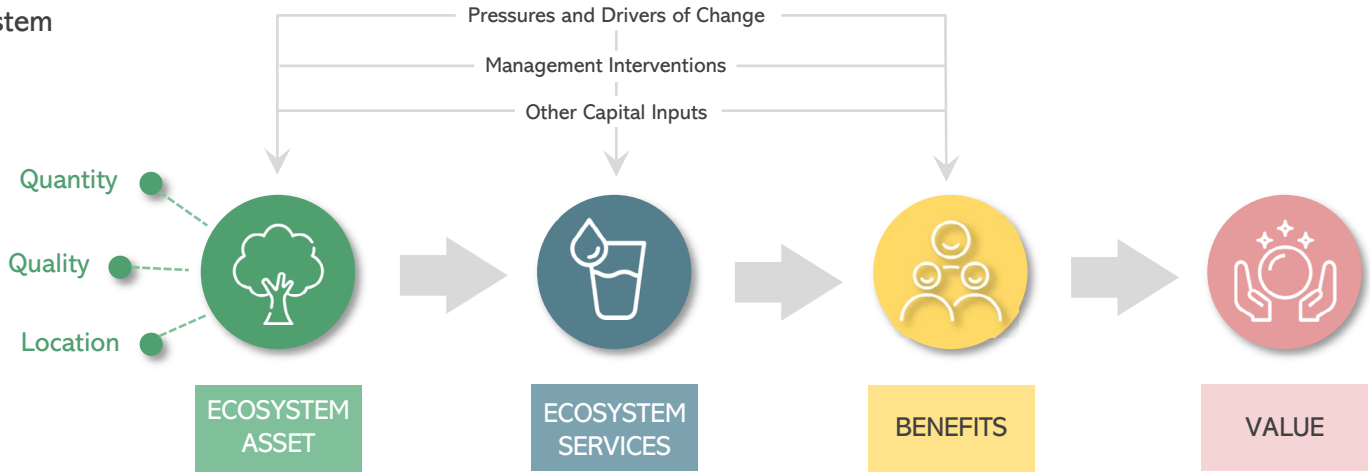


A graphic from 'Accounting for National Nature Reserves: A Natural Capital Account of the National Nature Reserves managed by Natural England (NERR078)' (Sunderland, Waters et al*, 2019)*

Ecosystem Logic Chains

Natural England show the links between ecosystem assets, services, benefits and value to people, through the use of logic chains. These show how the state of natural capital, its quantity, quality and location, affect the services and benefits it provides.

The Natural Capital Indicators logic chains show the attributes relevant to the provision of an ecosystem service. The project identified short and long list indicators for measuring change. Not all asset attributes have been identified as indicators (see woodland logic chain below). This atlas aims to map the short list indicators. Where data is not available to map a short list indicator, a long list indicator is mapped. Data gaps are identified where no data exists to map an indicator.



Example – Logic chain showing the characteristics that link woodland assets to the ecosystem service; air quality improvement. Short-list indicators are underlined.

Quantity:

- Coniferous woodland
- Broadleaved, mixed and yew woodland
- Individual trees/veteran trees

Location:

- Distribution, connectivity and fragmentation of woodland and interaction with other habitats
- Distribution of woodland in relation to settlements

Quality:

- Soil/sediment processes:
  - Soil depth
  - Soil bacteria
  - Soil mycorrhizal associations
  - Soil water retention
  - Soil Type
  - Soil erosion
  - Degree of compaction
  - Infiltration
- Nutrient (and chemical) status:
  - Soil N, P, C, pH
  - Atmospheric deposition (exceedance of critical loads - S, N, ozone)
- Vegetation:
  - Age structure
  - Canopy (density and spp. composition)
  - Leaf surface area and duration across year
  - Understorey (density and spp. composition)
  - Shadiness
  - Structural diversity
  - Cover/bare soil
  - Surface roughness/microtopography
  - Tree health
- Species Composition:
  - Naturalness of biological assemblage (no. of trophic levels and spp. composition within levels)
- Geology and topography:
  - Geology
  - Altitude, slope, aspect, landform
  - Catchment characteristics
- Climatic:
  - Air temperature
  - Sunlight/cloud cover
  - Precipitation (inc. distribution, seasonality, intensity)
  - Snow cover and length of snow lie
  - Frequency of freeze thaw
  - Wind (especially for wind throw)
  - Drought
  - Length of growing season (vegetation)

Ecosystem Service Flow:

- Air pollutants removed by vegetation

Benefits:

- Clean air, also underpinning health benefits

Value:

- It is difficult to measure the value of cleaner air; monetary savings (e.g. from reduced healthcare needs) should be considered, as well as social, cultural and environmental value

Photo: Phil Mclver – Burleigh Wood (CC BY-NC 2.0)

Report Structure

This report illustrates the state of natural capital in England. It maps a series of indicators of the quantity, quality and location of natural assets and the ecosystem services they support. The report structure follows this process. The quantity chapter is divided into eight broad habitat categories; freshwater; farmland; grassland; mountains, moor and heath; urban; woodland; coastal; and marine. The remaining chapters cover the quality, location and, where possible, the ecosystem services from all habitats combined.

Indicator Summary - Asset Quantity

The 'quantity indicators' are listed according to their broad habitat type, with references to the page where the mapped outputs appear in this report. A quantity indicator may occur in more than one broad habitat because water related services (water quality, flooding, water supply) are considered at a catchment scale. The marine and coastal parts of the report should be considered together.

Freshwater (p.13)

- Active flood plain
- Blanket bog
- Coastal and floodplain grazing marsh
- Lakes and standing waters
- Lowland Fens
- Lowland raised bog
- Modified waters e.g. reservoirs and canals
- Other semi-natural habitats
- Ponds
- Reedbeds
- Rivers
- Woodland

Farmland (p.22)

- Arable and rotational leys
- Horticulture
- Improved grassland
- Orchards and top fruit
- ○ Permanent pasture

Grasslands (p.26)

- Hay meadows
- Other semi-natural grasslands

Mountain, Moor and Heath (p.30)

- Blanket bog
- ○ Bracken
- Dwarf shrub heath
- Inland rock, scree and pavement (AML*)
- Lakes (AML)
- Mountain heath and willow scrub
- Reservoirs (AML)
- Rivers (AML)
- Semi-natural grassland (AML*)
- Upland flushes fens and swamps
- Wood pasture (AML*)
- Woodland (AML*)

**AML = Above Moorland Line*

Woodland (p.39)

- Broadleaved, mixed and yew woodland
- Coniferous woodland
- Individual trees/veteran trees
- Woodland priority habitats

Indicator Key

- ● Included in this atlas
- ○ Not included in this atlas

Urban (p.44)

- Blue space
- Green space - not semi-natural
- Open mosaic habitats
- ○ Urban/street trees
- Woodland, scrub and hedge
- Semi-natural habitats

Coastal (p.50)

- Beach
- Coastal lagoons
- Mudflats
- Salt marsh
- Sand dunes
- Sea cliff
- Shingle

Marine (p.57)

- ○ Deep sea habitats
- Intertidal rock
- ○ Intertidal sediment
- Maerl beds
- Reefs
- Sea grass beds
- Shallow subtidal sediment
- Shelf subtidal sediment
- Subtidal rock

Indicator Summary - Asset Quality

The 'quality indicators' are divided into broad categories, listed below with references to the page where the mapped outputs appear in this report.

Hydrology and Geomorphology (p.66)

- ○ Extent of artificial drainage
- ● Natural aquifer function - recharge and discharge
- ○ Naturalness of flooding regime
- ● Naturalness of flow regime
- ○ Naturalness of lake hydrological regime
- ○ Naturalness of water level regime
- ● Lack of physical modifications of water bodies
- ● River continuity – lack of obstructions

Nutrient and Chemical Status (p.70)

- ○ Atmospheric deposition - exceedance of critical loads
- ● Chemical status of water bodies
- ● Nutrient status of water bodies
- ○ pH
- ● Nutrient status of soil
- ○ Dissolved oxygen

Soil/Sediment Processes (p.73)

- ○ Sediment supply/availability (inc. type, grain size)
- ○ Peat depth
- ● Soil/sediment carbon/organic matter content
- ● Soil/sediment biota

Species Composition (p.76)

- ● Invasive non-native species
- ○ Net productivity by species
- ● Naturalness of biological assemblage - no. of trophic levels and community composition in each level
- ○ Plant species diversity

Vegetation (p. 79)

- ○ Extent and condition of linear vegetation features and pockets of semi natural vegetation
- ○ Plant growth rate
- ● Presence and frequency of pollinator (larval and adult) food plants
- ○ Proportion of peat mass actively forming peat
- ○ Surface/vegetation roughness
- ● Vegetation cover/bare soil
- ○ Vegetation next to water bodies
- ○ Vegetation structure/structural diversity

Indicator Key

- ● Included in this atlas
- ○ Not included in this atlas

Cultural (p.82)

- ○ Visibility of wildlife
- ○ Presence of flagship species
- ○ Presence of rare (red list) species
- ○ Species diversity
- ● Naturalness of watercourses
- ● Favourable condition of SSSIs/geosites/MPAs
- ○ Size of environmental space
- ○ Boundary features: type, length and condition
- ● Designated historic environment assets
- ● Tranquility
- ○ Perimeter access points
- ● Public Rights of Way
- ○ Presence of paths accessible to all
- ○ No. of organised events
- ○ Presence of clubs, schools, training centres
- ○ Active geomorphological processes

Indicator Gaps and Limitations

The Natural England Natural Capital Indicators report identified ideal indicators for measuring change in natural capital, as well as data to measure these indicators and gaps where data is not available. From the list on this page, it is evident that a number of indicators could not be included in this atlas because data was not available to measure them. Each indicator was investigated in turn and the datasets identified for mapping each indicator were tested. Many of the indicators were not mappable because the datasets were not appropriate, not readily accessible, or not available with national coverage. Some datasets existed for sub-national extents, but it was decided to use nationally-available data only for consistency and clarity (rather than merging datasets of differing resolution or accuracy). While every effort was made to use datasets that honoured the principles outlined in the Natural England report (e.g. transparent, knowable, scalable), some indicators ultimately used less favourable datasets when no alternative was available. Locally, additional data may exist which could not be used in these national scale maps.

Indicator Summary - Others

Other types of indicators are listed according to their broad habitat type and with references to the page where the mapped outputs appear in this report.

Asset Location (p.86)

- ○ Distribution of habitats in relation to water quality – source-pathway-receptor
- ○ Distribution of habitats and trees in relation to air quality, noise and temperature regulation
- ○ Distribution of habitats and boundary features in relation to soil erosion and landslip risk
- ○ Size and distribution of habitats in relation to flood protection of settlements and infrastructure
- ● Patch size, shape and edge
- ○ Proximity of boundary features and semi-natural habitats to insect pollinator crops
- ○ Transition and connectivity of aquatic, terrestrial and marine habitats
- ○ Area for dynamic movement and development of coastal habitats
- ○ Proximity and accessibility of habitats to people

Ecosystem Service Flows (p.90)

- ○ Number and type of reared animals
- ○ Production of crops
- ○ Production of fodder
- ● Production of timber, paper and other wood products
- ○ Wood-based fuel harvested
- ● Amount of water available for abstraction
- ○ Amount of fish and other marine products
- ○ Abundance of pollinators
- ● Carbon sequestered and greenhouse gases fixed
- ○ Local urban cooling
- ○ Maintenance of wildlife, habitats and species
- ○ Regulation of flooding
- ○ Stabilisation of soil/sediment
- ○ Noise abatement
- ○ Air quality
- ○ Water quality

Cultural

- ○ Number of visits
- ○ Duration of visits
- ○ Range of activities undertaken
- ○ Number of school visits
- ○ Number of research projects

Indicator Key

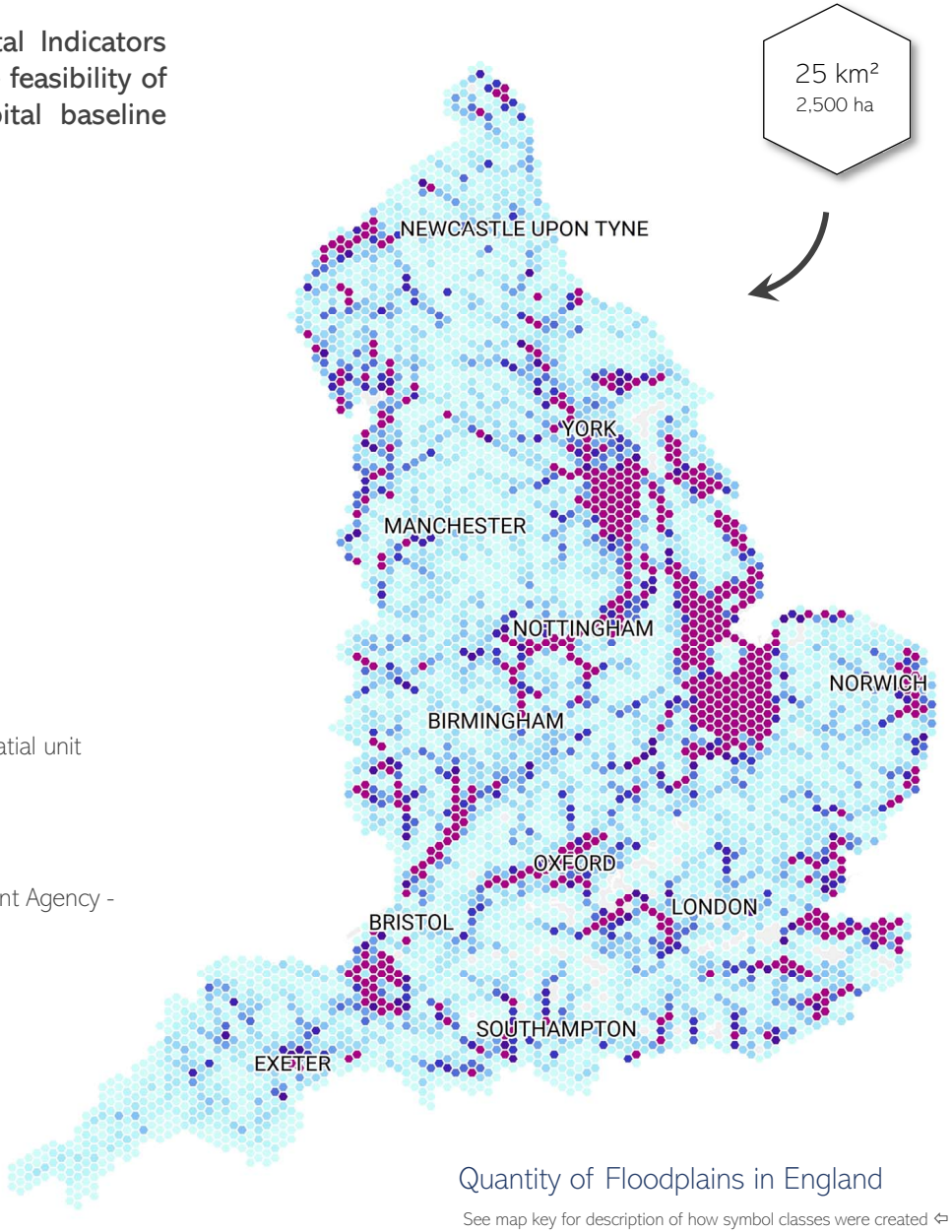
- ● Included in this atlas
- ○ Not included in this atlas

Photo: Terry Kearney – A walk in the Pikes (CC BY-NC 2.0)

Methodology

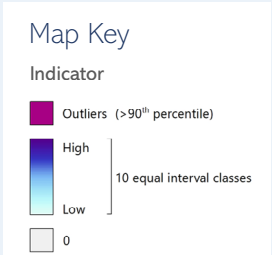
The indicators and datasets identified in Natural England's Natural Capital Indicators Project provide the foundation for this project. The main aim was to test the feasibility of using the datasets and indicators for producing a national natural capital baseline assessment. The following steps were taken to achieve this:

1. **Review indicators and datasets**
   - ⇨ A systematic process for evaluating the datasets and indicators was undertaken
   - ⇨ The feasibility of mapping each indicator was investigated
   - ⇨ New datasets were added and inappropriate datasets discounted
   - ⇨ Dataset queries and enquiries were made
2. **Access and collate datasets**
   - ⇨ National datasets were obtained from a variety of sources
   - ⇨ Datasets were processed for use in GIS software
3. **Define spatial analysis unit**
   - ⇨ The pros and cons of different unit shapes and sizes were reviewed
   - ⇨ Hexagonal units of 25km² were chosen and a national 'grid' was created
     N.b. this is not related to the resolution of the data itself, just the optimum size of the units for national display
4. **Calculate indicator values**
   - ⇨ Datasets were processed and indicator values were calculated and assigned to each spatial unit (e.g. area of habitat per hexagon)
5. **Create indicator maps and summary tables**
   - ⇨ The values were symbolised and indicator maps were created
   - ⇨ The values for the spatial units were summarised using regional boundaries (Environment Agency - Natural England areas – see map on p98) and summary data tables were produced



Quantity of Floodplains in England

See map key for description of how symbol classes were created ⇦
Majority (90%) of values range from **0 – 4.8 km²** per hexagon
The 'outliers' (top 10%) range from **4.8 – 25 km²** per hexagon



Map Symbol Classification

In order to see variation amongst the bulk of the data values, the highest 10% of values are separated from the rest and symbolised as 'outliers' in the key (coloured purple on the map). This is purely for visualisation purposes. The remaining values are divided into 10 equal interval classes and are symbolised using a colour gradient (shades of blue). Values of zero are shown as either grey or white – see each individual page key to clarify.

ASSET QUANTITY

This section breaks down England's natural environment into the eight broad habitat types used by the UK National Ecosystem Assessment. These broad habitat types sit within landscapes and are underpinned and influenced by geodiversity. This classification system breaks down ecosystems into component parts, but in reality all aspects of a place should to be considered together to fully understand the state of natural capital.

The 8 broad habitat types are:

- Freshwater
- Farmland
- Grassland
- Mountains, moors and heaths
- Woodland
- Urban
- Coastal
- Marine

ASSET QUANTITY: FRESHWATER

Freshwater habitats encompass all waterbodies and wetlands, such as rivers, lakes, ponds, fens, marshes and bogs. The importance of artificial freshwater habitats, such as canals and reservoirs, for some ecosystem services is also acknowledged. Despite occupying only 0.7% of land in England (CEH LCM2015), freshwater habitats are vital for many plant and animal species, including the water vole, Britain's fastest declining mammal.

Freshwater habitats can regulate flooding, erosion, sedimentation, local climates and water quality, while facilitating the dilution and disposal of pollutants. Additionally, rivers provide cultural value for recreation, tourism, and education (UK NEA, 2011). This assessment primarily focuses on freshwater habitats themselves (i.e. water bodies and wetlands). However, indicators of importance for water quality, water supply and flood protection are considered in this chapter for whole freshwater catchments.

Photo: Roger Bunting – Grebes' nest on Godfrey's pond (CC BY-NC-ND 2.0)

Ecosystem Services

The following are key ecosystem services that can be assessed using the freshwater quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Water Supply

Water for drinking & non-drinking purposes

Flood Protection

Climate Regulation

Global, regional & local climate regulation

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Asset Quantity Indicators - Freshwater

This page illustrates how the indicators for freshwater habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below.

The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Extent: Indicator ↓	Water supply *	Water quality *	Flood protection *	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
Active flood plain			●			
Coastal and floodplain grazing marsh			●	●	●	●
Lakes and standing waters	●			●		●
Lowland fens				●	●	●
Lowland raised bog				●	●	●
Modified waters (e.g. reservoirs and canals)	●			●		●
Ponds				●		●
Reedbeds				●	●	●
Rivers	●			●		●
Blanket bog **	●	●	●			
Woodland **	●	●	●			
Other semi-natural habitats **	●	●	●			

Catchment services

Please note:

Land across the wider catchment can play a vital role in providing catchment services: water supply, regulating water quality and flood protection.

Blanket bog and woodland are particularly important, however all other semi-natural habitats also play a role in contributing to these services.

The other ecosystem services provided by woodland and blanket bog are listed in the relevant broad habitat sections.

* Ecosystem service that relates to the entire hydrological catchment

** Indicator that relates to the entire hydrological catchment

ASSET QUANTITY

Indicators showing freshwater habitat quantity in England

Map Key

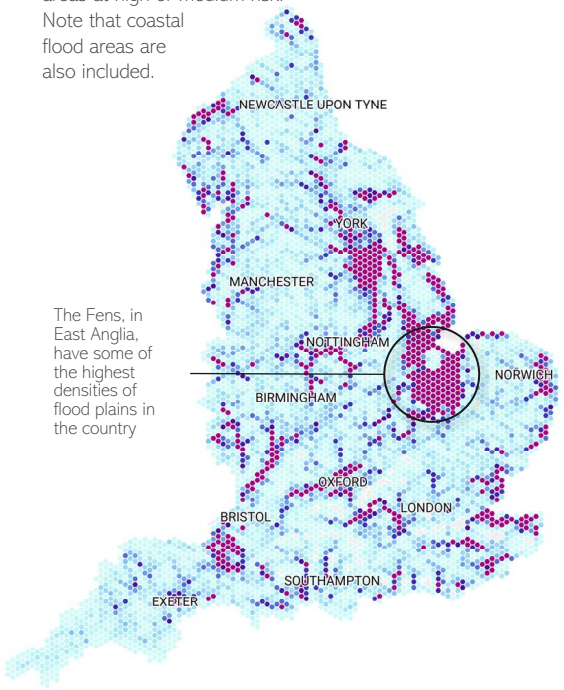
Indicator value:

- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Active Flood Plain (ID: 1)

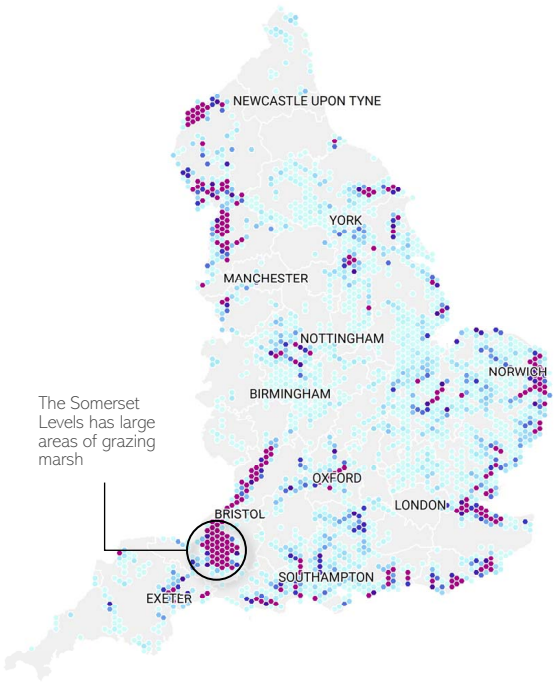
The Environment Agency (EA)'s Risk of Flooding from Rivers and Sea dataset can be used to highlight the distribution of river flood plains. This map shows areas at high or medium risk. Note that coastal flood areas are also included.



Hexagon values: 0 – 4.8 km²; Outliers: 4.8 – 25 km²

Coastal and Floodplain Grazing Marsh (ID: 2)

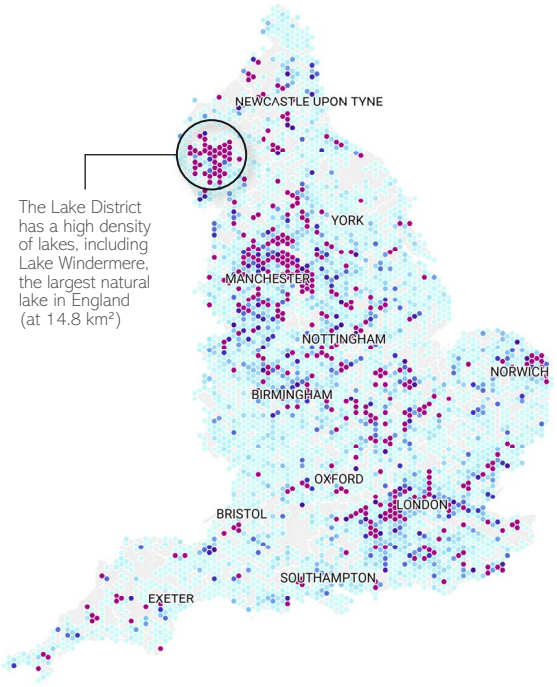
Area of coastal floodplain and grazing marsh mapped using Natural England's Priority Habitat Inventory.



Hexagon values: 0 – 0.9 km²; Outliers: 0.9 – 19.3 km²

Lakes and Standing Waters (ID: 3)

Area of lakes and reservoirs mapped using the Centre for Ecology and Hydrology (CEH)'s UK Lakes Portal dataset.



Hexagon values: 0 – 0.2 km²; Outliers: 0.2 – 7.3 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

- Cultural services

Geodiversity:

- Geodiversity services

ASSET QUANTITY

Indicators showing freshwater habitat quantity in England

Map Key

Indicator value:

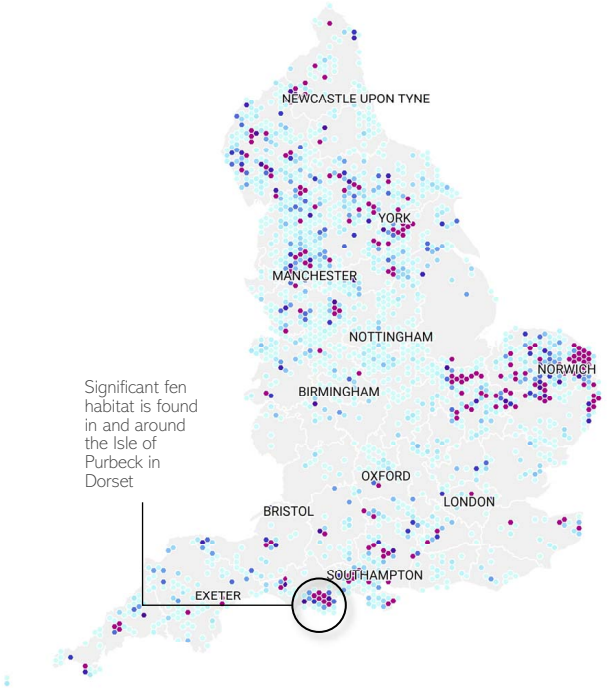
- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Lowland Fens (ID: 4)

H C C

Area of lowland fens mapped using Natural England's Priority Habitat Inventory.



Hexagon values: 0 – 0.08 km²; Outliers: 0.08 – 6.15 km²

Lowland Raised Bog (ID: 5)

H C C

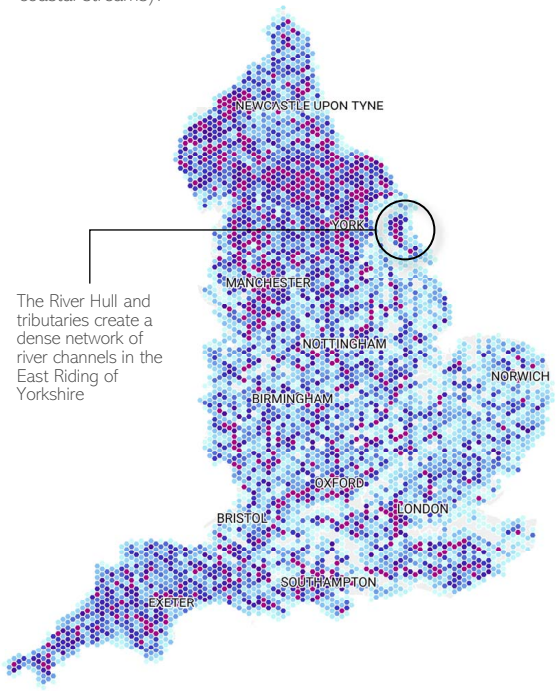
Area of lowland raised bog mapped using Natural England's Priority Habitat Inventory.

Hexagon values: 0 – 1.8 km²; Outliers: 1.8 – 16.1 km²

Rivers (ID: 6)

S H C

Length of rivers mapped using EA's Water Framework Directive (WFD) river waterbodies dataset (cycle 1, to include coastal streams).



Hexagon values: 0 – 16 km; Outliers: 16 – 34 km

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUANTITY

Indicators showing freshwater habitat quantity in England

Map Key

Indicator value:

- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

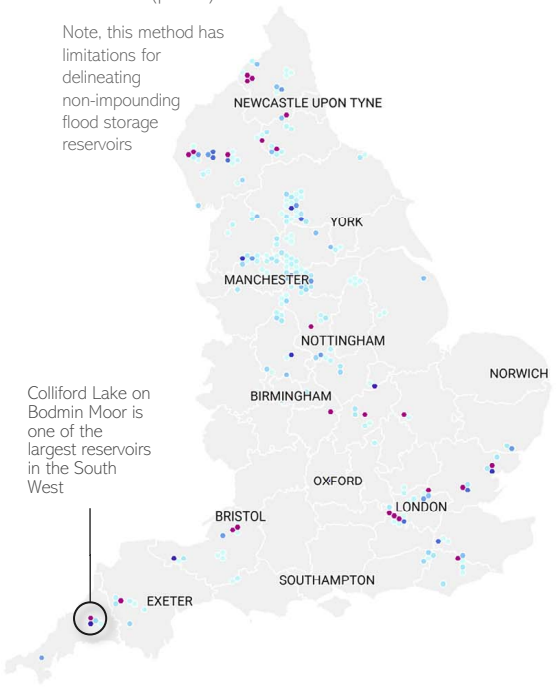
25 km²
2,500 ha

Modified Waters (Reservoirs) (ID: 7)

S H C

Area of reservoirs mapped by selecting Ordnance Survey (OS) surface water polygons (VectorMap District) that coincide with CEH's Inventory of UK reservoirs (points).

Note, this method has limitations for delineating non-impounding flood storage reservoirs

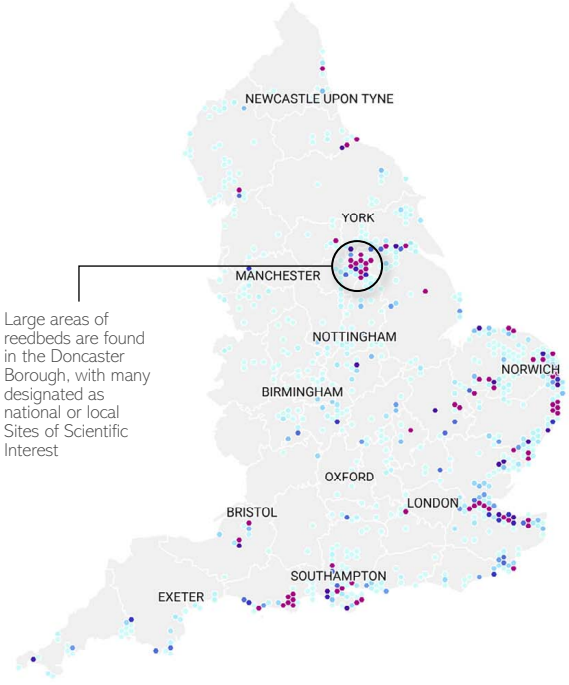


Hexagon values: 0 – 1.76 km²; Outliers: 1.76 – 6.19 km²

Reedbeds (ID: 8)

H C C

Area of reedbed habitat mapped using NE's Priority Habitat Inventory

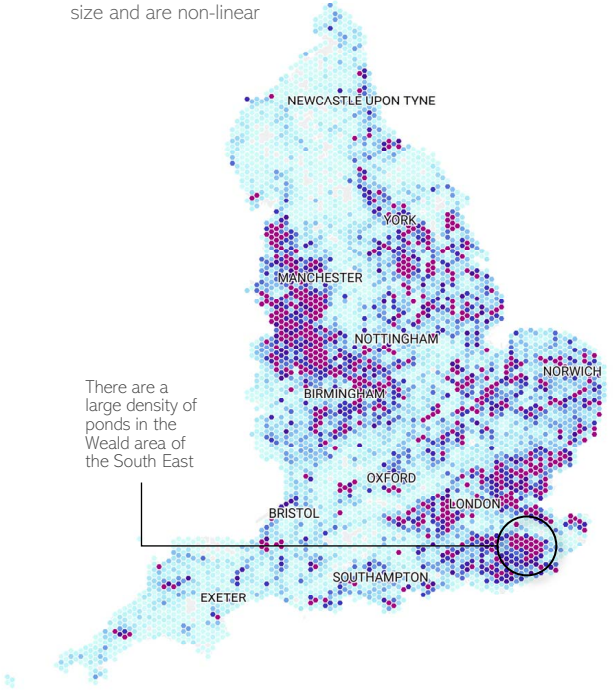


Hexagon values: 0 – 0.3 km²; Outliers: 0.3 – 1.9 km²

Ponds (ID: 9)

H C

Area of ponds mapped by selecting surface waterbodies (from OS VectorMap District) that do not intersect rivers, are smaller than 2ha in size and are non-linear



Hexagon values: 0 – 0.08 km²; Outliers: 0.08 – 0.43 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUANTITY

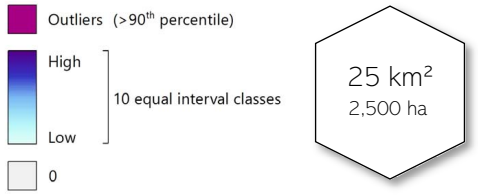
Indicators showing freshwater habitat quantity in England

River Catchments

The indicators shown on this page refer to the whole hydrological catchment, not just fresh water habitats themselves. Land across the wider catchment can play a vital role in regulating water supply, quality and flows.

Map Key

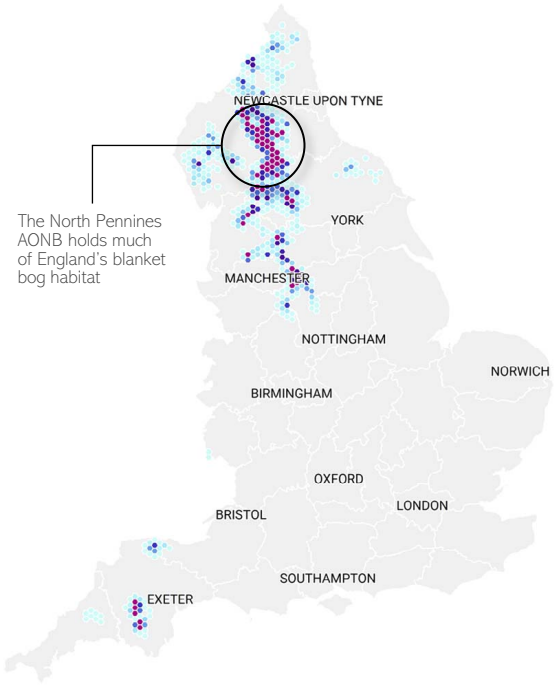
Indicator value:



Blanket Bog (ID: 10)

S W F

Area of blanket bog mapped using Natural England's Priority Habitat Inventory.

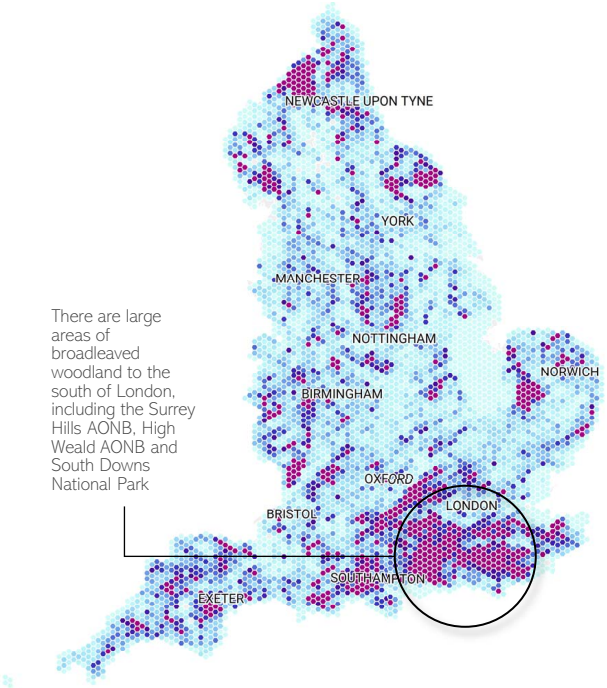


Hexagon values: 0 – 15.7 km²; Outliers: 15.7 – 24.6 km²

Woodland (ID: 11)

S W F

Area of woodland mapped using Forestry Commission (FC)'s National Forest Inventory.

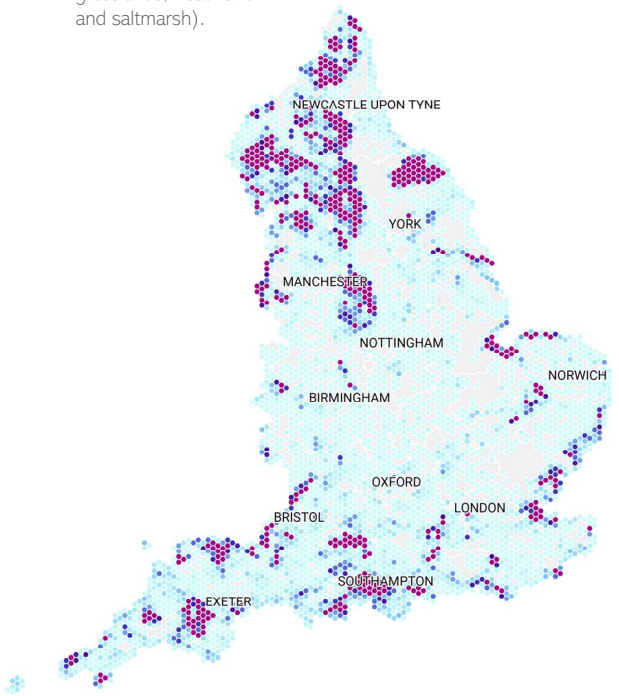


Hexagon values: 0 – 5.1 km²; Outliers: 5.1 – 23.4 km²

Other Semi-Natural Habitats (ID: 12)

S W F

Area of other semi-natural habitat mapped using Natural England's Priority Habitat Inventory (including upland and lowland grasslands, heathland and saltmarsh).



Hexagon values: 0 – 4.1 km²; Outliers: 4.1 – 23.0 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

INDICATOR SUMMARY

A table summarising the freshwater habitat quantity indicators in England

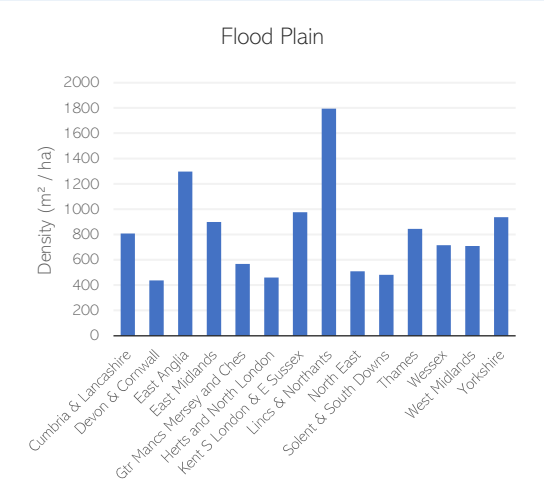
Location (see map of areas on p98)	Area (km²)	Indicator																					
		Active Flood Plain		Coastal and Floodplain Grazing Marsh		Lakes and Standing Waters		Lowland Fens		Lowland Raised Bog		Modified Waters		Ponds		Reedbeds		Rivers		Blanket Bog		Woodland		Other Semi-Natural Habitats	
		Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Length (km)	Density (m/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Length (km)	Density (m/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)
England	132,948	11,676	878	2,182	164	492	37	222	17	97	7	16,189	1	178	13	70	5	47,607	4	2,771	208	13,053	982	6,120	460
Cumbria and Lancashire	10,446	843	807	**335**	**320**	**84**	**81**	**23**	**22**	**46**	**44**	1,380	1	8	8	1	1	**4,870**	**5**	**809**	**775**	892	854	**924**	**885**
Devon and Cornwall	10,476	458	437	66	63	18	17	9	9	0	0	282	0	7	6	2	2	4,635	**4**	179	171	1,130	1,078	648	618
East Anglia	17,495	**2,268**	**1,296**	**382**	218	**58**	33	**76**	**43**	1	0	**2,765**	**2**	**33**	**19**	**22**	**13**	4,584	3	0	0	**1,339**	765	416	238
East Midlands	6,947	624	898	29	42	31	45	4	6	0	0	781	1	10	14	2	3	2,477	**4**	141	203	566	815	181	261
Greater Manchester Merseyside and Cheshire	4,474	254	567	28	63	24	55	11	**25**	**10**	**22**	1,204	**3**	12	**27**	0	1	1,867	**4**	59	131	302	676	157	350
Hertfordshire and North London	3,332	153	460	13	40	19	**56**	2	5	0	0	491	1	5	16	1	2	997	3	0	0	360	1,080	17	50
Kent, South London and East Sussex	7,045	687	**976**	198	**281**	23	33	7	10	0	0	826	1	14	**20**	**9**	**12**	1,783	3	0	0	1,034	1,468	239	340
Lincolnshire and Northamptonshire	10,286	**1,846**	**1,794**	74	72	40	39	7	7	2	2	**1,598**	**2**	**16**	15	2	2	2,928	3	0	0	494	480	152	148
North East	8,676	441	509	16	18	33	38	7	8	1	2	872	1	6	7	2	3	3,411	**4**	**689**	**794**	1,162	**1,339**	**802**	**925**
Solent and South Downs	6,273	302	481	115	184	15	24	12	19	0	0	387	1	8	12	5	8	1,880	3	0	0	**1,211**	**1,931**	369	589
Thames	7,262	613	844	83	114	**46**	**64**	6	8	0	0	756	1	9	13	1	2	2,604	**4**	0	0	983	**1,354**	120	166
Wessex	11,208	801	714	**553**	**494**	20	18	19	17	2	2	596	1	9	8	**9**	8	3,903	3	36	32	1,035	924	754	673
West Midlands	14,544	1,030	708	156	107	39	27	11	7	5	3	1,433	1	**27**	18	1	1	**5,008**	3	7	5	**1,423**	978	217	149
Yorkshire	14,483	**1,356**	936	134	93	42	29	**29**	20	**30**	**21**	**2,817**	**2**	15	10	**12**	**9**	**6,658**	**5**	**850**	**587**	1,120	774	**1,122**	**775**

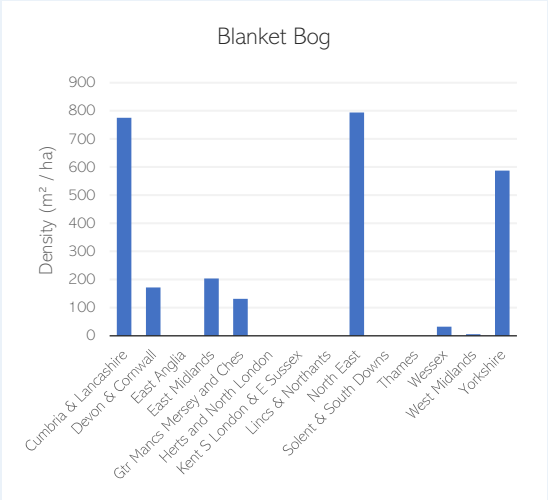
Note: Highest three values for each indicator are highlighted and **bold**.

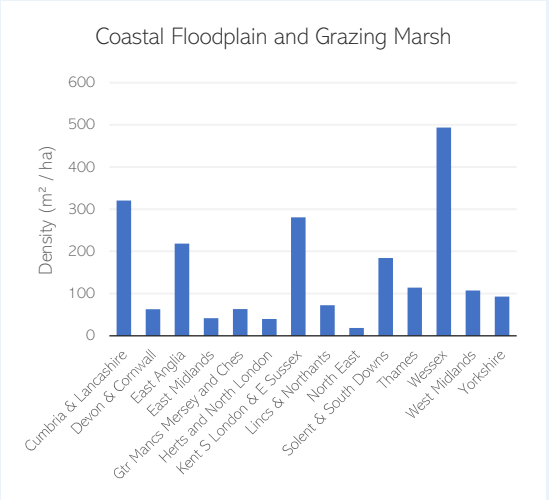
Note: Values are rounded to the nearest whole number, which in some cases is zero (explaining differences between area and density values, in such cases).

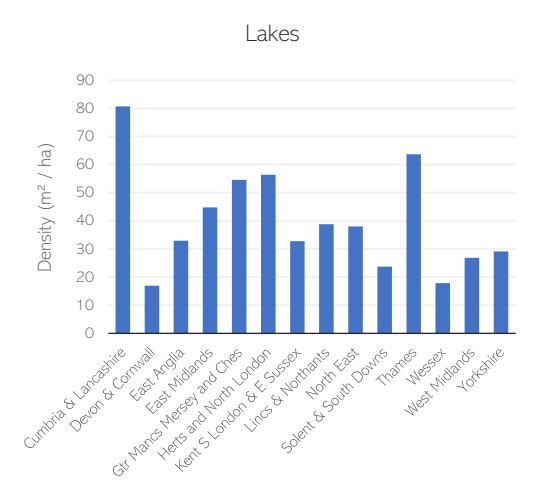
INDICATOR SUMMARY

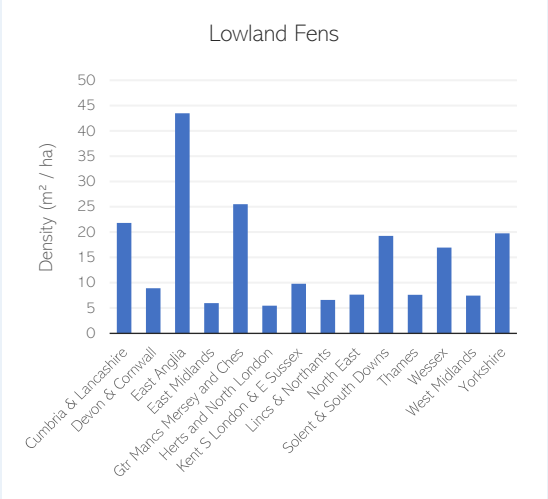
Charts showing the freshwater habitat quantity indicators for areas of England

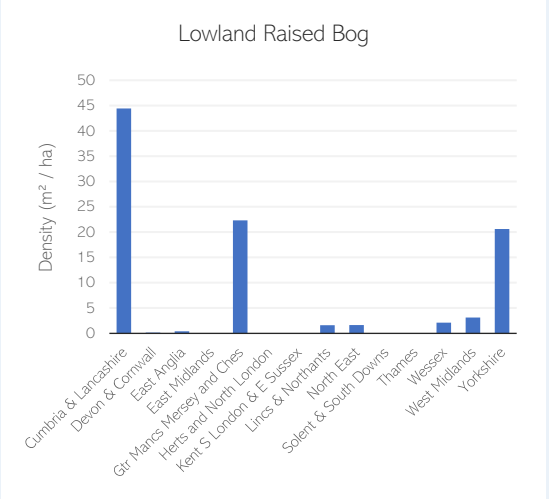






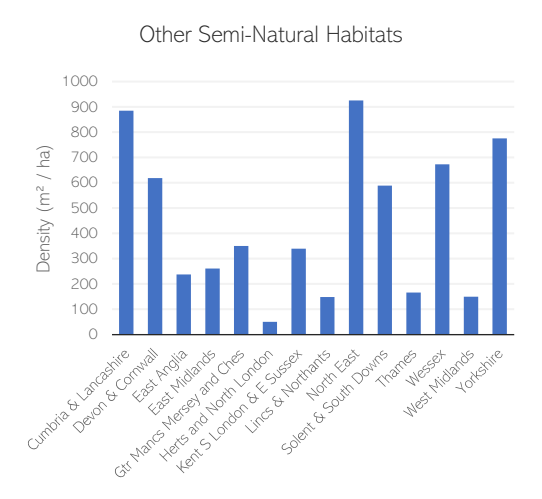


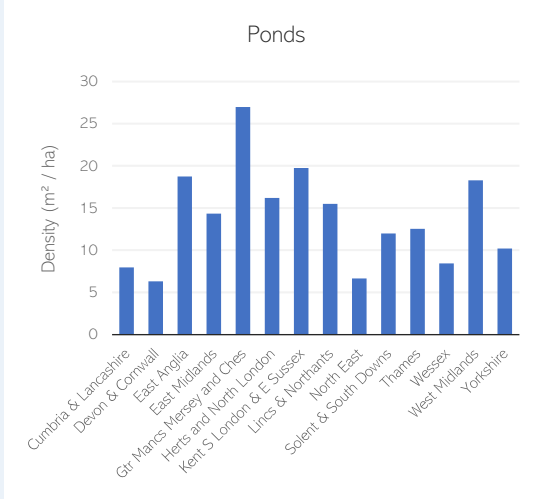


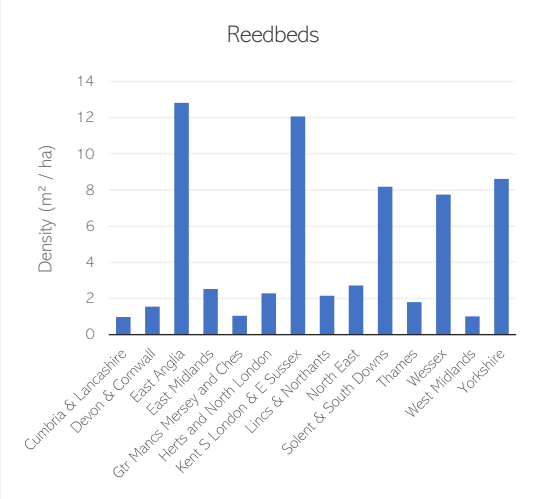


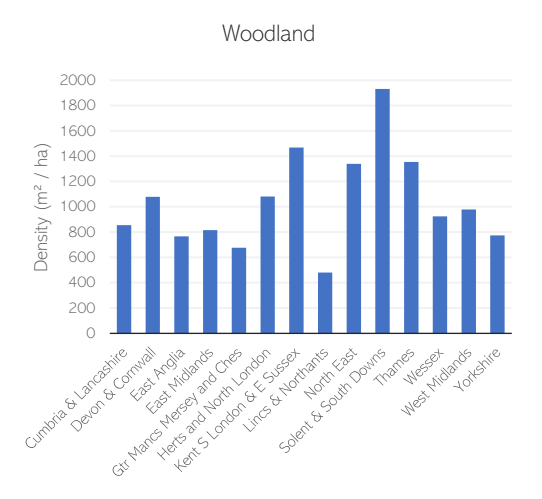
INDICATOR SUMMARY

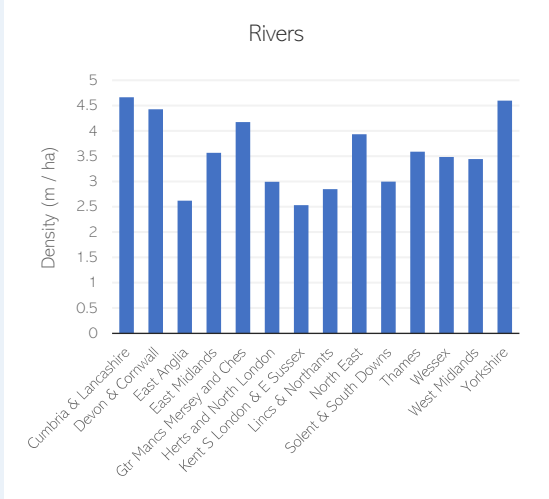
Charts showing the freshwater habitat quantity indicators for areas of England

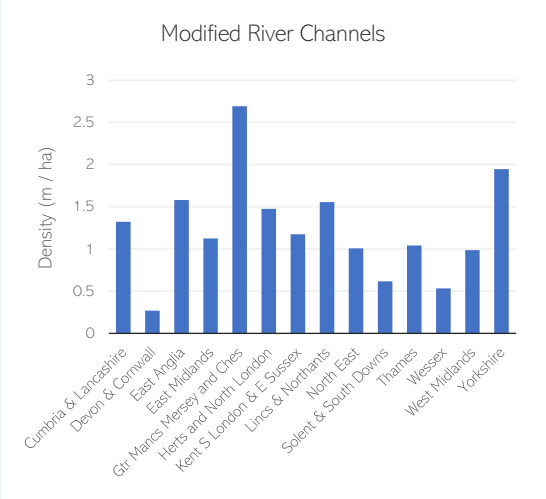












ASSET QUANTITY: FARMLAND

About 70% of land in the UK is used for agriculture (Defra, 2017), producing a variety of goods for consumers across the UK and around the world. Farmland takes many forms, from grazing pastures to arable fields and orchards; it varies greatly in character across the country. Well managed farmland provides habitat for a variety of animals and plants, including the brown hare, a Biodiversity Action Plan Priority Species.

In addition to primary agricultural products, farmland provides many other services to society. If managed effectively, farmland can help to prevent soil erosion by stabilising soils, support flood risk alleviation through surface water storage and runoff attenuation, and sequester carbon, assisting in global climate regulation (UK NEA, 2011). Furthermore, farmlands hold significant cultural and heritage value. They are often considered a key component of England's traditional countryside landscape, as well as a place for recreation via rural Public Rights of Way.


Photo: Dave_S. – Yorkshire Dales (CC BY 2.0)

Ecosystem Services

The following are key ecosystem services that can be assessed using the farmland quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Cultivated Crops

Mass Stabilisation

Mass stabilisation and control of erosion rates

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Reared Animals & their Outputs

Climate Regulation

Global, regional & local climate regulation

Asset Quantity Indicators - Farmland

This page illustrates how the indicators for farmland habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Extent	Indicator	Cultivated crops	Reared animals and outputs	Mass stabilisation	Climate regulation	Cultural services
	Arable and rotational leys	●				●
	Horticulture	●				
	Improved grassland		●	●	●	●
	Orchards and top fruit	●		●	●	●

* Ecosystem service that was considered under the 'freshwater hydrological catchment' chapter

ASSET QUANTITY

Indicators showing farmland habitat quantity in England

Map Key

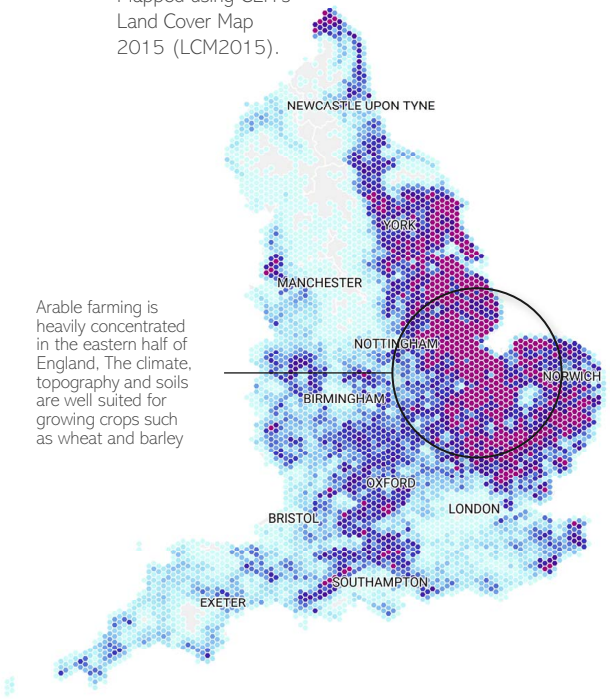
Indicator value:

- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Arable and Horticulture (ID: 13)

Area of arable and rotational leys, and horticulture individually, this map shows the area of arable and horticulture combined. Mapped using CEH's Land Cover Map 2015 (LCM2015).

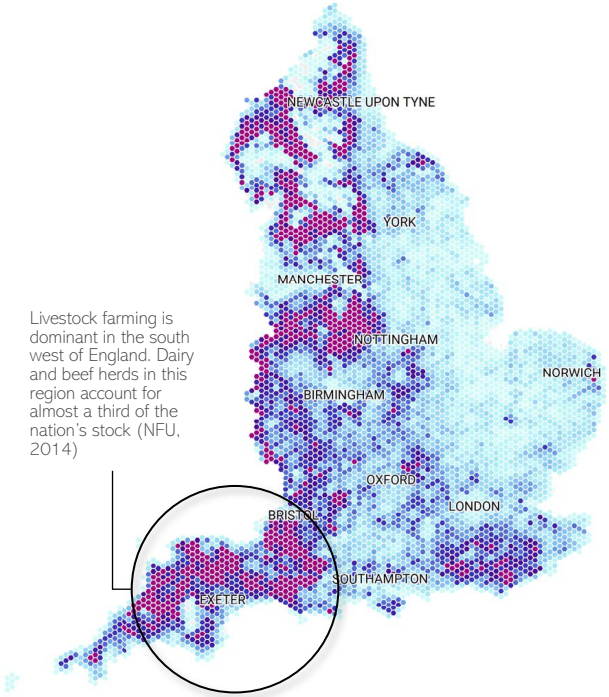


Arable farming is heavily concentrated in the eastern half of England, The climate, topography and soils are well suited for growing crops such as wheat and barley

Hexagon values: 0 – 19.2 km²; Outliers: 19.2 – 24.7 km²

Improved Grassland (ID: 14)

Area of improved grassland mapped using CEH's LCM2015.

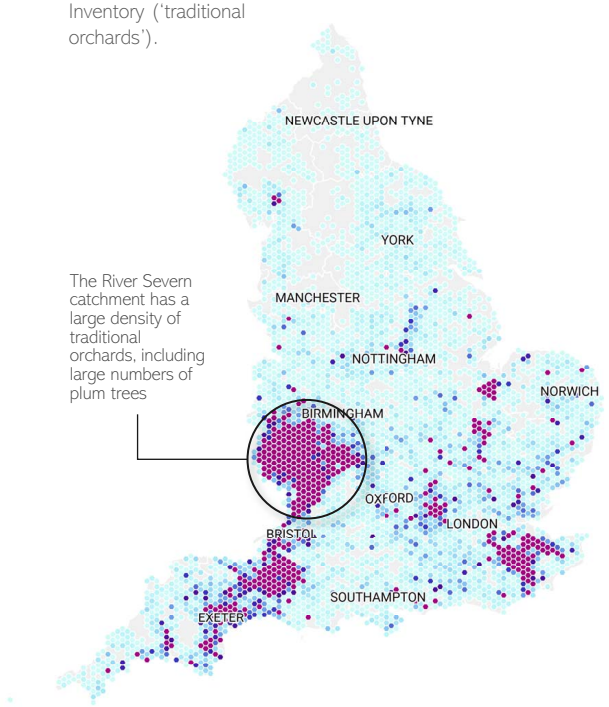


Livestock farming is dominant in the south west of England. Dairy and beef herds in this region account for almost a third of the nation's stock (NFU, 2014)

Hexagon values: 0 – 16.1 km²; Outliers: 16.1 – 23.6 km²

Orchards and Top Fruit (ID: 15)

Area of orchards and top fruit mapped using Natural England's Priority Habitat Inventory ('traditional orchards').



The River Severn catchment has a large density of traditional orchards, including large numbers of plum trees

Hexagon values: 0 – 0.09 km²; Outliers: 0.09 – 1.99 km²

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

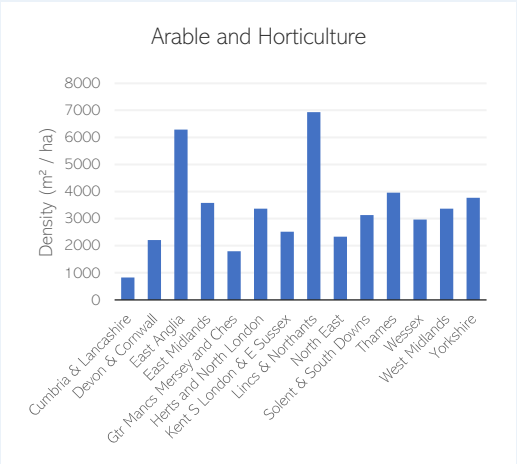
- C Cultural services

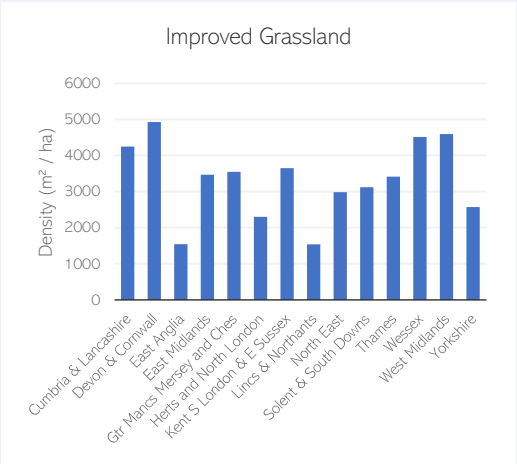
Geodiversity:

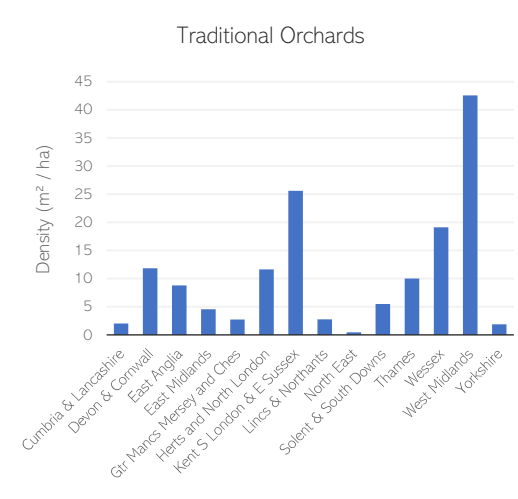
- G Geodiversity services

INDICATOR SUMMARY

Charts showing the farmland habitat quantity indicators for areas of England







Location (see map of areas on p98)	Area (km²)	Indicator: Arable and Horticulture Area (km²)	Arable and Horticulture Density (m²/ha)	Improved Grassland Area (km²)	Improved Grassland Density (m²/ha)	Orchards and Top Fruit Area (km²)	Orchards and Top Fruit Density (m²/ha)
England	132,948	48,033	3,613	43,670	3,285	156	12
Cumbria and Lancashire	10,446	860	823	4,435	4,245	2	2
Devon and Cornwall	10,476	2,313	2,208	**5,157**	**4,922**	12	12
East Anglia	17,495	**11,002**	**6,289**	2,692	1,539	15	9
East Midlands	6,947	2,488	3,581	2,407	3,464	3	5
Greater Manchester Merseyside and Cheshire	4,474	804	1,797	1,586	3,544	1	3
Hertfordshire and North London	3,332	1,122	3,367	765	2,297	4	12
Kent, South London and East Sussex	7,045	1,772	2,516	2,570	3,648	**18**	**26**
Lincolnshire and Northamptonshire	10,286	**7,128**	**6,930**	1,579	1,535	3	3
North East	8,676	2,022	2,330	2,587	2,982	0	0
Solent and South Downs	6,273	1,965	3,132	1,956	3,118	3	5
Thames	7,262	2,873	**3,957**	2,479	3,414	7	10
Wessex	11,208	3,323	2,964	**5,057**	**4,512**	**21**	**19**
West Midlands	14,544	4,900	3,369	**6,677**	**4,591**	**62**	**43**
Yorkshire	14,483	**5,462**	3,771	3,724	2,571	3	2

Note: Highest three values for each indicator are highlighted and **bold**

ASSET QUANTITY: GRASSLAND

Grassland habitats comprise almost 40% of England's land cover (CEH LCM2015), taking a variety of forms ranging from rough moorland grazing to urban parks and gardens. This chapter focuses on semi-natural grasslands, which are scarcer than other grassland types, accounting for only 5% of England's land cover. Encompassing acid, neutral and calcareous grasslands along with purple moor grass and rush pastures, semi-natural grasslands represent an important habitat for many plants and animals.

Semi-natural grasslands provide a range of ecosystem services, primarily related to livestock production and cultural heritage. Semi-natural grasslands provide open space for recreation and exercise, yielding physical and mental benefits for visitors and residents, as well as potential economic gain - in the South Downs National Park, tourists drawn to green spaces provided by this grassland generate over £300 million each year (UK NEA, 2011).

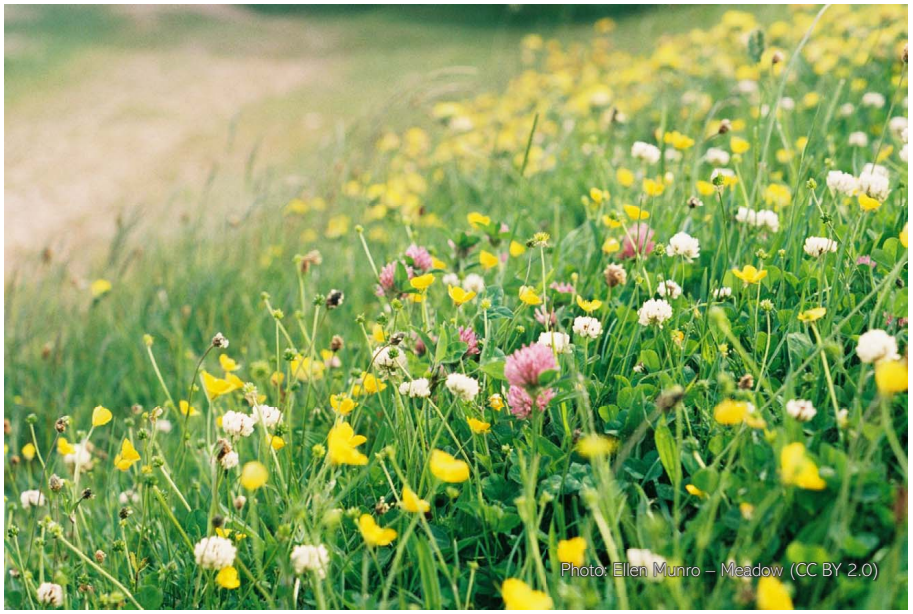


Photo: Ellen Munro – Meadow (CC BY 2.0)

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Ecosystem Services

The following are key ecosystem services that can be assessed using the grassland quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Materials from Plants, Animals & Algae

Hay and other materials

Pollination & Seed Dispersal

Climate Regulation

Global, regional & local climate regulation

Reared Animals & their Outputs

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Asset Quantity Indicators - Grassland

This page illustrates how the indicators for grassland habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Indicator	Materials from plants animals and algae	Reared animals and outputs	Pollination and seed dispersal	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
Extent: Hay meadows	●	●	●	●	●	●
Extent: Other semi-natural grasslands		●	●	●	●	●

Catchment Services

Please note:

These semi-natural habitats also contribute to providing catchment services: water supply, water quality and flood protection.

Please refer to the Freshwater section.

* Ecosystem service that was considered under the 'freshwater hydrological catchment' chapter

ASSET QUANTITY

Indicators showing grassland habitat quantity in England

Map Key

Indicator value:

Outliers (>90th percentile)

High

10 equal interval classes

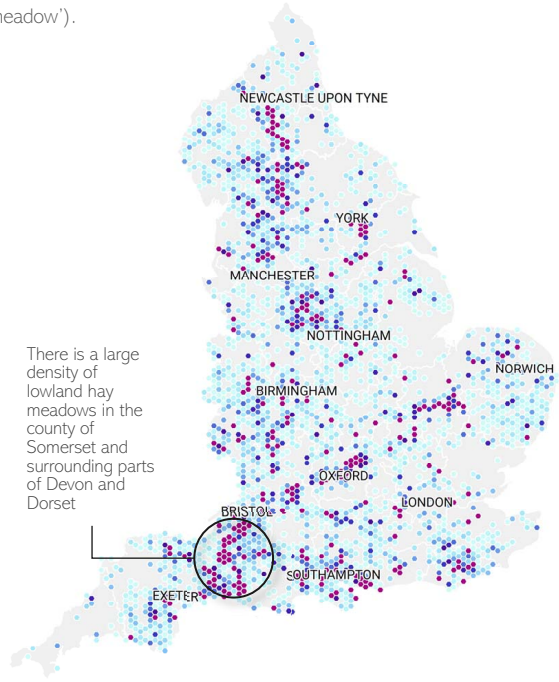
Low

0

25 km²
2,500 ha

Hay Meadows (ID: 16)

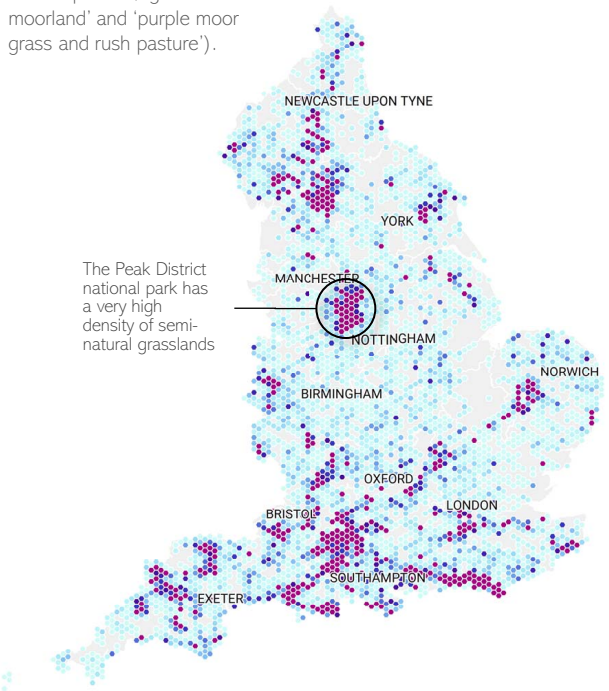
Area of hay meadow mapped using Natural England's Priority Habitat Inventory ('upland meadow' and 'lowland meadow').



Hexagon values: 0 – 0.35 km²; Outliers: 0.35 – 5.64 km²

Other Semi-Natural Grassland (ID: 17)

Area of other semi-natural grassland, mapped using Natural England's Priority Habitat Inventory ('upland calcareous', 'lowland calcareous', 'lowland dry acid', 'good quality semi-improved', 'grass moorland' and 'purple moor grass and rush pasture').



Hexagon values: 0 – 0.87 km²; Outliers: 0.87 – 22.19 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

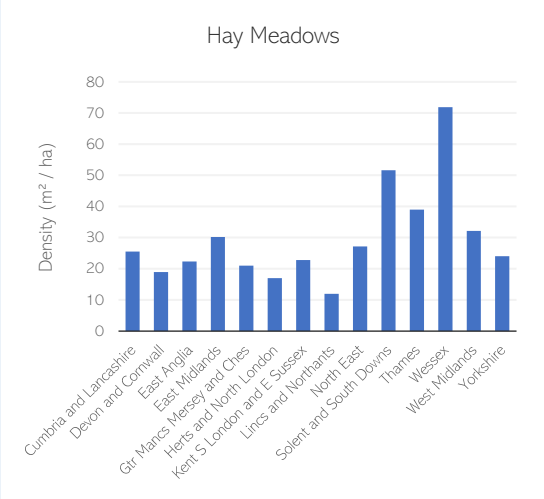
- Cultural services

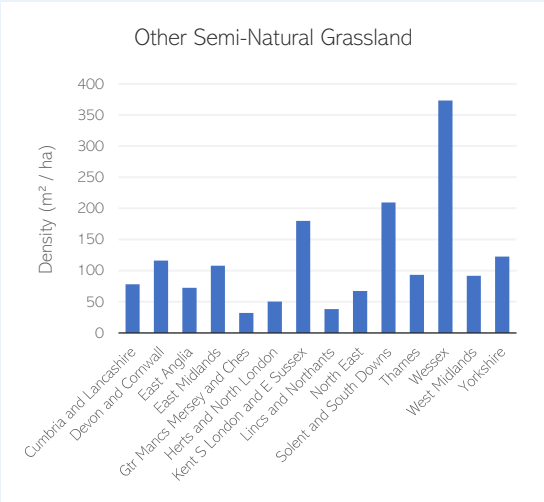
Geodiversity:

- Geodiversity services

INDICATOR SUMMARY

Table and charts summarising the grassland habitat quantity indicators for areas of England





		Indicator			
		Hay Meadows		Other Semi-Natural Grassland	
Location (see map of areas on p98)	Area (km²)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)
England	132,948	396	30	1,588	119
Cumbria and Lancashire	10,446	27	25	82	78
Devon and Cornwall	10,476	20	19	122	116
East Anglia	17,495	**39**	22	126	72
East Midlands	6,947	21	30	75	108
Greater Manchester Merseyside and Cheshire	4,474	9	21	14	32
Hertfordshire and North London	3,332	6	17	17	50
Kent, South London and East Sussex	7,045	16	23	127	**180**
Lincolnshire and Northamptonshire	10,286	12	12	39	38
North East	8,676	24	27	58	67
Solent and South Downs	6,273	32	**52**	131	**209**
Thames	7,262	28	**39**	68	93
Wessex	11,208	**81**	**72**	**418**	**373**
West Midlands	14,544	**47**	32	**133**	92
Yorkshire	14,483	35	24	**177**	123

Note: Highest three values for each indicator are highlighted and **bold**

ASSET QUANTITY: MOUNTAINS, MOOR & HEATH

Mountains, moorlands and heaths cover 18% of the UK's land area (CEH LCM2015), ranging from highly fragmented lowland heaths to upland moors and heathland, representing some of the largest contiguous semi-natural habitats in the UK. Mountains, moorlands and heaths are the source of around 70% of the UK's drinking water, hold an estimated 40% of UK soil carbon (UK NEA, 2011) and host numerous rare plants and animals, such as the ring ouzel bird.

Mountains, moor and heath provide a wide range of ecosystem services, including food provision (from livestock, crops and game), fibre provision (sheep wool) and the regulation of water quality and river flows, as well as a host of cultural, historical and recreational services. Such cultural services can be lucrative - the Lake District National Park attracted 19 million tourists in 2017, generating £1.4 billion (STEAM 2017: Cumbria Tourism).

Ecosystem Services

The following are key ecosystem services that can be assessed using the mountain, moor and heath quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Water Supply

Water for drinking & non-drinking purposes

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Flood Protection

Climate Regulation

Global, regional & local climate regulation

Reared Animals & their Outputs

Mass Stabilisation

Mass stabilisation and control of erosion rates

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry); spiritual and/or emblematic.

Asset Quantity Indicators - Mountains, Moor and Heath

This page illustrates how the indicators for mountain, moor and heath habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below.

The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

	Indicator	Water supply *	Reared animals and outputs	Water quality *	Mass stabilisation	Flood protection *	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
Extent	Blanket bog	●		●	●	●	●	●	●
	Dwarf shrub heath		●		●	●	●	●	●
	Inland rock, scree and pavement AML**						●		●
	Lakes and reservoirs AML**	●					●		●
	Mountain heath and willow scrub					●	●	●	●
	Rivers AML**	●					●		●
	Semi-natural grassland AML**		●		●	●	●	●	●
	Upland flushes fens and swamps	●				●	●	●	●
	Wood pasture AML**								●
	Woodland AML**			●	●	●	●	●	●

Catchment Services

Please note:

In upland headwater areas some habitats are particularly important for providing catchment services: water supply, regulating water quality and flood protection. These are highlighted in the table. Other semi-natural habitats also contribute to providing catchment services.

Please refer to the Freshwater section.

* Ecosystem service that was considered under the 'freshwater hydrological catchment' chapter

** AML = Above moorland line

ASSET QUANTITY

Indicators showing mountain, moor and heath habitat quantity in England

Duplication

Some of the moorland indicators duplicate habitats that are included in the freshwater indicators, e.g. blanket bog, lakes and rivers. If used for accounting purposes, the moorland components of the freshwater indicators would need to be excluded.

Map Key

Indicator value:

Outliers (>90th percentile)

High

Low

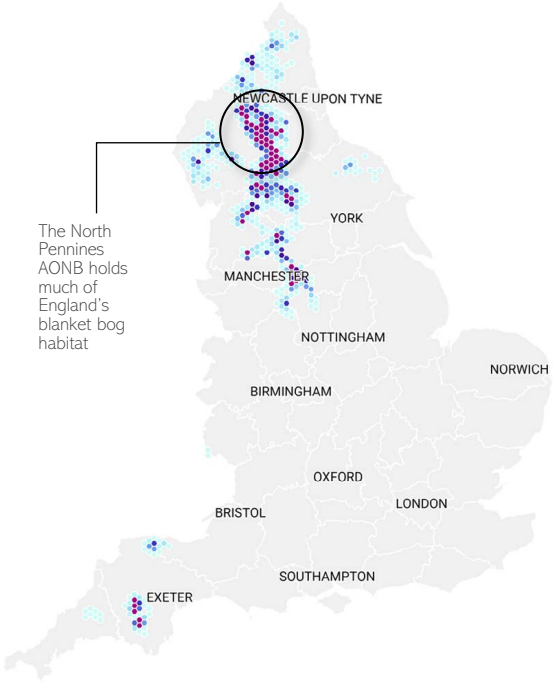
10 equal interval classes

0

25 km²
2,500 ha

Blanket Bog (ID: 18)

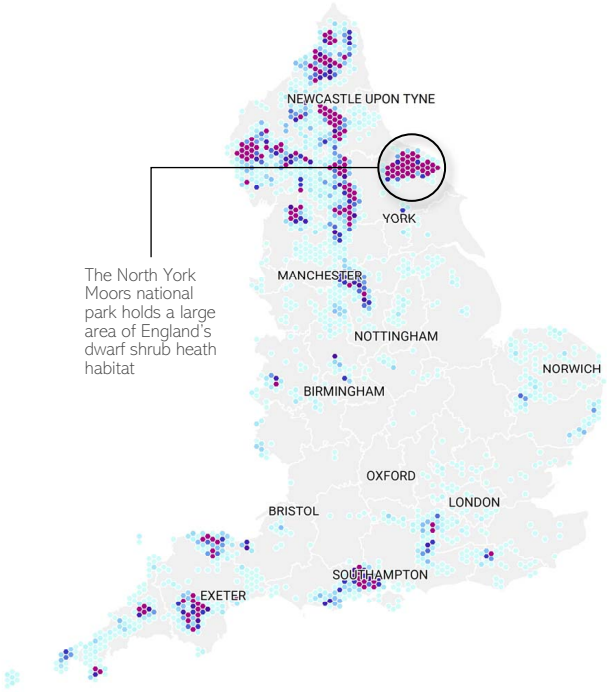
Area of blanket bog mapped using Natural England's Priority Habitat Inventory.



Hexagon values: 0 – 15.7 km²; Outliers: 15.7 – 24.6 km²

Dwarf Shrub Heath (ID: 19)

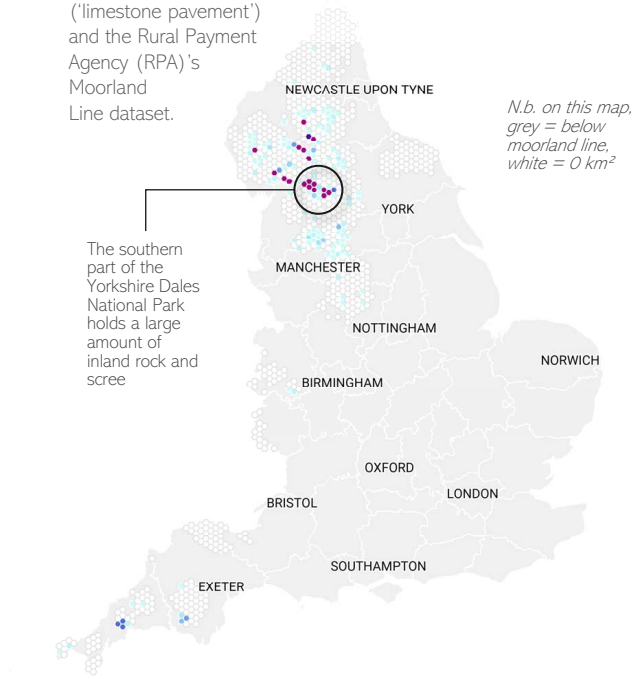
Area of dwarf shrub heath mapped using Natural England's Priority Habitat Inventory ('fragmented heath', 'lowland heathland' and 'upland heathland').



Hexagon values: 0 – 6.5 km²; Outliers: 6.5 – 22.5 km²

Inland Rock, Scree and Pavement (Above Moorland Line) (ID: 20)

Area of inland rock and limestone pavement above the moorland line, mapped using CEH's LCM2015 ('inland rock'), Natural England's Priority Habitats Inventory ('limestone pavement') and the Rural Payment Agency (RPA)'s Moorland Line dataset.



Hexagon values: 0 – 0.60 km²; Outliers: 0.60 – 6.94 km²

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

- Cultural services

Geodiversity:

- Geodiversity services

ASSET QUANTITY

Indicators showing mountain, moor and heath habitat quantity in England

Map Key

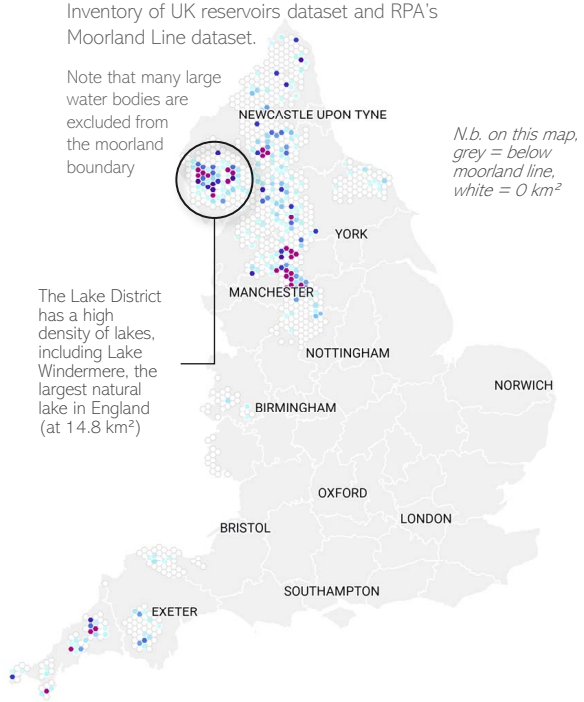
Indicator value:

- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Lakes and Reservoirs (Above Moorland Line) (ID: 21)

Area of lakes and reservoirs above the moorland line, mapped using CEH's UK Lakes dataset, CEH's Inventory of UK reservoirs dataset and RPA's Moorland Line dataset.



Hexagon values: 0 – 0.04 km²; Outliers: 0.04 – 0.27 km²

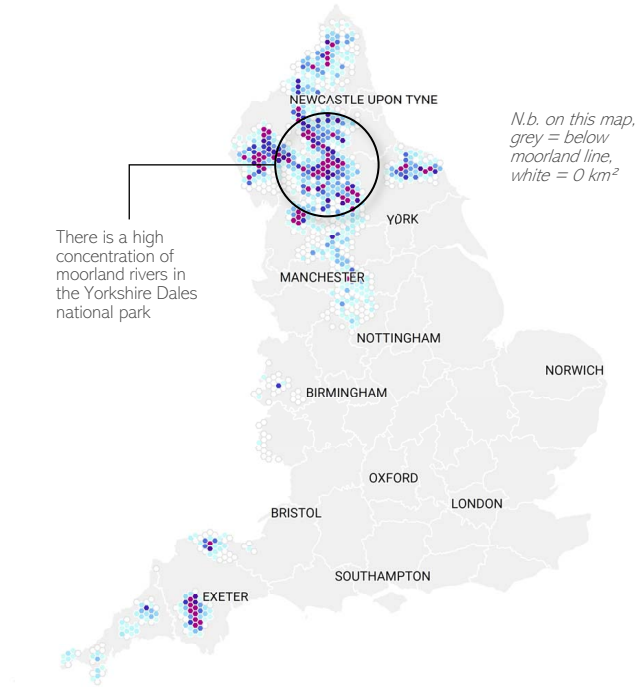
Mountain Heath and Willow Scrub (ID: 22)

Area of mountain heath and willow scrub mapped using Natural England's Priority Habitat Inventory.

Hexagon values: 0 – 4.42 km²; Outliers: 4.42 – 12.31 km²

Rivers (Above Moorland Line) (ID: 23)

Length of rivers mapped using EA's WFD river waterbodies dataset and RPA's Moorland Line dataset.



Hexagon values: 0 – 8.3 km; Outliers: 8.3 – 17.1 km

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- (M) Materials from plants, animals and algae
- (W) Wild animals, plants, algae and outputs
- (P) Plant-based energy
- (A) Aquaculture
- (C) Cultivated crops
- (S) Water supply
- (R) Reared animals and outputs

Regulating:

- (W) Water quality
- (A) Air quality
- (N) Noise regulation
- (M) Mass stabilisation
- (F) Flood protection
- (P) Pollination and seed dispersal
- (H) Maintenance of nursery pops and habitats
- (D) Pest and disease control
- (C) Climate regulation

Cultural:

- (C) Cultural services

Geodiversity:

- (G) Geodiversity services

ASSET QUANTITY

Indicators showing mountain, moor and heath habitat quantity in England

Map Key

Indicator value:

Outliers (>90th percentile)

High

Low

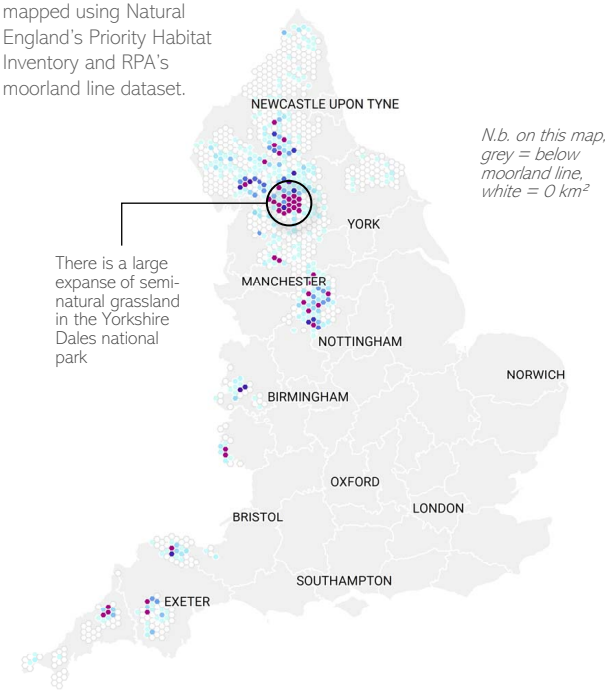
10 equal interval classes

0

25 km²
2,500 ha

Semi-Natural Grassland (Above Moorland Line) (ID: 24)

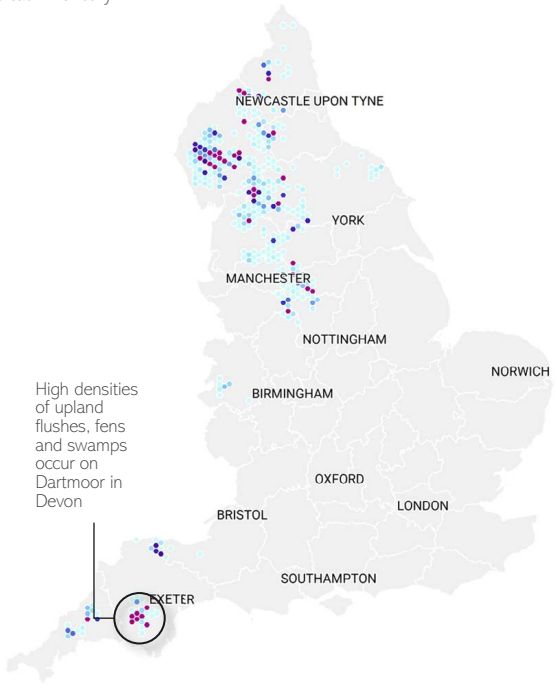
Area of semi-natural grassland above the moorland line, mapped using Natural England's Priority Habitat Inventory and RPA's moorland line dataset.



Hexagon values: 0 – 1.28 km²; Outliers: 1.28 – 14.23 km²

Upland Flushes, Fens & Swamps (ID: 25)

Area of upland flushes, fens and swamps, mapped using Natural England's Priority Habitat Inventory.



Hexagon values: 0 – 0.82 km²; Outliers: 0.82 – 5.69 km²

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

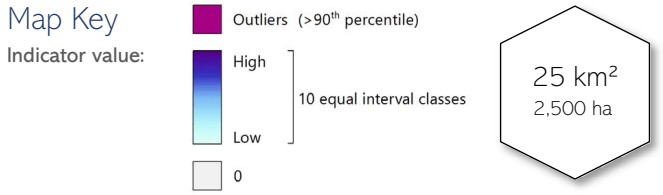
- Cultural services

Geodiversity:

- Geodiversity services

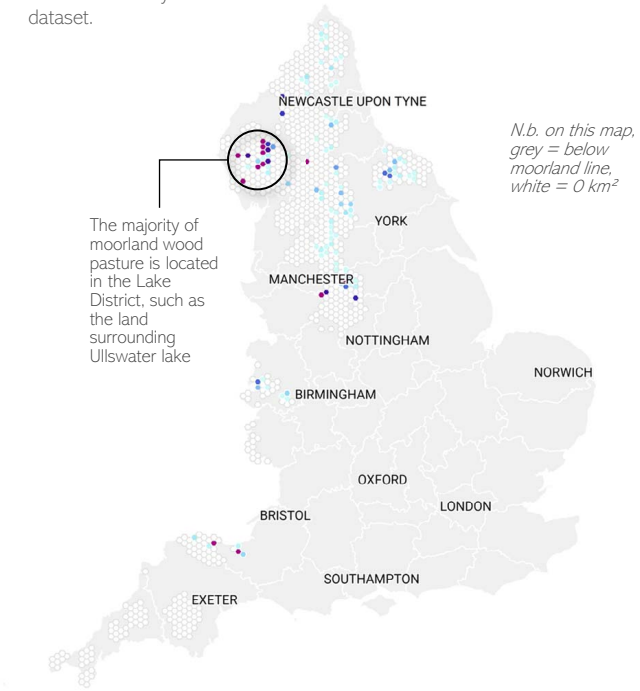
ASSET QUANTITY

Indicators showing mountain, moor and heath habitat quantity in England



Wood Pasture (Above Moorland Line) (ID: 26)

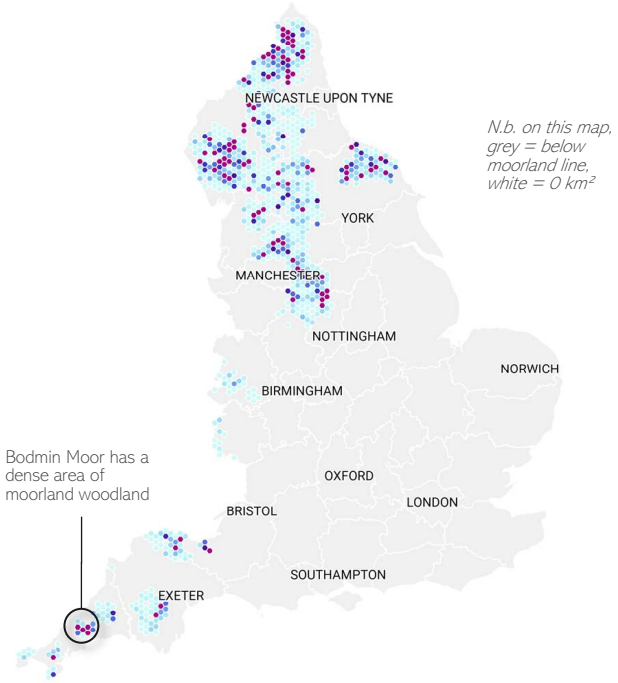
Area of wood pasture above the moorland line, mapped using Natural England's provisional Wood-Pasture and Parkland BAP Priority Habitat Inventory and RPA's Moorland line dataset.



Hexagon values: 0 – 0.27 km²; Outliers: 0.27 – 1.58 km²

Woodland (Above Moorland Line) (ID: 27)

Area of woodland above the moorland line, mapped using FC's National Forest Inventory and RPA's moorland line dataset.



Hexagon values: 0 – 0.43 km²; Outliers: 0.43 – 1.91 km²

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

- Cultural services

Geodiversity:

- Geodiversity services

INDICATOR SUMMARY

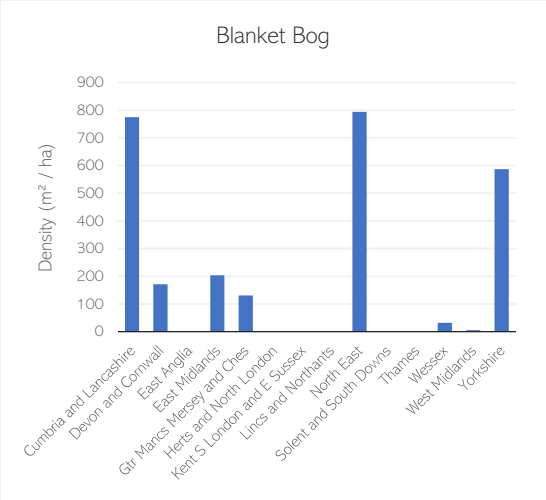
A table summarising the mountain, moor and heath habitat quantity indicators in England

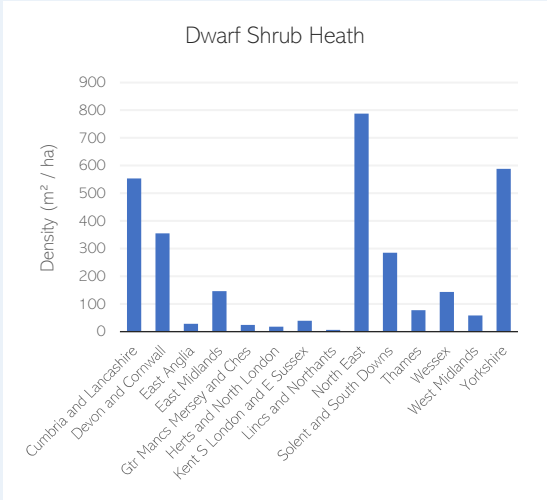
Location (see map of areas on p98)	Area (km²)	Moorland Area (km²)	Indicator																			
			Blanket Bog		Dwarf Shrub Heath		Inland Rock, Scree and Pavement (AML)*		Lakes (AML)*		Mountain Heath and Willow Scrub		Rivers (AML)*		Semi-Natural Grassland (AML)*		Upland Flushes, Fens and Swamps		Wood Pasture (AML)*		Woodland (AML)*	
			Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Length (km)	Density (m/ha)	Area (km²)	Density (m²/ha)	Length (km)	Density (m/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)
England	132,948	7731	2,771	208	3,168	238	42	54	5	6	62	5	2,115	3	185	239	107	8	12	15	129	167
Cumbria and Lancashire	10,446	2508	**809**	**775**	**578**	**553**	**20**	**80**	**2**	6	**52**	**50**	**742**	**3**	**31**	125	**51**	**49**	**6**	24	**43**	**172**
Devon and Cornwall	10,476	676	179	171	372	355	**2**	31	**1**	**8**	0	0	237	**3**	**25**	371	**16**	**15**	0	3	11	162
East Anglia	17,495	0	0	0	50	28	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
East Midlands	6,947	316	141	203	102	146	0	3	0	3	0	0	46	1	19	**604**	6	9	**1**	16	8	243
Greater Manchester Merseyside and Cheshire	4,474	115	59	131	11	25	0	**32**	0	**36**	0	0	17	1	2	197	2	4	**1**	**57**	4	**365**
Hertfordshire and North London	3,332	0	0	0	6	18	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Kent, South London and East Sussex	7,045	0	0	0	28	39	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Lincolnshire and Northamptonshire	10,286	0	0	0	6	6	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
North East	8,676	1725	**689**	**794**	**683**	**788**	0	2	**1**	3	**10**	**11**	**397**	2	7	42	8	10	**1**	3	**30**	**172**
Solent and South Downs	6,273	0	0	0	179	285	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Thames	7,262	0	0	0	56	78	0	-	0	-	0	0	0	-	0	-	0	0	0	-	0	-
Wessex	11,208	128	36	32	161	143	0	0	0	1	0	0	35	**3**	5	359	3	3	**1**	**72**	4	**299**
West Midlands	14,544	109	7	5	85	59	0	7	0	1	0	0	13	1	10	**921**	2	2	0	**38**	2	165
Yorkshire	14,483	2155	**850**	**587**	**851**	**588**	**19**	**88**	**2**	**8**	0	0	**629**	**3**	**85**	**393**	**18**	**12**	**2**	11	**28**	130

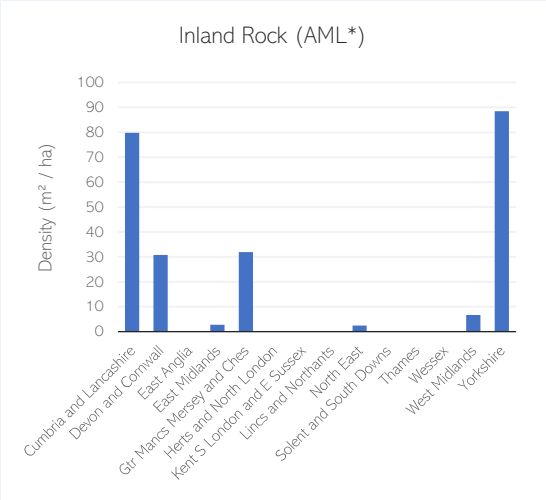
* AML = Above moorland line. Note: The density values for these indicators are area of habitat per unit of moorland (not total land).
Note: Highest three values for each indicator are highlighted and **bold**.
Note: Values are rounded to the nearest whole number, which in some cases is zero (explaining differences between area and density values, in such cases).

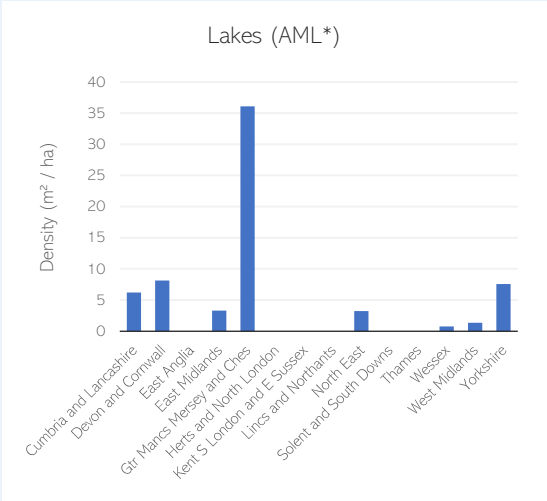
INDICATOR SUMMARY

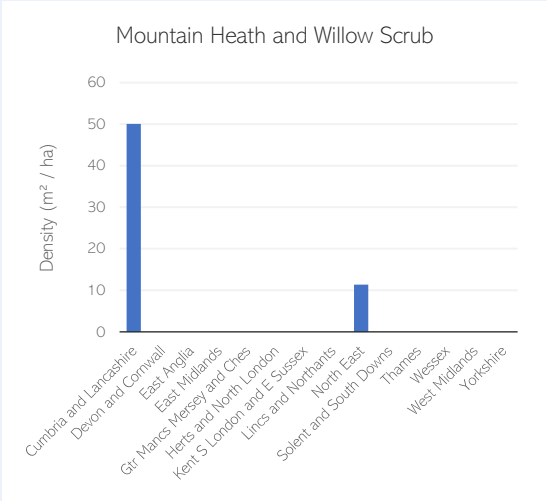
Charts showing the mountain, moor and heath habitat quantity indicators for areas of England







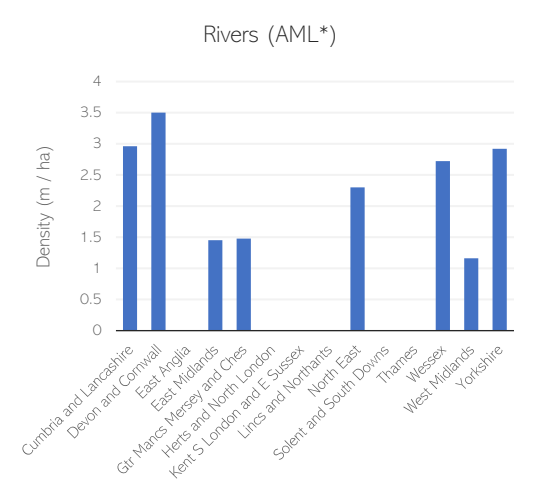


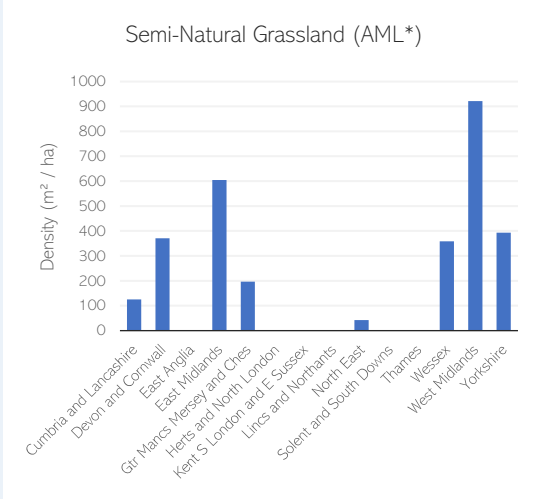


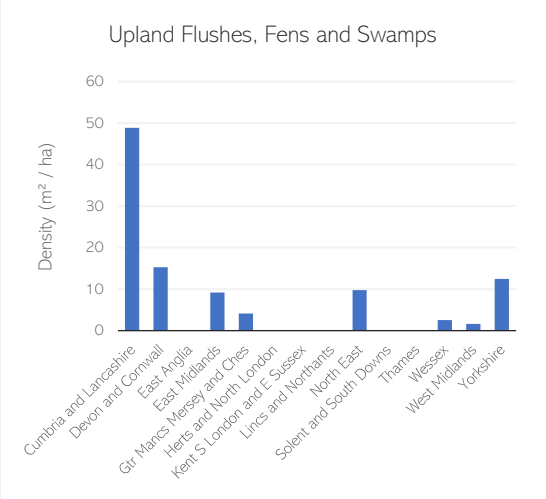
* AML = Above moorland line. Note: The density values for these indicators are area of habitat per unit of moorland (not total land)

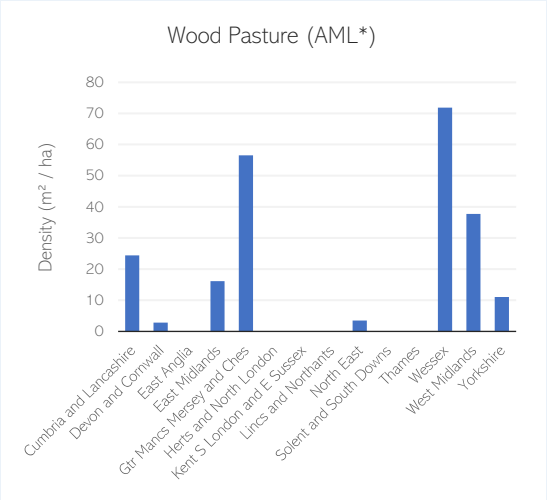
INDICATOR SUMMARY

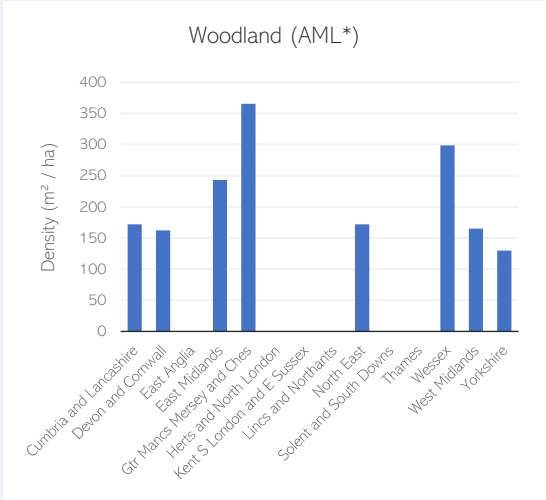
Charts showing the mountain, moor and heath habitat quantity indicators for areas of England











* AML = Above moorland line. Note: The density values for these indicators are area of habitat per unit of moorland (not total land)

ASSET QUANTITY: WOODLAND

Woodland occupies 1.3 million hectares (12.5%) of England's land cover, of which 74% is broadleaved and 26% is coniferous (Forestry Research, 2018). Much of this woodland has been subject to extensive management and modification, but nonetheless still represents very important habitat for a multitude of rare and threatened organisms, such as hazel dormice, lady orchid and scarlet elf cup. Ancient woodlands are especially important, supporting unique, complex and rich ecosystems.

As well as providing habitats for wildlife, woodlands are a vitally important store of carbon, helping to negate the effects of global climate change. Urban woodland can improve air quality by filtering particulate pollutants and can also mitigate noise pollution when appropriately positioned. Woodlands play an important role in water management, helping to improve water quality and alleviate downstream flood risk. Woodland also has immense cultural and recreational value.

Photo: Roman Hobler – Beech tree opposite Blackwater Arboretum (CC BY-SA 2.0)

Ecosystem Services

The following are key ecosystem services that can be assessed using the woodland quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3). **Note that the role of woodland, in providing water supply, water quality and flood protection services, is included in the freshwater catchments section.*

Materials from Plants, Animals & Algae

Timber and other materials

Air Quality

Maintenance of air quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)

Climate Regulation

Global, regional & local climate regulation

Plant-Based Energy

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Asset Quantity Indicators - Woodland

This page illustrates how the indicators for woodland habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Extent	Indicator	Materials from plants animals and algae	Plant-based energy	Air quality	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
	Broadleaved, mixed and yew woodland	●	●	●	●	●	●
	Coniferous woodland	●	●	●		●	●
	Individual trees/veteran trees				●	●	●
	Woodland priority habitats				●		●

Catchment Services

Please note:

Woodland habitats also contribute to providing catchment services: water supply, water quality and flood protection.

Please refer to the Freshwater section.

* Ecosystem service that was considered under the 'freshwater hydrological catchment' chapter

ASSET QUANTITY

Indicators showing woodland habitat quantity in England

Map Key

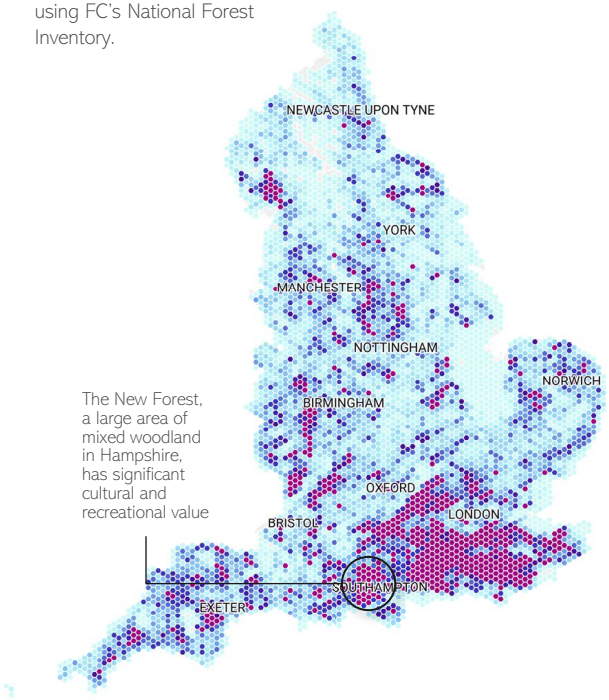
Indicator value:

- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Broadleaved, Mixed and Yew Woodland (ID: 28)

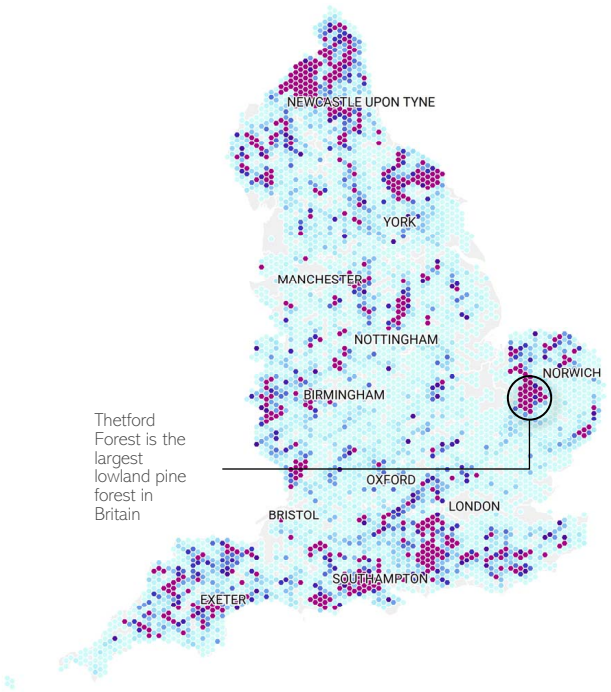
Area of broadleaved, mixed and yew woodland mapped using FC's National Forest Inventory.



Hexagon values: 0 – 3.4 km²; Outliers: 3.4 – 13.1 km²

Coniferous Woodland (ID: 29)

Area of coniferous woodland mapped using FC's National Forest Inventory.



Hexagon values: 0 – 1.5 km²; Outliers: 1.5 – 13.5 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

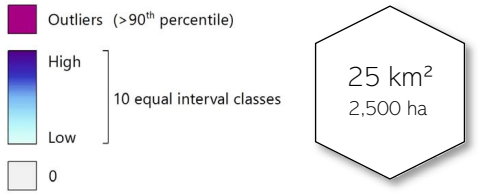
- G Geodiversity services

ASSET QUANTITY

Indicators showing woodland habitat quantity in England

Map Key

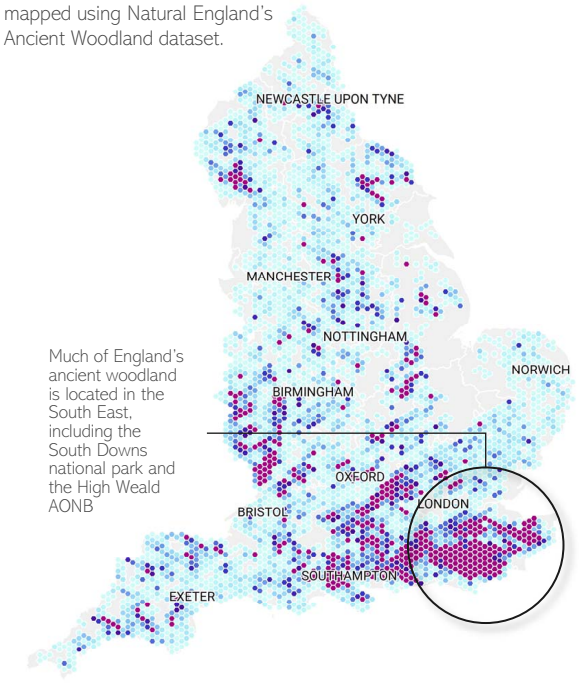
Indicator value:



Ancient Woodland (ID: 30)

H C C

It was unfeasible to map the 'individual/veteran trees' indicator at a national scale. Instead, the area of ancient woodland has been mapped using Natural England's Ancient Woodland dataset.

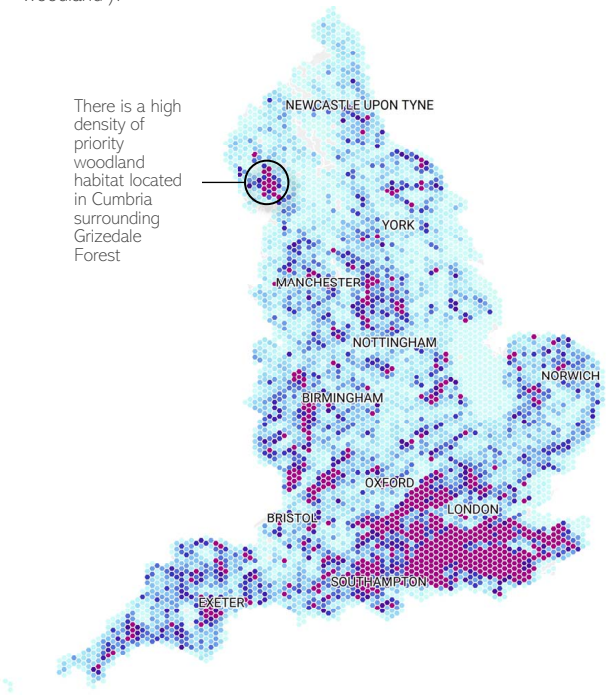


Hexagon values: 0 – 2.4 km²; Outliers: 2.4 – 21.0 km²

Priority Woodland Habitats (ID: 31)

H C

Area of priority woodland mapped using Natural England's Priority Habitat Inventory ('deciduous woodland').



Hexagon values: 0 – 3.0 km²; Outliers: 3.0 – 11.7 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

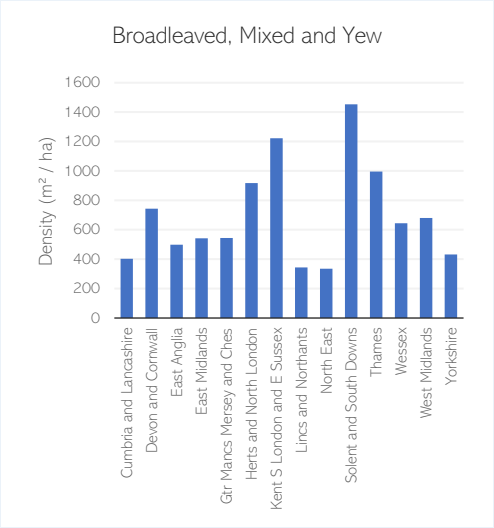
- C Cultural services

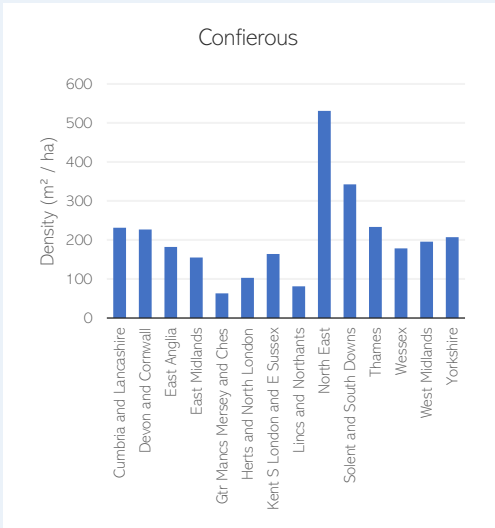
Geodiversity:

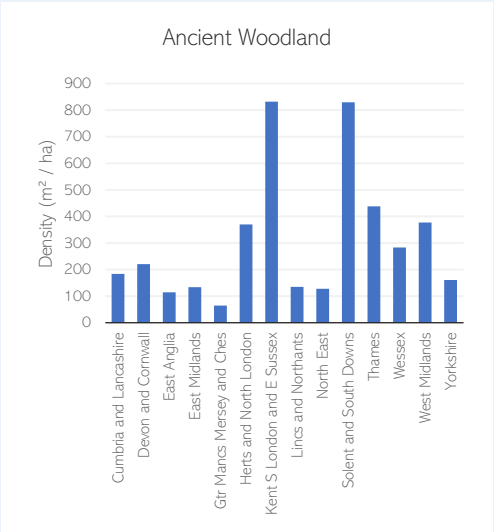
- G Geodiversity services

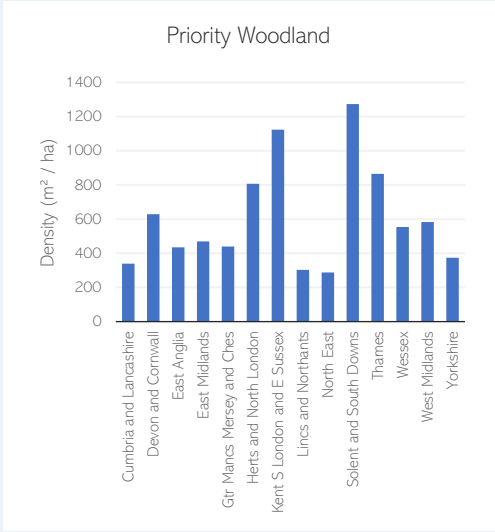
INDICATOR SUMMARY

A table and charts summarising the woodland habitat quantity indicators for areas of England









Location (see map of areas on p98)	Area (km²)	Indicator: Broadleaved, Mixed and Yew Woodland – Area (km²)	Broadleaved, Mixed and Yew Woodland – Density (m²/ha)	Coniferous Woodland – Area (km²)	Coniferous Woodland – Density (m²/ha)	Ancient Woodland – Area (km²)	Ancient Woodland – Density (m²/ha)	Priority Woodland Habitats – Area (km²)	Priority Woodland Habitats – Density (m²/ha)
England	132,948	8,468	637	2,796	210	3,640	274	7,354	553
Cumbria and Lancashire	10,446	420	402	242	231	192	184	354	339
Devon and Cornwall	10,476	778	742	238	227	231	220	659	629
East Anglia	17,495	**871**	498	**319**	182	200	114	761	435
East Midlands	6,947	376	542	108	155	93	133	326	469
Greater Manchester Merseyside and Cheshire	4,474	243	544	28	63	29	64	196	439
Hertfordshire and North London	3,332	305	917	34	103	123	370	269	806
Kent, South London and East Sussex	7,045	861	**1,222**	116	164	**586**	**832**	**792**	**1,124**
Lincolnshire and Northamptonshire	10,286	353	343	83	81	139	135	311	303
North East	8,676	290	335	**460**	**531**	111	128	250	288
Solent and South Downs	6,273	**911**	**1,452**	215	**342**	**520**	**829**	**799**	**1,273**
Thames	7,262	723	**996**	169	**233**	318	**438**	628	**865**
Wessex	11,208	722	644	200	178	317	283	621	554
West Midlands	14,544	**988**	679	285	196	**548**	377	**847**	582
Yorkshire	14,483	625	432	**300**	207	233	161	541	374

Note: Highest three values for each indicator are highlighted and **bold**

ASSET QUANTITY: URBAN

Urban areas in the UK cover just under 7% of land area, yet are home to 8 out of 10 people, often living at extremely high population densities. Pockets of green space assume disproportionate ecological and cultural significance within urban areas. However, urban populations are also dependent on other broad habitats in rural areas for provision of most of their ecosystem services. (UK NEA, 2011).

Despite occupying a relatively small area within our towns and cities, the urban natural environment provides a wide range of ecosystem services. Gardens represent a highly heterogeneous urban sub-habitat, supporting a diverse array of plants and animals, and can be particularly important for pollination services. Amenity greenspaces (parks, outdoor sports facilities) are vital for community cohesion, and the mental and physical health of urban residents (UK NEA, 2011). Such cultural and recreational services are particularly important in urban areas, where human population density is higher than in all other habitats.

Ecosystem Services

The following are key ecosystem services that can be assessed using the urban quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Air Quality

Maintenance of air quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Noise Regulation

Noise regulation - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)

Climate Regulation

Global, regional & local climate regulation

Asset Quantity Indicators - Urban

This page illustrates how the indicators for urban habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

	Indicator	Air quality	Noise regulation	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
Extent	Blue space			●	●	●
	Green space – not semi-natural	●	●	●	●	●
	Open mosaic habitats			●		
	Woodland, scrub and hedge	●	●	●	●	●
	Semi-natural habitats	●	●	●	●	●

Catchment Services

Please note:

Urban semi-natural and woodland habitats also contribute to providing catchment services: water supply, water quality and flood protection.

Please refer to the Freshwater section.

* Ecosystem service that was considered under the 'freshwater hydrological catchment' chapter

ASSET QUANTITY

Indicators showing urban habitat quantity in England

Map Key

Indicator value:

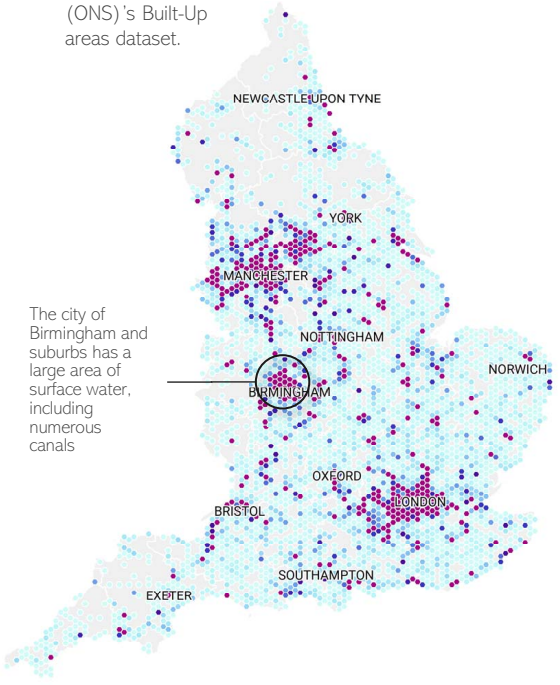
- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Blue Space (ID: 32)

H C C

Area of urban blue space mapped by intersecting OS VectorMap District Surface Water with the Office for National Statistic (ONS)'s Built-Up areas dataset.

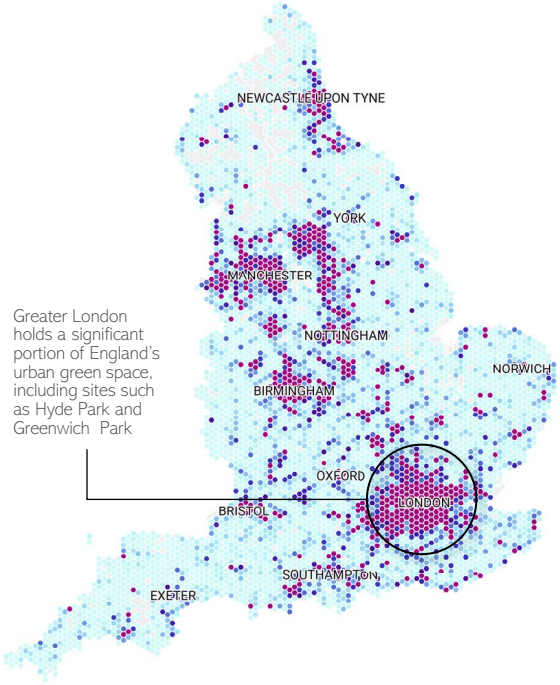


Hexagon values: 0 – 0.05 km²; Outliers: 0.05 – 1.54 km²

Green Space (ID: 33)

A N H C C

Area of urban green space (not semi-natural), mapped using the OS Open Greenspace Layer.

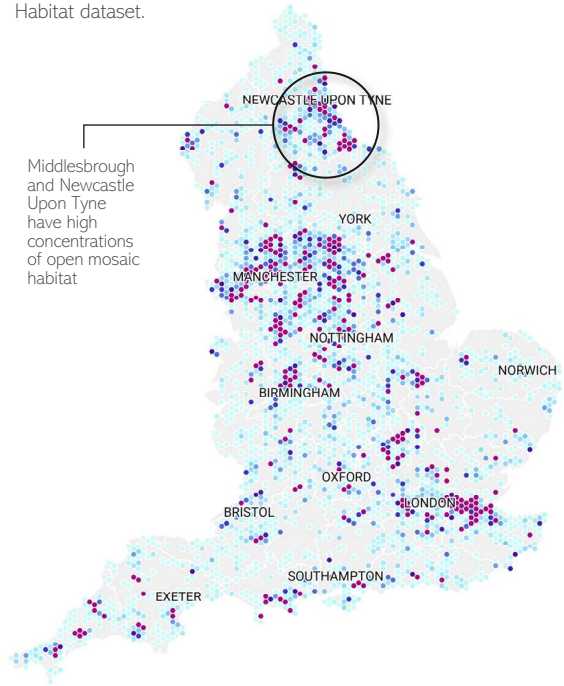


Hexagon values: 0 – 1.74 km²; Outliers: 1.74 – 19.98 km²

Open Mosaic Habitats (ID: 34)

H

Area of open mosaic habitats on previously developed land, mapped using Natural England's draft Open Mosaic Habitat dataset.



Hexagon values: 0 – 0.46 km²; Outliers: 0.46 – 7.30 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUANTITY

Indicators showing urban habitat quantity in England

Map Key

Indicator value:

Outliers (>90th percentile)

High

Low

10 equal interval classes

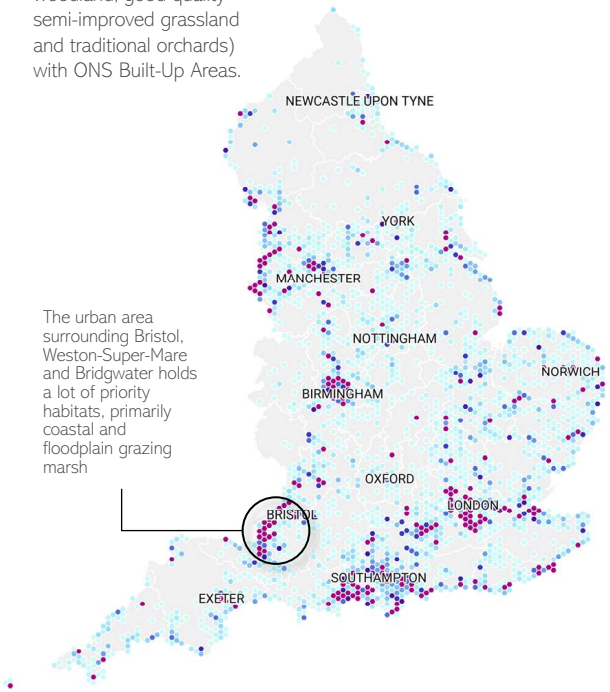
0

25 km²
2,500 ha

Semi-Natural Habitats (ID: 35)

A N H C C

Area of urban semi-natural habitats mapped by intersecting Natural England's Priority Habitat Inventory habitats (excluding woodland, good quality semi-improved grassland and traditional orchards) with ONS Built-Up Areas.

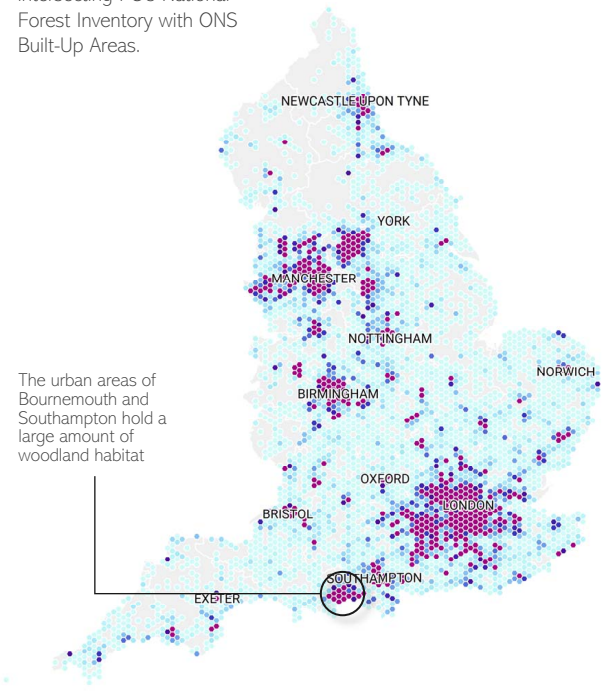


Hexagon values: 0 – 0.07 km²; Outliers: 0.07 – 4.76 km²

Woodland, Scrub and Hedge (ID: 36)

A N H C C

While urban scrub and hedge are difficult to map at a national scale, the area of urban woodland is mapped here by intersecting FC's National Forest Inventory with ONS Built-Up Areas.



Hexagon values: 0 – 0.36 km²; Outliers: 0.36 – 3.84 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

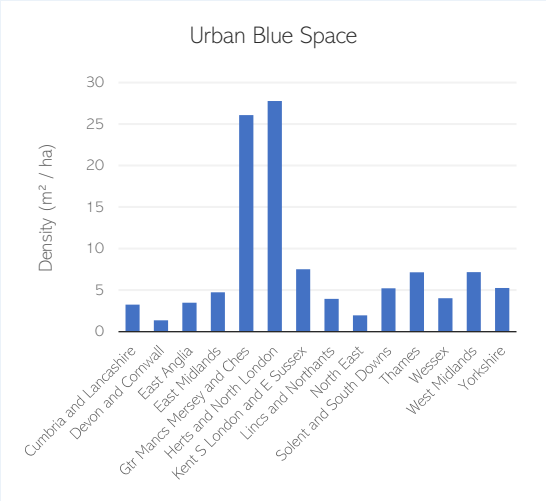
- C Cultural services

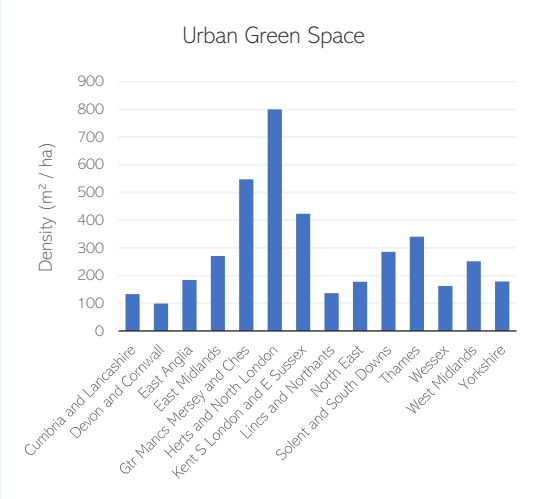
Geodiversity:

- G Geodiversity services

INDICATOR SUMMARY

A table and charts summarising the urban habitat quantity indicators for areas of England



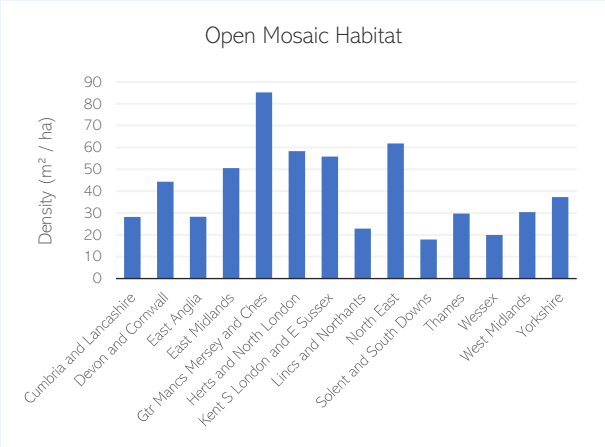


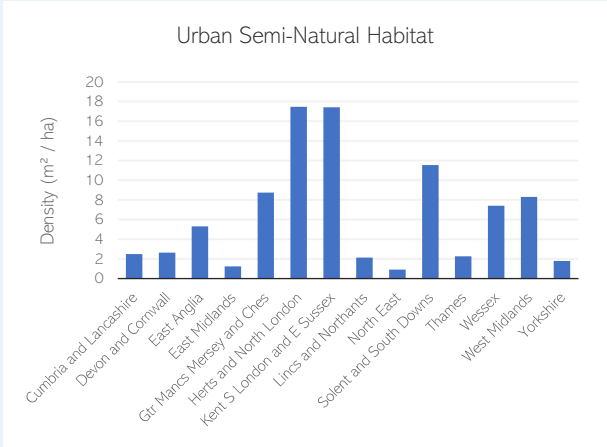
Location (see map of areas on p98)	Area (km²)	Indicator: Blue Space Area (km²)	Blue Space Density (m²/ha)	Green Space Area (km²)	Green Space Density (m²/ha)	Open Mosaic Habitats Area (km²)	Open Mosaic Habitats Density (m²/ha)	Semi-Natural Habitats Area (km²)	Semi-Natural Habitats Density (m²/ha)	Woodland Area (km²)	Woodland Density (m²/ha)
England	132,948	77	6	3,087	232	488	37	72	5	528	40
Cumbria and Lancashire	10,446	3	3	139	133	29	28	3	2	17	16
Devon and Cornwall	10,476	1	1	103	98	46	44	3	3	16	15
East Anglia	17,495	6	3	**322**	184	**49**	28	**9**	5	45	25
East Midlands	6,947	3	5	188	270	35	51	1	1	20	29
Greater Manchester Merseyside and Cheshire	4,474	**12**	**26**	245	**547**	38	**85**	4	9	46	**103**
Hertfordshire and North London	3,332	**9**	**28**	267	**800**	19	**58**	6	**17**	**58**	**174**
Kent, South London and East Sussex	7,045	5	**8**	**298**	**423**	39	56	**12**	**17**	**80**	**114**
Lincolnshire and Northamptonshire	10,286	4	4	140	136	23	23	2	2	11	11
North East	8,676	2	2	154	177	**54**	**62**	1	1	17	19
Solent and South Downs	6,273	3	5	179	285	11	18	7	**12**	41	65
Thames	7,262	5	7	247	340	22	30	2	2	45	62
Wessex	11,208	5	4	182	162	22	20	8	7	29	26
West Midlands	14,544	**10**	7	**366**	251	44	30	**12**	8	**57**	39
Yorkshire	14,483	8	5	258	178	**54**	37	3	2	47	32

Note: Highest three values for each indicator are highlighted and **bold**

INDICATOR SUMMARY

Charts showing the urban habitat quantity indicators for areas of England





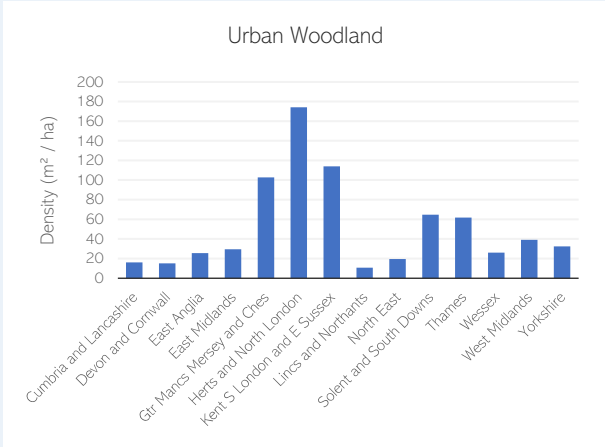


Photo: © Nick Paling – Bath, Somerset.
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ASSET QUANTITY: COASTAL

England's coastline accounts for less than 1% of land cover, but hosts a wealth of habitats, including saltmarsh, shingle, sand dunes, mudflats and sea cliffs. These habitats are important for a variety of life, from the charismatic avocet to the grey seal. Additionally, coastal habitats can act as important nursery sites for commercially valuable fish species.

Coastal habitats provide a range of benefits to society. While provisioning services in the coastal margins are relatively minor (e.g. meat and wool from saltmarsh, cooling water for nuclear power stations), cultural and regulatory services can be immensely valuable. For example, coastal habitats act as sea defences, dissipating energy to protect coastal settlements from storm events. Cultural services are numerous and are primarily linked to tourism and recreation, alongside social, artistic, and physical/mental health benefits (UK NEA, 2011).

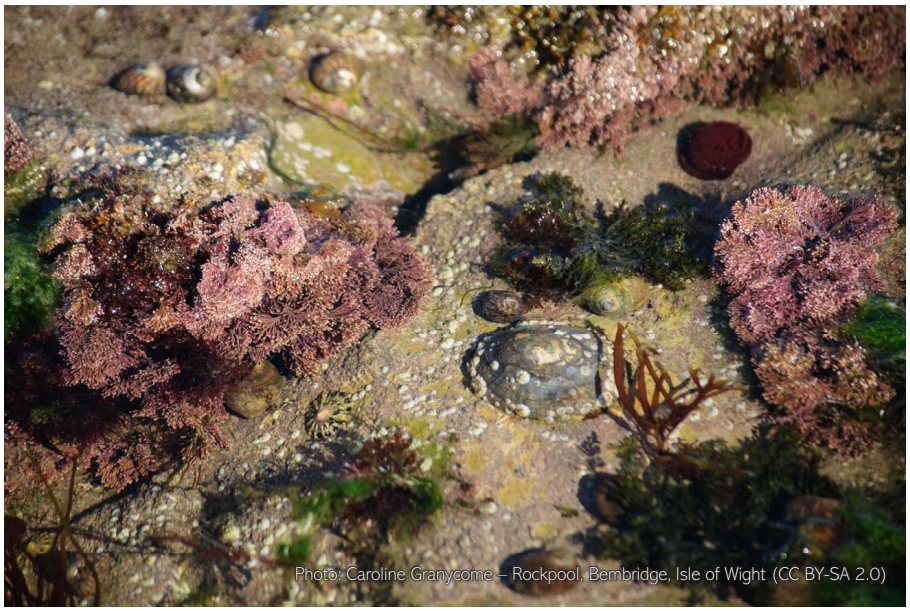


Photo: Caroline Granycome – Rockpool, Bembridge, Isle of Wight (CC BY-SA 2.0)

Ecosystem Services

The following are key ecosystem services that can be assessed using the coastal quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Mass Stabilisation

Mass stabilisation and control of erosion rates

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Flood Protection

Climate Regulation

Global, regional & local climate regulation

Asset Quantity Indicators - Coastal

This page illustrates how the indicators for coastal habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map. For a more comprehensive suite of ecosystem services for coastal and marine, the two parts should be considered together.

	Indicator ↓	Mass stabilisation	Flood protection	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
Extent	Beach	●	●	●	●	●
	Coastal lagoons			●		●
	Mudflats	●	●	●	●	●
	Salt marsh	●	●	●	●	●
	Sand dunes	●	●	●	●	●
	Sea cliff			●		●
	Shingle	●	●	●		●

ASSET QUANTITY

Indicators showing coastal habitat quantity in England

Map Key

Indicator value:

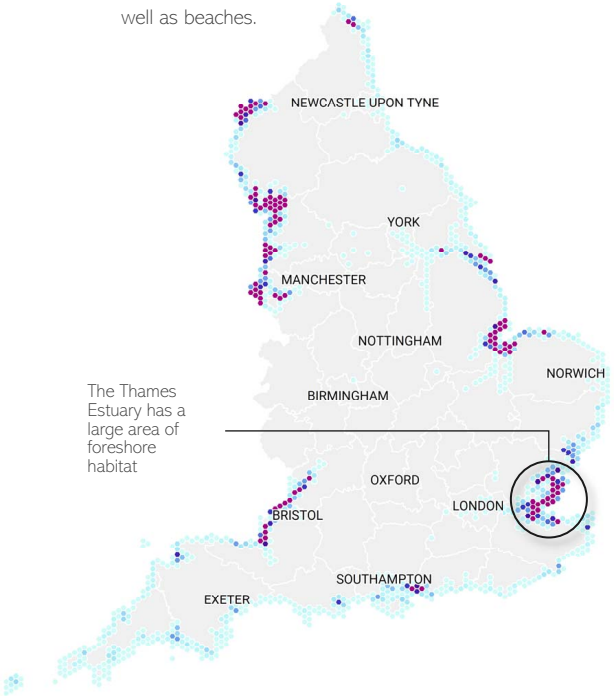
- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0

25 km²
2,500 ha

Beach (ID: 37)

M F H C C

Area of beach mapped using OS VectorMap District ('foreshore'). Note that this dataset includes areas of intertidal sediment as well as beaches.



Hexagon values: 0 – 6.08 km²; Outliers: 6.08 – 20.90 km²

Coastal Lagoons (ID: 38)

H C

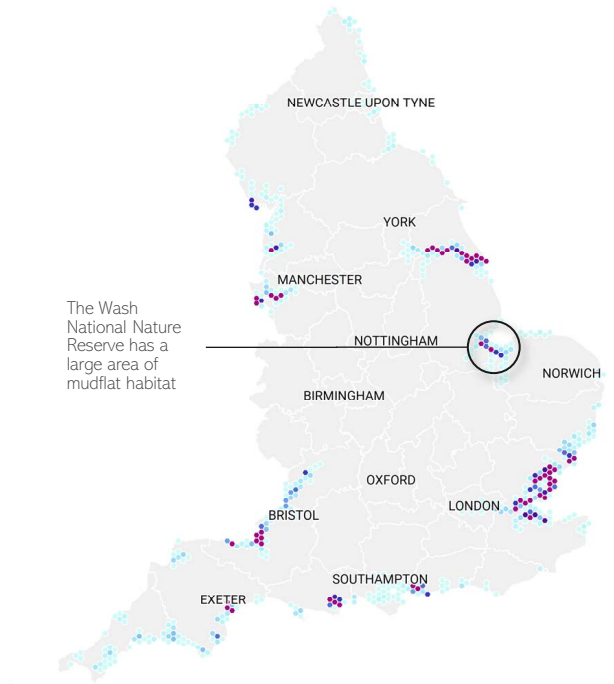
Area of coastal lagoons mapped using Natural England's Priority Habitat Inventory ('saline lagoons').

Hexagon values: 0 – 0.34 km²; Outliers: 0.34 – 20.86 km²

Mudflats (ID: 39)

M F H C C

Area of intertidal mudflats mapped using the EMODnet (Natural England) Intertidal Mudflats dataset.



Hexagon values: 0 – 1.63 km²; Outliers: 1.63 – 16.28 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUANTITY

Indicators showing coastal habitat quantity in England

Map Key

Indicator value:

Outliers (>90th percentile)

High

Low

10 equal interval classes

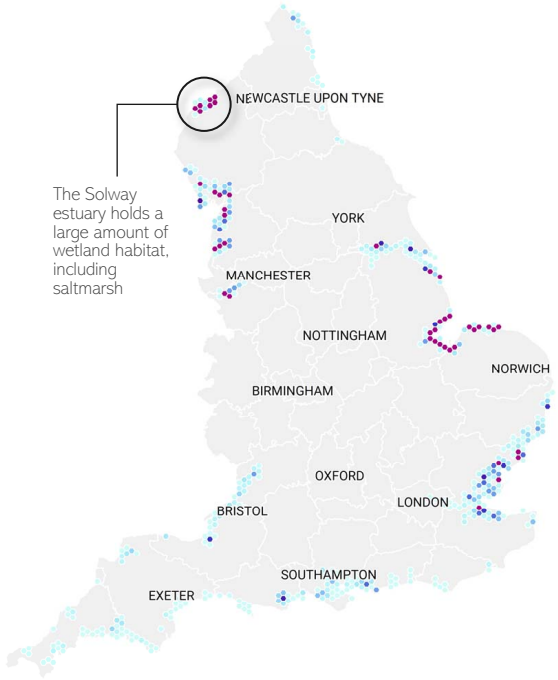
0

25 km²
2,500 ha

Salt Marsh (ID: 40)

M F H C C

Area of saltmarsh mapped using EA's Saltmarsh Extent dataset.



Hexagon values: 0 – 2.36 km²; Outliers: 2.36 – 12.42 km²

Sand Dunes (ID: 41)

M F H C C

Area of sand dunes mapped using Natural England's Priority Habitat Inventory ('coastal dunes').

Hexagon values: 0 – 1.47 km²; Outliers: 1.47 – 8.40 km²

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUANTITY

Indicators showing coastal habitat quantity in England

Map Key

Indicator value:

Outliers (>90th percentile)

High

Low

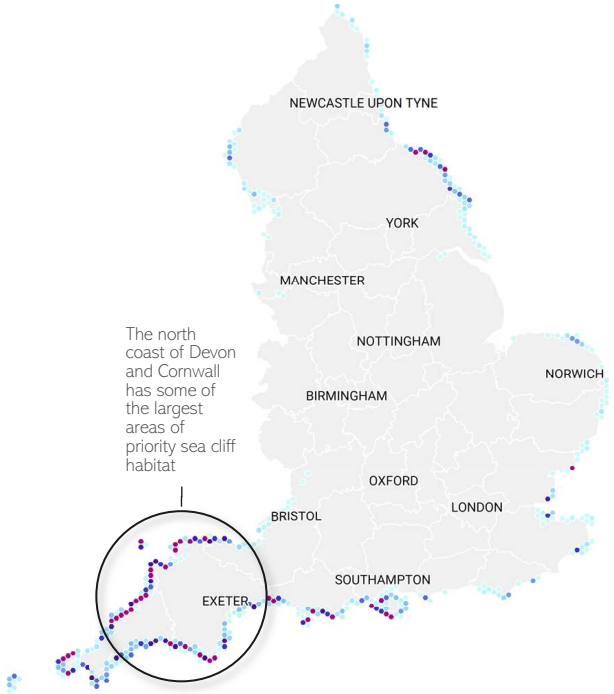
10 equal interval classes

0

25 km²
2,500 ha

Sea Cliff (ID: 42)

Area of sea cliff habitat mapped using Natural England's Priority Habitat Inventory ('maritime cliff and slopes').



Hexagon values: 0 – 0.75 km²; Outliers: 0.75 – 1.75 km²

Shingle (ID: 43)

Area of shingle mapped using Natural England's Priority Habitat Inventory ('coastal vegetated shingle').

Hexagon values: 0 – 0.63 km²; Outliers: 0.63 – 11.73 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

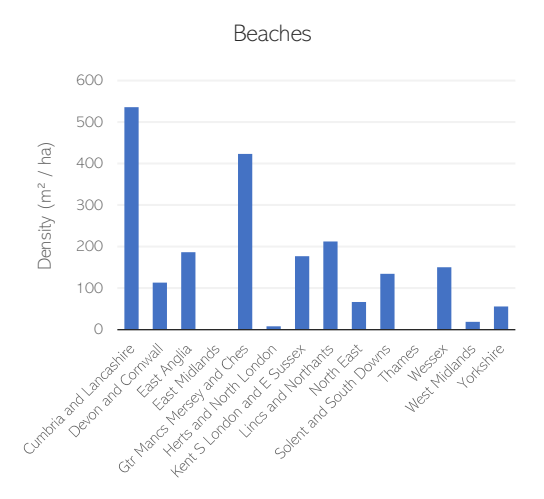
- C Cultural services

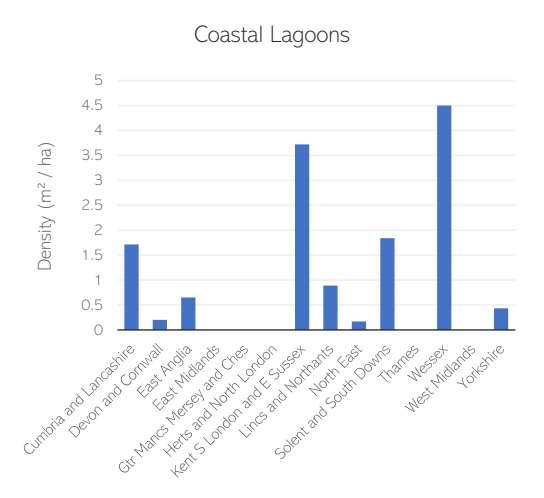
Geodiversity:

- G Geodiversity services

INDICATOR SUMMARY

A table and charts summarising the coastal habitat quantity indicators for areas of England



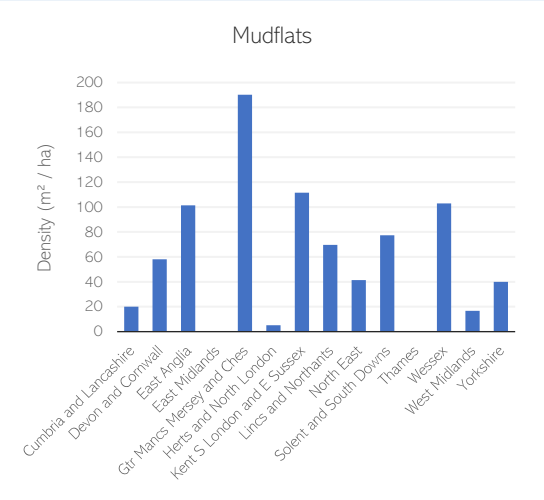


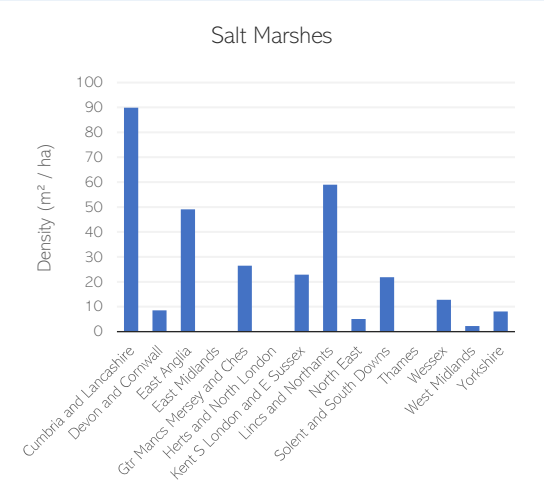
		Indicator													
		Beach		Coastal Lagoons		Mudflats		Salt Marsh		Sand Dunes		Sea Cliff		Shingle	
Location (see map of areas on p98)	Area (km²)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Length (km)	Density (m/ha)	Area (km²)	Density (m²/ha)
England	132,948	1,959	147	14	1	778	59	325	24	106	8	114	9	41	3
Cumbria and Lancashire	10,446	**560**	**536**	**2**	**2**	21	20	**94**	**90**	**17**	16	3	3	0	0
Devon and Cornwall	10,476	119	113	0	0	61	58	9	9	**27**	**25**	**66**	**63**	1	1
East Anglia	17,495	**326**	187	1	1	**177**	**101**	**86**	**49**	10	6	4	2	**9**	**5**
East Midlands	6,947	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greater Manchester Merseyside and Cheshire	4,474	189	**423**	0	0	**85**	**190**	12	26	16	**35**	0	0	0	0
Hertfordshire and North London	3,332	3	8	0	0	2	5	0	0	0	0	0	0	0	0
Kent, South London and East Sussex	7,045	125	177	**3**	**4**	79	**111**	16	23	7	11	4	6	**25**	**35**
Lincolnshire and Northamptonshire	10,286	**218**	**212**	1	1	72	70	**61**	**59**	7	7	0	0	0	0
North East	8,676	58	67	0	0	36	41	4	5	**17**	**20**	5	6	0	0
Solent and South Downs	6,273	84	134	1	**2**	49	77	14	22	1	2	**10**	**16**	**3**	**5**
Thames	7,262	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wessex	11,208	169	150	**5**	**5**	**115**	103	14	13	3	3	**13**	**12**	**3**	3
West Midlands	14,544	28	19	0	0	24	17	3	2	0	0	0	0	0	0
Yorkshire	14,483	81	56	1	0	58	40	12	8	1	1	8	6	0	0

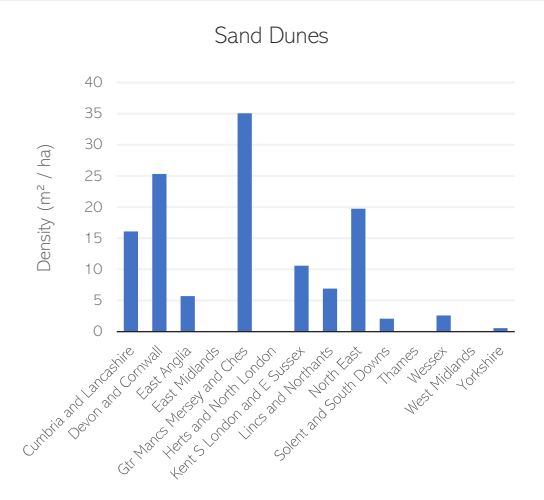
Note: Highest three values for each indicator are highlighted and **bold**.
Note: Values are rounded to the nearest whole number, which in some cases is zero (explaining differences between area and density values, in such cases).

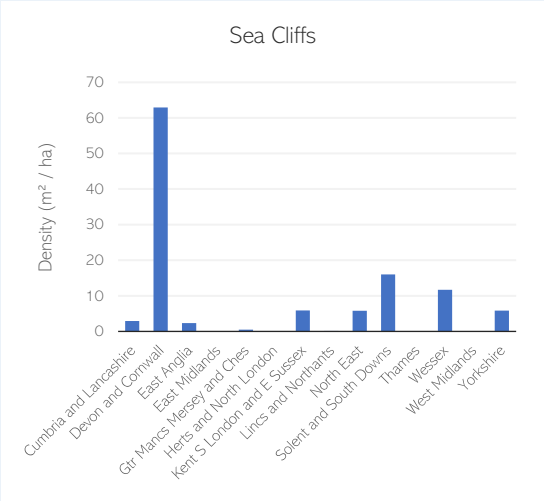
INDICATOR SUMMARY

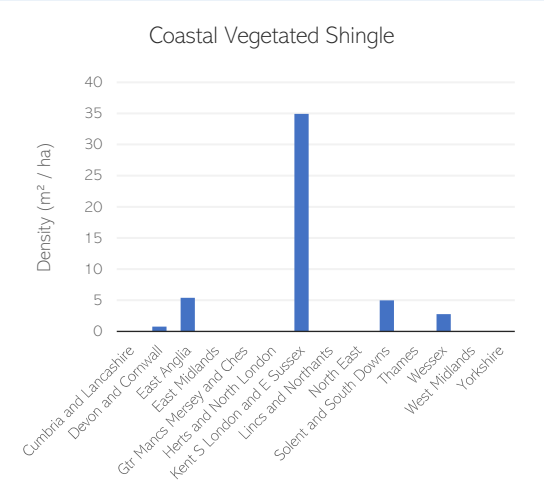
Charts summarising the coastal habitat quantity indicators for areas of England











ASSET QUANTITY: MARINE

Marine habitats of the UK cover more than three and a half times the land area and are composed of a wide variety of sub-habitats, from the seagrass beds of Dorset to cold-water coral reefs on the deep fringes of southwest England's continental shelf. These sub-habitats support a diverse array of life, including such iconic flagship species as the colossal basking shark.

Marine habitats provide numerous ecosystem services, many of which are of significant value to society. The fishing industry remains an important socio-economic activity in coastal regions, harvesting fish and shellfish for consumption in the UK and abroad. The marine environment acts as a carbon sink, regulating the global climate, while biogenic reefs and seagrass beds stabilise sediment and create natural sea defences. In addition, marine habitats provide tourism, leisure and recreation opportunities, and promote physical and mental health (UK NEA, 2011). This assessment focuses on inshore waters, up to 12 nautical miles from the coastline. This section includes intertidal and subtidal habitats, other than those covered in the coastal section, and the indicators include both the seabed and the water column above.

Photo: Sam Tasker – Hermet Crab through the Zostera, near Cawsand (CC BY-SA 2.0)

Ecosystem Services

The following are key ecosystem services that can be assessed using the marine quantity indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Wild Animals, Plants, Algae & their Outputs

Fish and other marine products from wild sources

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Climate Regulation

Global, regional & local climate regulation

Aquaculture

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

Asset Quantity Indicators - Marine

This page illustrates how the indicators for marine habitat quantity are connected to ecosystem services, benefits and value, as shown in the logic chain below.

The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map. These indicators include both the sea bed and the water column above it. For a more comprehensive suite of ecosystem services for coastal and marine, the two parts should be considered together.

Indicator ↓	Wild animals, plants, algae and outputs	Aquaculture	Water quality	Maintenance of nursery pops and habitats	Climate regulation	Cultural services
Intertidal rock	●			●		
Maerl beds	●			●		
Reefs	●			●	●	●
Seagrass beds	●	●	●	●		●
Shallow subtidal sediment	●			●		
Shelf subtidal sediment	●			●		
Subtidal rock	●			●		

ASSET QUANTITY

Indicators showing marine habitat quantity in England

Note: the Map Key is slightly different for the marine maps – 'no data / not applicable' values have been added

Map Key

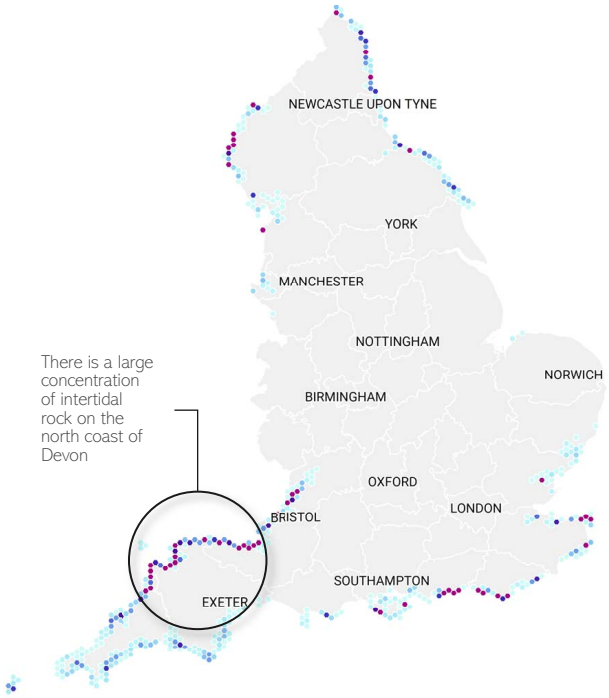
Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

25 km²
2,500 ha

Intertidal Rock (ID: 44)

Area of intertidal rock mapped using Natural England's Open Marine Evidence Base (EUNIS code A1).



Hexagon values: 0 – 0.6 km²; Outliers: 0.6 – 5.0 km²

Maerl Beds (ID: 45)

Area of maerl beds mapped using Natural England's Open Marine Evidence Base (EUNIS code A5.51).

Hexagon values: 0 – 6.0 km²; Outliers: 6.0 – 10.0 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- (M) Materials from plants, animals and algae
- (W) Wild animals, plants, algae and outputs
- (P) Plant-based energy
- (A) Aquaculture
- (C) Cultivated crops
- (S) Water supply
- (R) Reared animals and outputs

Regulating:

- (W) Water quality
- (A) Air quality
- (N) Noise regulation
- (M) Mass stabilisation
- (F) Flood protection
- (P) Pollination and seed dispersal
- (H) Maintenance of nursery pops and habitats
- (D) Pest and disease control
- (C) Climate regulation

Cultural:

- (C) Cultural services

Geodiversity:

- (G) Geodiversity services

ASSET QUANTITY

Indicators showing marine habitat quantity in England

Map Key

Indicator value:

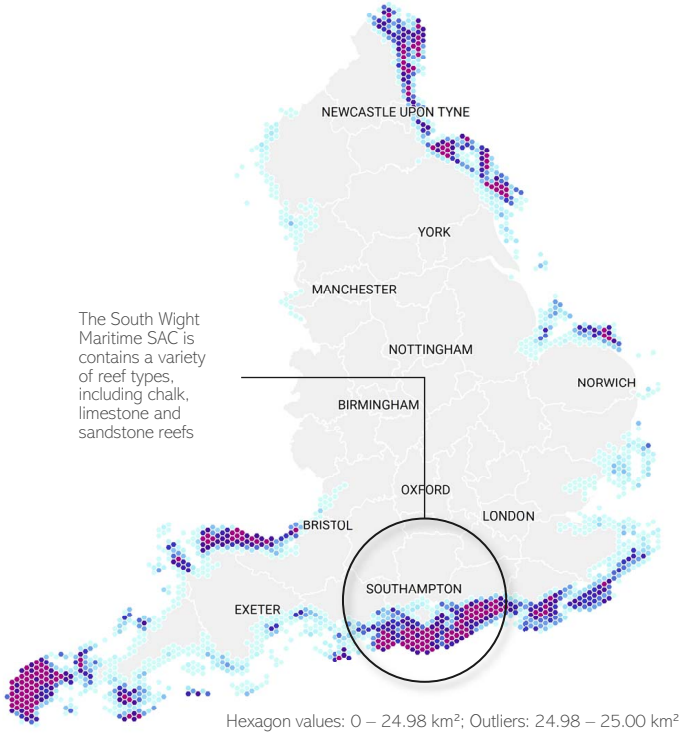
- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

25 km²
2,500 ha

Reefs (ID: 46)

W H C C

Area of potential reefs mapped using JNCC's Potential Annex 1 Reefs.



The South Wight Maritime SAC is contains a variety of reef types, including chalk, limestone and sandstone reefs

Hexagon values: 0 – 24.98 km²; Outliers: 24.98 – 25.00 km²

Seagrass Beds (ID: 47)

W A W H C

Area of seagrass beds mapped using Natural England's Open Marine Evidence Base (EUNIS code A2.61).

There are pockets of seagrass beds all around the English coast. A number of citizen science projects are attempting to map seagrass distribution, which should help to improve the accuracy of these habitat maps

Hexagon values: 0 – 0.8 km²; Outliers: 0.8 – 3.5 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUANTITY

Indicators showing marine habitat quantity in England

Map Key

Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

25 km²
2,500 ha

Shallow Subtidal Sediment (ID: 48)

Area of shallow subtidal sediment mapped using JNCC's UKSea Map 2018 (biozone = shallow circalittoral or infralittoral and substrate = sediment, sand or mud).

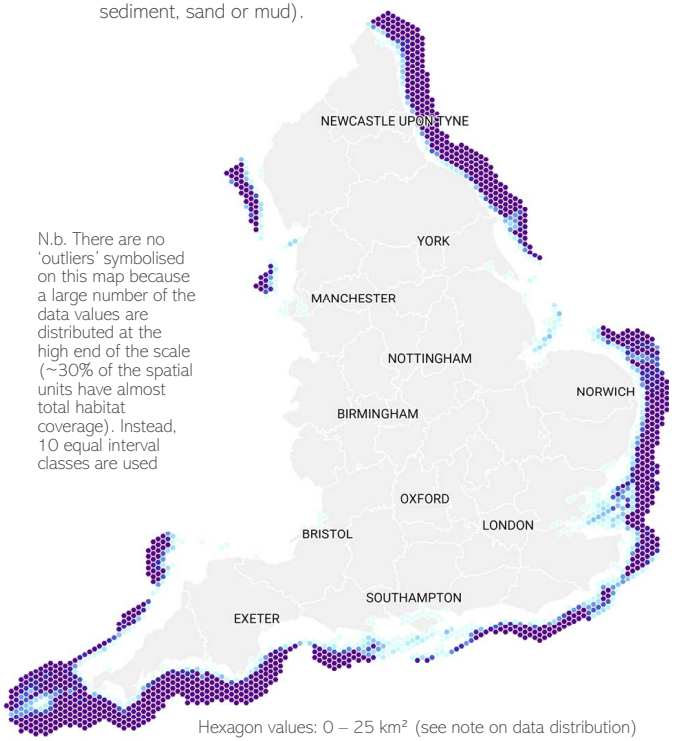
N.b. There are no 'outliers' symbolised on this map because a large number of the data values are distributed at the high end of the scale (~20% of the spatial units have almost total habitat coverage). Instead, 10 equal interval classes are used

Hexagon values: 0 – 25 km² (see note on data distribution)

Shelf Subtidal Sediment (ID: 49)

Area of shelf subtidal sediment mapped using JNCC's UKSea Map 2018 (biozone = deep circalittoral and substrate = sediment, sand or mud).

N.b. There are no 'outliers' symbolised on this map because a large number of the data values are distributed at the high end of the scale (~30% of the spatial units have almost total habitat coverage). Instead, 10 equal interval classes are used

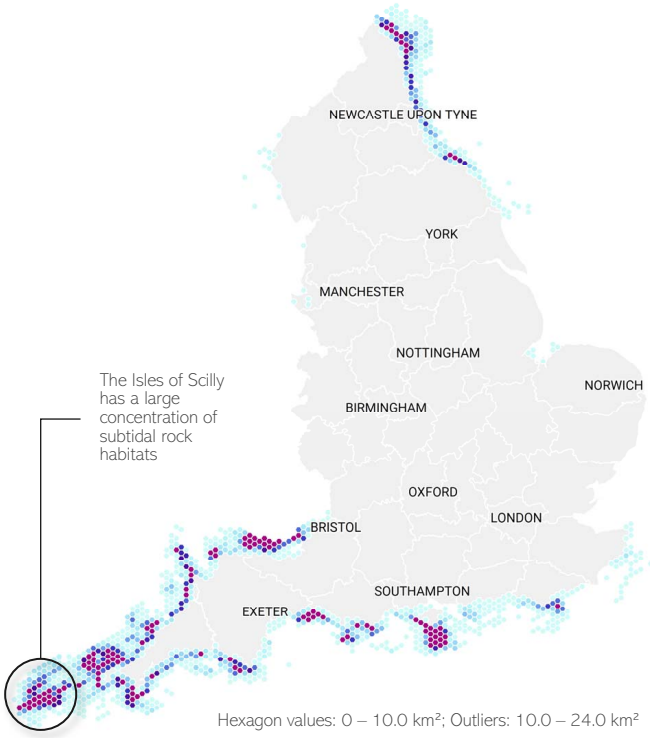


Hexagon values: 0 – 25 km² (see note on data distribution)

Subtidal Rock (ID: 50)

Area of subtidal rock mapped using JNCC's UKSea Map 2018 (substrate = rock).

The Isles of Scilly has a large concentration of subtidal rock habitats



Hexagon values: 0 – 10.0 km²; Outliers: 10.0 – 24.0 km²

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

INDICATOR SUMMARY

A table summarising the marine habitat quantity indicators in England

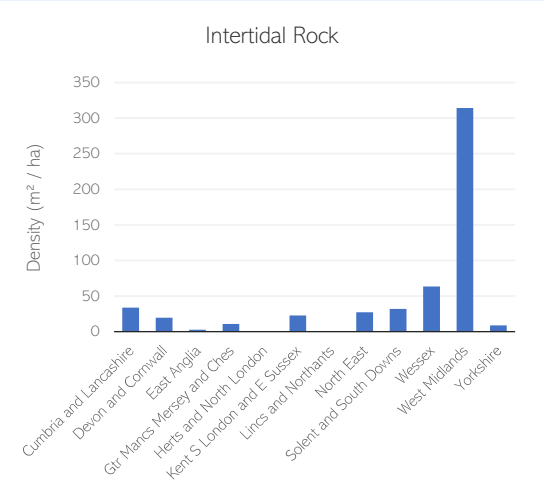
Location (see map of areas on p98)	Area of Marine Habitat (km²)	Indicator													
		Intertidal Rock		Maerl Beds		Reef		Seagrass Beds		Shallow Subtidal Sediment		Shelf Subtidal Sediment		Subtidal Rock	
		Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)	Area (km²)	Density (m²/ha)
England	49,226	103	21	36	7	16,095	3,270	17	3	27,872	5,662	25,815	5,244	3,651	742
Cumbria and Lancashire	3,306	**11**	**34**	0	0	112	339	1	**4**	2,969	**8,982**	886	2,680	2	6
Devon and Cornwall	16,427	**32**	20	**36**	**22**	**5,000**	3,044	**2**	1	**6,617**	4,028	**10,111**	**6,155**	**2,164**	**1,318**
East Anglia	7,853	2	3	0	0	705	898	**2**	3	**4,364**	5,558	**4,714**	6,003	0	0
Greater Manchester Merseyside and Cheshire	839	1	11	0	0	3	32	0	0	1,022	**12,184**	252	3,008	0	3
Hertfordshire and North London *	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Kent, South London and East Sussex	4,990	**11**	23	0	0	2,121	4,250	0	0	**3,026**	6,063	2,400	4,810	98	197
Lincolnshire and Northamptonshire	1,884	0	0	0	0	195	1,035	0	0	2,096	**11,124**	77	408	1	4
North East	4,032	**11**	27	0	0	**2,358**	**5,847**	**6**	**15**	646	1,602	**3,539**	**8,777**	**463**	1,150
Solent and South Downs	3,127	10	**32**	0	**1**	**2,913**	**9,316**	**4**	**13**	2,626	8,399	482	1,542	391	**1,250**
Wessex	3,225	**20**	**63**	0	0	1,635	**5,069**	1	3	2,648	8,211	1,024	3,176	**510**	**1,582**
West Midlands *	25	1	-	0	-	1	-	0	-	4	-	0	-	0	-
Yorkshire	3,543	3	9	0	0	1,053	2,972	0	0	1,853	5,231	2,329	**6,573**	21	60

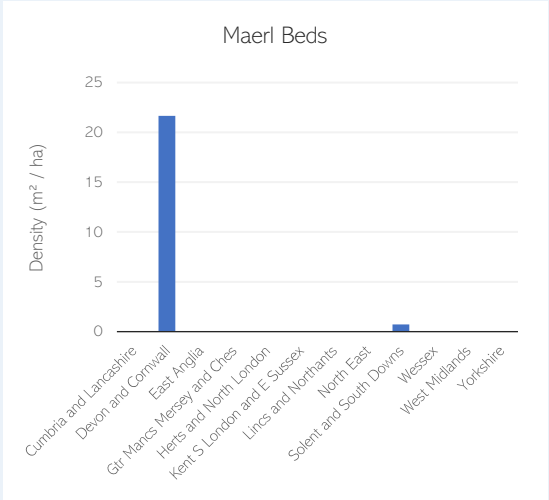
* No marine habitat present but included due to presence of intertidal habitats

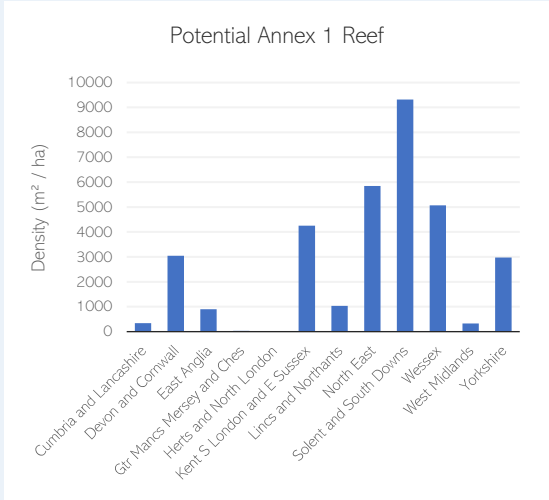
Note: Highest three values for each indicator are highlighted and **bold**

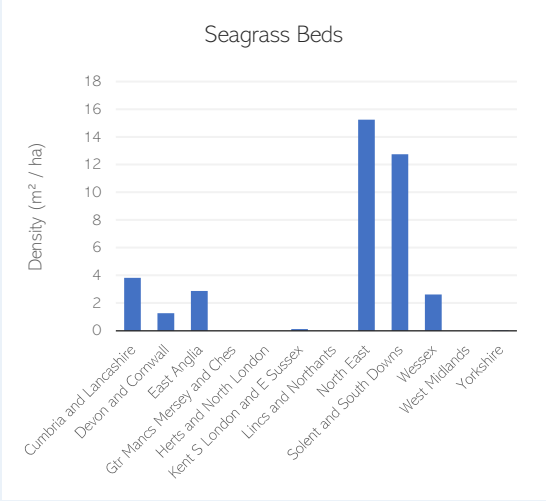
INDICATOR SUMMARY

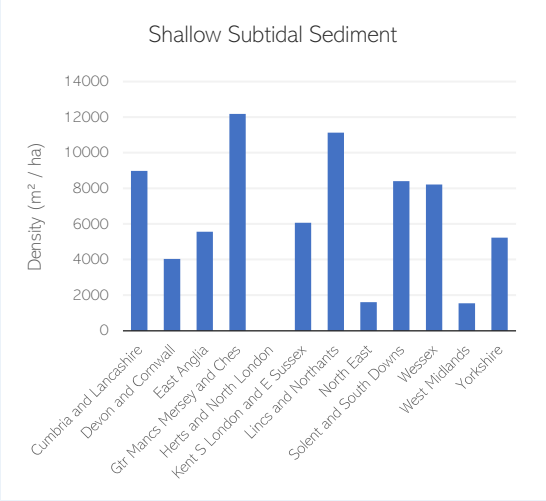
Charts showing the marine habitat quantity indicators for areas of England





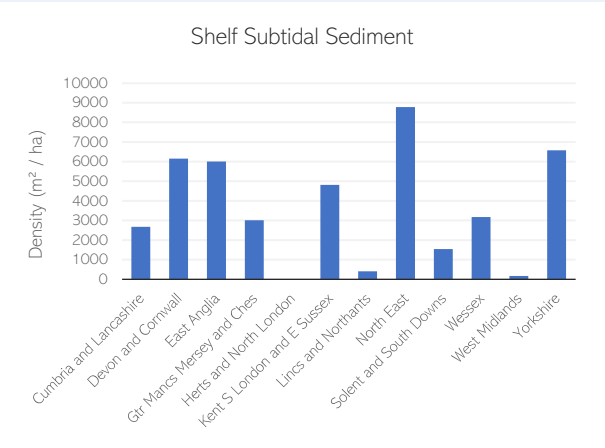






INDICATOR SUMMARY

Charts showing the marine habitat quantity indicators for areas of England



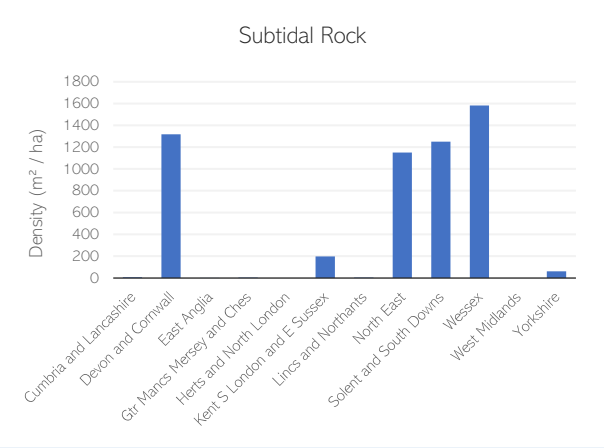


Photo: Richard Szwejkowski – Lulworth Dorset (CC BY-SA 2.0)

ASSET QUALITY

In addition to habitat asset quantity, it is important to consider the quality of habitats. This chapter explores how the condition of habitats influences the ecosystem services they provide. Indicators describing asset quality are mapped for all habitat types combined, using the following themes:

- Hydrology and geomorphology
- Nutrient and chemical status
- Soil/sediment processes
- Species composition
- Vegetation
- Cultural

ASSET QUALITY: HYDROLOGY & GEOMORPHOLOGY

The hydrology and geomorphology of habitats influence their ability to provide ecosystem services and subsequently impacts the benefits received by society. Hydrology is concerned with the properties of the Earth's water, especially its movement in relation to land. Geomorphology is the study of landforms, their processes, form and sediments at the surface of the Earth. To understand natural capital quality, hydrological and geomorphogical processes are important, because they relate to the processes, distribution and effects of water, the water cycle and sediment processes.

Hydrology and geomorphology have wide-ranging effects on the delivery of ecosystem services. Water supply is affected by the naturalness of aquifer function and river flow regime. River channel obstruction may block the migration of diadromous fishes and channel modification may lead to the loss of fish nursery habitat. Flood risk in different locations is influenced by the underlying geology and the way in which the local natural hydrological processes operate. It can be increased by human management actions for example, modifying river channels and covering natural surfaces with impermeable materials.


Photo: Jenny Downing – Overflow (CC BY 2.0)

Ecosystem Services

The following are key ecosystem services that can be assessed using the hydrology and geomorphology indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Water Supply

Water for drinking & non-drinking purposes

Flood Protection

Maintenance of Nursery Populations & Habitats

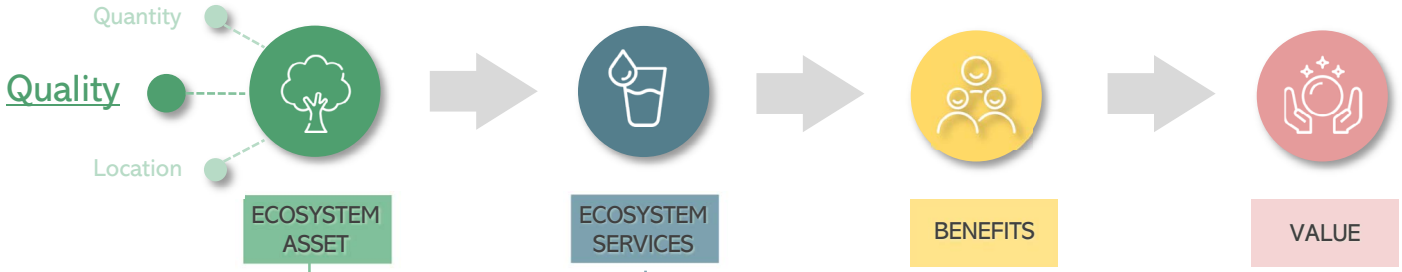
Biodiversity-thriving plants and wildlife

Climate Regulation

Global, regional & local climate regulation

Asset Quality Indicators - Hydrology & Geomorphology

This page illustrates how the indicators for habitat quality (hydrology and geomorphology) are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.



Indicator ↓	Habitat Types ↓	Water supply *	Flood protection *	Maintenance of nursery pops and habitats	Climate regulation
Natural aquifer function - recharge and discharge	Fr / MMH	●	●		
Naturalness of flow regime	Fr / MMH	●	●	●	
Lack of physical modifications of water bodies	Fr / MMH		●	●	●
River continuity – lack of obstructions	Fr			●	

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET QUALITY

Indicators of habitat quality: hydrology and geomorphology

Note: the Map Key is slightly different for the asset quality maps – 'no data / not applicable' values have been added

Map Key

Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

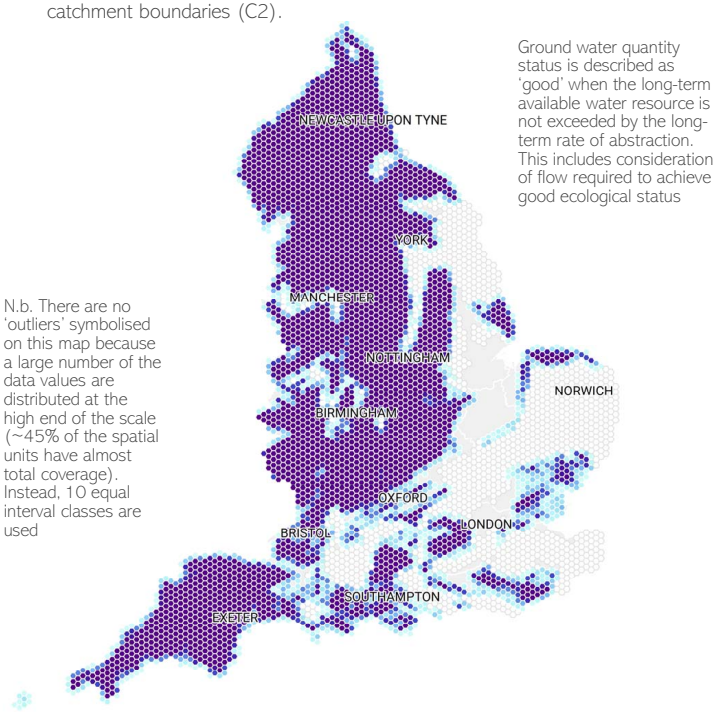
25 km²
2,500 ha

Natural Aquifer Function (ID: 51)

Area of groundwater catchment with 'good' quantitative status for WFD 2016, mapped using EA's WFD data and groundwater catchment boundaries (C2).

Ground water quantity status is described as 'good' when the long-term available water resource is not exceeded by the long-term rate of abstraction. This includes consideration of flow required to achieve good ecological status

N.b. There are no 'outliers' symbolised on this map because a large number of the data values are distributed at the high end of the scale (~45% of the spatial units have almost total coverage). Instead, 10 equal interval classes are used



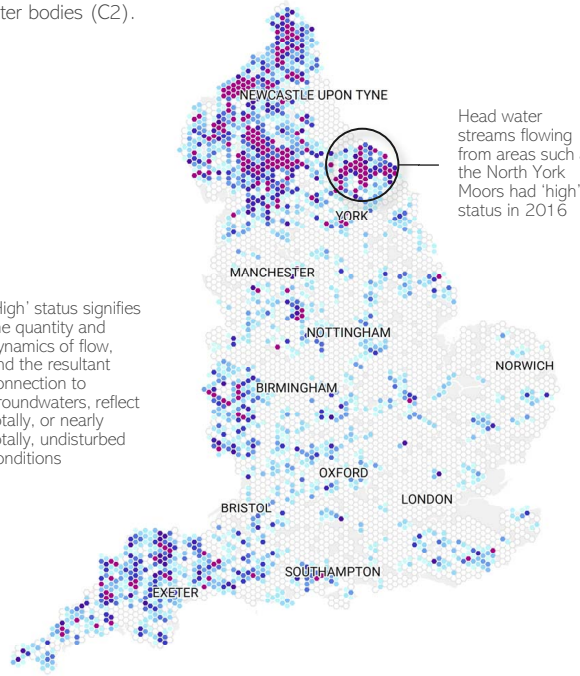
Hexagon values: 0 – 25 km² (see note on data distribution)

Naturalness of Flow Regime (ID: 52)

The WFD hydrological regime classification describes the naturalness of river flows. This map shows the length of river with 'high' WFD hydrological status in 2016, mapped using EA's WFD data and river water bodies (C2).

Head water streams flowing from areas such as the North York Moors had 'high' status in 2016

'High' status signifies the quantity and dynamics of flow, and the resultant connection to groundwaters, reflect totally, or nearly totally, undisturbed conditions



Hexagon values: 0 – 11.7 km; Outliers: 11.7 – 25.7 km

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

- Cultural services

Geodiversity:

- Geodiversity services

ASSET QUALITY

Indicators of habitat quality: hydrology and geomorphology

Map Key

Indicator value:

Outliers (>90th percentile)

High

Low

10 equal interval classes

0

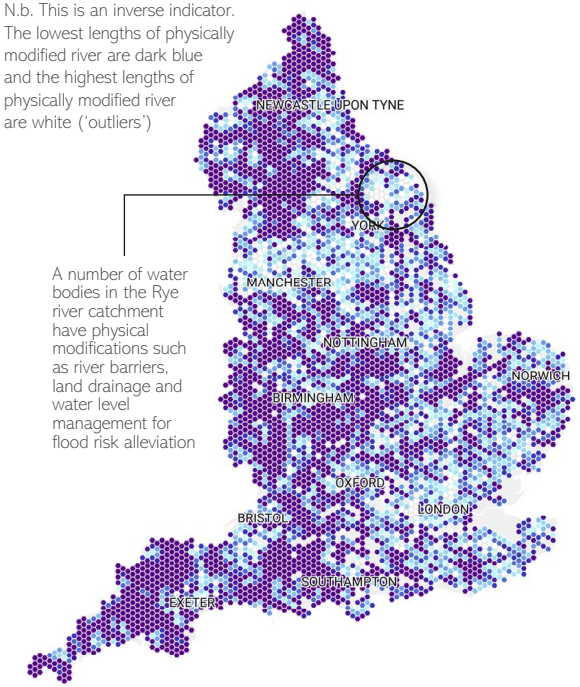
No data / not applicable

25 km²
2,500 ha

Lack of Physical Modifications of Water Bodies (ID: 53)

Lack of physical modification of rivers, mapped using EA's Reasons for Not Achieving Good Status data (SWMI = 'physical modification'), 2013-2016.

N.b. This is an inverse indicator. The lowest lengths of physically modified river are dark blue and the highest lengths of physically modified river are white ('outliers')

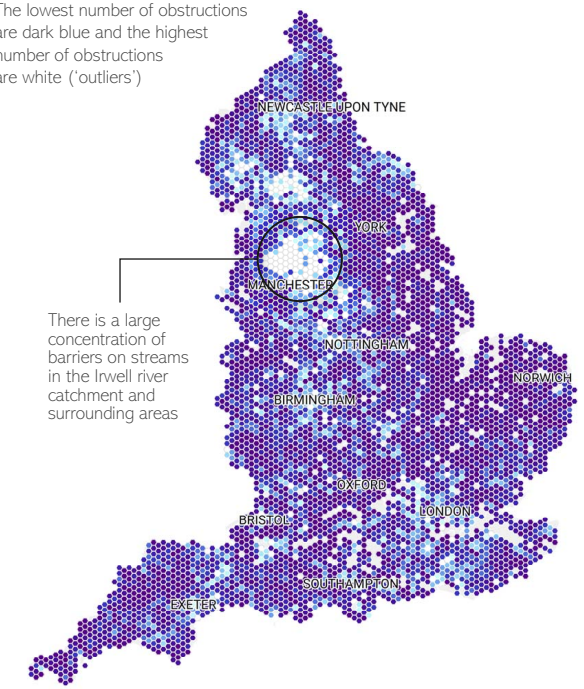


Hexagon values: 0 – 12.5 km; Outliers: 12.5 – 30.5 km (n.b. as this is an inverse indicator the outliers are shown in white)

River Continuity – Lack of Obstructions (ID: 54)

Lack of river obstructions mapped using EA's Potential Sites of Hydropower Opportunity dataset.

N.b. This is an inverse indicator. The lowest number of obstructions are dark blue and the highest number of obstructions are white ('outliers')



Hexagon values: 0 – 20; Outliers: 20 – 132 (n.b. as this is an inverse indicator the outliers are shown in white)

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

- Cultural services

Geodiversity:

- Geodiversity services

ASSET QUALITY: NUTRIENT & CHEMICAL STATUS

The nutrient and chemical status of habitats influence their ability to provide ecosystem services and subsequently impacts benefits received by society. Nutrient and chemical factors encompass the availability of innumerable elements and compounds in water and soil/sediment.

In freshwater habitats, for example, excess nitrate and phosphate leads to eutrophication, with a potentially deleterious impact on biodiversity. Nitrogen and phosphate levels also affect the processing of potable water at treatment plants. In terrestrial habitats, the availability of nitrogen, phosphorus and potassium are vital to primary production, thus affecting the provision of food and raw materials. Nutrient and chemical status also influences waste decomposition, climate regulation and the purification of water and air.

Ecosystem Services

The following are key ecosystem services that can be assessed using the nutrient and chemical status indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Wild Animals, Plants, Algae & their Outputs

Fish and other marine products from wild sources

Cultivated Crops

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Aquaculture

Reared Animals & their Outputs

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Asset Quality Indicators - Nutrient and Chemical Status

This page illustrates how the indicators for habitat quality (nutrient and chemical status) are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Indicator ↓	Habitat Types ↓	Wild animals, plants, algae and outputs	Aquaculture	Cultivated crops	Reared animals and outputs	Water quality *	Maintenance of nursery pops and habitats	Climate regulation
Chemical status of water bodies	Fr / Ma	●	●			●	●	
Nutrient status of water bodies	Fr / Ma	●	●			●	●	
Nutrient status of soil	Fr / Fa / Gr / Wo / Co			●	●	●	●	●

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET QUALITY

Indicators of habitat quality: nutrient and chemical status

Map Key

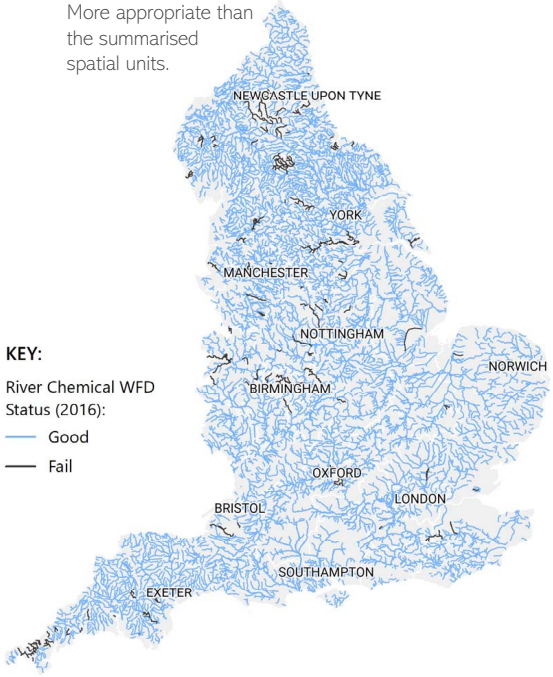
Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

25 km²
2,500 ha

Chemical Status of Water Bodies (ID: 55)

River chemical status for WFD 2016, mapped using EA's WFD data and river water bodies (C2). The vast majority of rivers are 'good', therefore a map showing actual data was deemed More appropriate than the summarised spatial units.

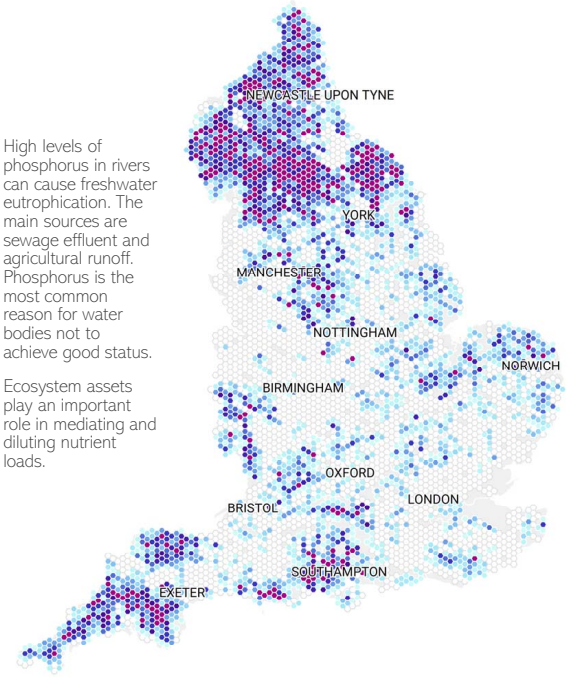


Nutrient Status of Water Bodies (ID: 56)

Length of river with 'good' or 'high' phosphate status for WFD 2016, mapped using EA's WFD data and river water bodies (C2).

High levels of phosphorus in rivers can cause freshwater eutrophication. The main sources are sewage effluent and agricultural runoff. Phosphorus is the most common reason for water bodies not to achieve good status.

Ecosystem assets play an important role in mediating and diluting nutrient loads.

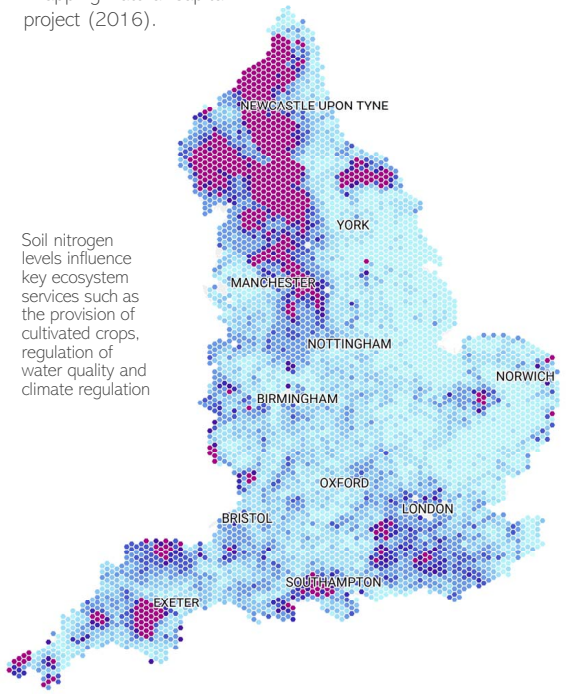


Hexagon values: 0 – 14.3 km; Outliers: 14.3 – 29.8 km

Nutrient Status of Soil (ID: 57)

Mean estimates of total nitrogen concentration in topsoil (0-15cm depth) - % dry weight of soil, mapped using data produced from Natural England and CEH's 'Mapping Natural Capital' project (2016).

Soil nitrogen levels influence key ecosystem services such as the provision of cultivated crops, regulation of water quality and climate regulation



Hexagon values: 0.17 – 0.66%; Outliers: 0.66 – 1.65%

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- Materials from plants, animals and algae
- Wild animals, plants, algae and outputs
- Plant-based energy
- Aquaculture
- Cultivated crops
- Water supply
- Reared animals and outputs

Regulating:

- Water quality
- Air quality
- Noise regulation
- Mass stabilisation
- Flood protection
- Pollination and seed dispersal
- Maintenance of nursery pops and habitats
- Pest and disease control
- Climate regulation

Cultural:

- Cultural services

Geodiversity:

- Geodiversity services

ASSET QUALITY: SOIL/SEDIMENT PROCESSES

The soil/sediment processes that occur in habitats influence their ability to provide ecosystem services and subsequently impacts the benefits received by society. Soil/sediment processes influence factors such as peat depth, organic matter content and soil structure.

Density of carbon/organic matter in topsoil is of vital importance to the production of both cultivated crops and natural vegetation, due to its role as the primary energy source in soils. As soil carbon is the biosphere's largest carbon reservoir, soils also play a vital role in climate regulation. Peatlands store approximately twice the carbon that is stored in all the world's forests (UN Environment, 2019), making them irreplaceable in climate regulation. Additionally, peatland supports numerous cultural services, from the preservation of ancient human artefacts to the unique and cherished 'wilderness' landscapes it underpins. Soil biota are easily overlooked, yet are crucial in nutrient cycling, soil aeration and the maintenance of healthy soil structure.

Ecosystem Services

The following are key ecosystem services that can be assessed using the soil/sediment processes indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Wild Animals, Plants, Algae & their Outputs

Fish and other marine products from wild sources

Reared Animals & their Outputs

Mass Stabilisation

Mass stabilisation and control of erosion rates

Pest & Disease Control

Cultivated Crops

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Climate Regulation

Global, regional & local climate regulation

Asset Quality Indicators - Soil/Sediment Processes

This page illustrates how the indicators for habitat quality (soil/sediment processes) are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Indicator ↓	Habitat Types ↓	Wild animals, plants, algae and outputs	Cultivated crops	Reared animals and outputs	Water quality *	Mass stabilisation	Maintenance of nursery pops and habitats	Pest and disease control	Climate regulation
Soil carbon/organic matter	Fr / Fa / Gr / MMH / Wo / Co		●		●	●	●		●
Soil biota	Fa / Gr / Wo / Co / Ma	●	●	●			●	●	●

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET QUALITY

Indicators of habitat quality: soil/sediment processes

Map Key

Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

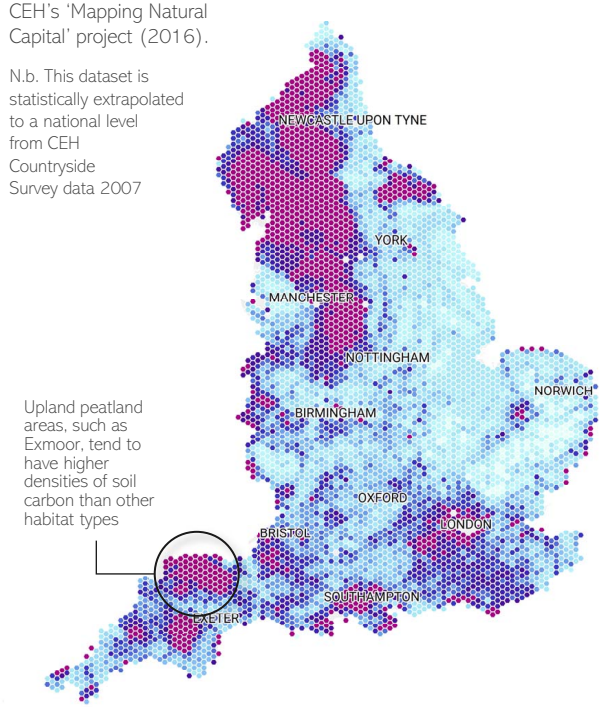
25 km²
2,500 ha

Soil Carbon/Organic Matter (ID: 58)

C W M H C

Mean estimates of carbon density in topsoil (0-15cm depth) – tonnes per hectare, mapped using data produced from Natural England and CEH's 'Mapping Natural Capital' project (2016).

N.b. This dataset is statistically extrapolated to a national level from CEH Countryside Survey data 2007



Upland peatland areas, such as Exmoor, tend to have higher densities of soil carbon than other habitat types

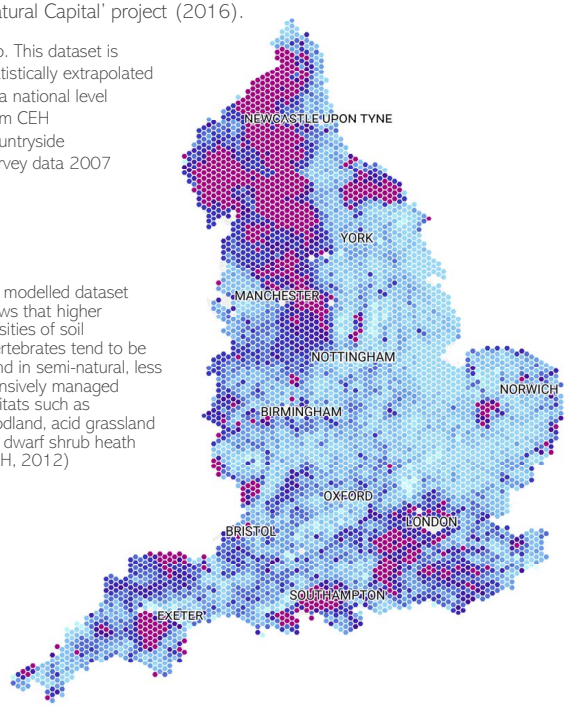
Hexagon values: 45.7 – 73.7 t; Outliers: 73.7 – 93.8 t

Soil Biota (ID: 59)

W C R H D C

Mean estimates of total abundance of invertebrates in topsoil (0-8 cm depth), mapped using data produced from Natural England and CEH's 'Mapping Natural Capital' project (2016).

N.b. This dataset is statistically extrapolated to a national level from CEH Countryside Survey data 2007



The modelled dataset shows that higher densities of soil invertebrates tend to be found in semi-natural, less intensively managed habitats such as woodland, acid grassland and dwarf shrub heath (CEH, 2012)

Hexagon values: 11 - 80; Outliers: 80 – 156

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUALITY: SPECIES COMPOSITION

The species composition of habitats influence their ability to provide ecosystem services and subsequently impacts the benefits received by society. The composition of plant and animal species present within a habitat reflects the degree of naturalness of that habitat.

Habitats with a more natural species assemblage often have greater aesthetic and cultural value, with associated benefits for tourism, education and recreation. Species composition also impacts on provisioning services, for example, increased species richness has been shown to increase biomass production in natural and plantation forests, bolstering timber provision (Piotto, 2008). Invasive species may impair the delivery of ecosystem services. Signal crayfish predate on fish eggs, potentially reducing the value of freshwater fisheries, while rhododendron bushes outcompete native plants and contribute to the spread of ramorum dieback, putting native trees (and the many ecosystem services they provide) at risk.

Photo: © Nick Paling – Wildflower meadow. Reproduced with permission.

Ecosystem Services

The following are key ecosystem services that can be assessed using the species composition indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Wild Animals, Plants, Algae & their Outputs

Fish and other marine products from wild sources

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Asset Quality Indicators - Species Composition

This page illustrates how the indicators for habitat quality (species composition) are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

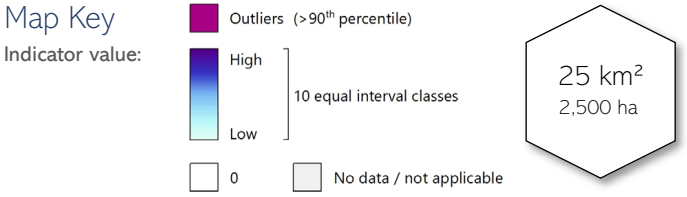
Indicator ↓	Habitat Types ↓	Wild animals, plants, algae and outputs	Water quality *	Maintenance of nursery pops and habitats
Invasive non-native species	Fr / MMH / Wo / Co / Ma	•		•
Naturalness of biological assemblage - no. of trophic levels and community composition in each level	Fr / Fa / Gr / MMH / Wo / Co / Ma	•	•	•

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET QUALITY

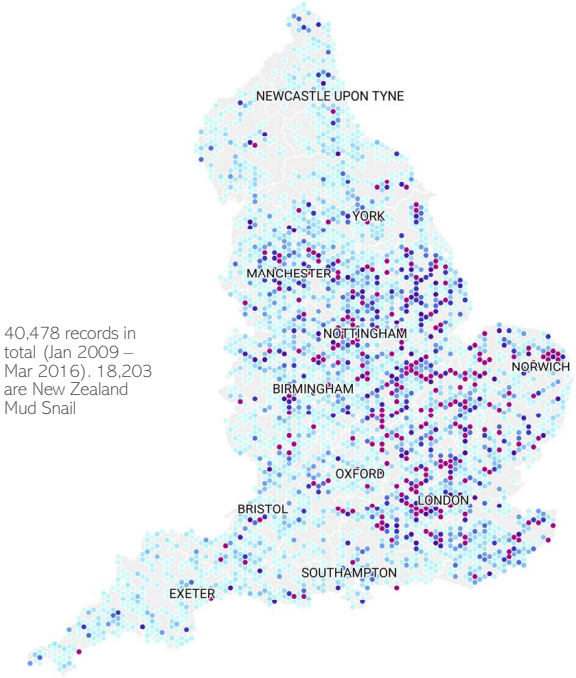
Indicators of habitat quality: species composition



H Invasive Non-Native Species (ID: 60)

Number of INNS surveyed and collected during EA monitoring activities between 2009 and 2016 (latest accessible surveys). Primarily aquatic and riparian species.

40,478 records in total (Jan 2009 – Mar 2016). 18,203 are New Zealand Mud Snail



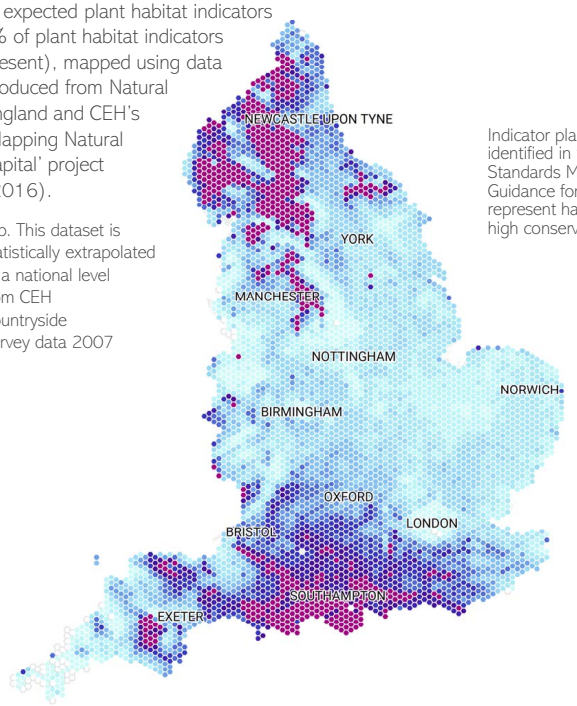
Hexagon values: 0 – 35; Outliers: 35 – 312

W W H Naturalness of Biological Assemblage (ID: 61)

Naturalness of biological assemblage is a difficult indicator to map as there are a number of factors to consider. The presence of certain plant species can be indicative of good quality, natural habitats. This map shows the mean estimates of expected plant habitat indicators (% of plant habitat indicators present), mapped using data produced from Natural England and CEH's 'Mapping Natural Capital' project (2016).

N.b. This dataset is statistically extrapolated to a national level from CEH Countryside Survey data 2007

Indicator plants were identified in the Common Standards Monitoring Guidance for SSSIs, so represent habitats of high conservation value



Hexagon values: 0 – 2.8%; Outliers: 2.8 – 10.1%

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUALITY: VEGETATION

The vegetation characteristics of habitats influence their ability to provide ecosystem services and subsequently impacts the benefits received by society. Vegetation cover, structure and the presence of nectar plants are important factors influencing the provision of ecosystem service provision. Furthermore, linear vegetation features, such as hedgerows and wooded strips, are important features of the English rural mosaic for habitat connectivity and aesthetic appreciation.

Vegetation stabilises soils and reduces flood risk by regulating the hydrological cycle. Additionally, vegetation can buffer noise pollution from roadways and scrubs gaseous pollutants like nitrogen oxides and particulates from the air. Vegetation promotes pollination of cultivated crops through the provision of nectar to pollinators.

Ecosystem Services

The following are key ecosystem services that can be assessed using the vegetation indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Water Supply

Water for drinking & non-drinking purposes

Noise Regulation

Pollination & Seed Dispersal

Water Quality

Maintenance of water quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)/chemical condition of freshwaters

Mass Stabilisation

Mass stabilisation and control of erosion rates

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Air Quality

Maintenance of air quality - Mediation of wastes, toxins & other nuisances (by biota & ecosystems)

Flood Protection

Climate Regulation

Global, regional & local climate regulation

Asset Quality Indicators - Vegetation

This page illustrates how the indicators for habitat quality (vegetation) are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Indicator ↓	Habitat Types ↓	Water supply *	Water quality *	Air quality	Noise regulation	Mass stabilisation	Flood protection *	Pollination and seed dispersal	Maintenance of nursery pops and habitats	Climate regulation
Presence and frequency of pollinator (larval and adult) food plants	Fa / Gr							●		
Vegetation cover/bare soil	Fr / Gr / MMH / Ur / Co	●	●	●	●	●	●	●	●	●

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET QUALITY

Indicators of habitat quality: Vegetation

Map Key

Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

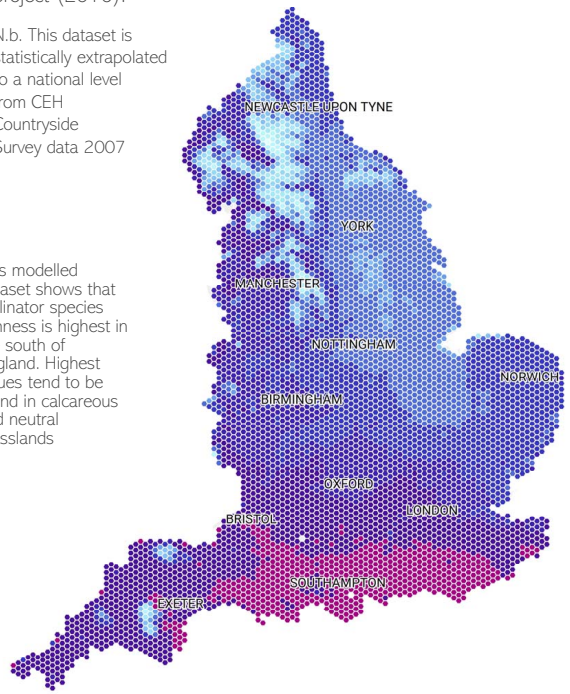
25 km²
2,500 ha

P Presence & Frequency of Pollinator Food Plants (ID: 62)

Mean estimates of number of nectar plant species for bees per 2x2m plot, mapped using data produced from Natural England and CEH's 'Mapping Natural Capital' project (2016).

N.b. This dataset is statistically extrapolated to a national level from CEH Countryside Survey data 2007

This modelled dataset shows that pollinator species richness is highest in the south of England. Highest values tend to be found in calcareous and neutral grasslands

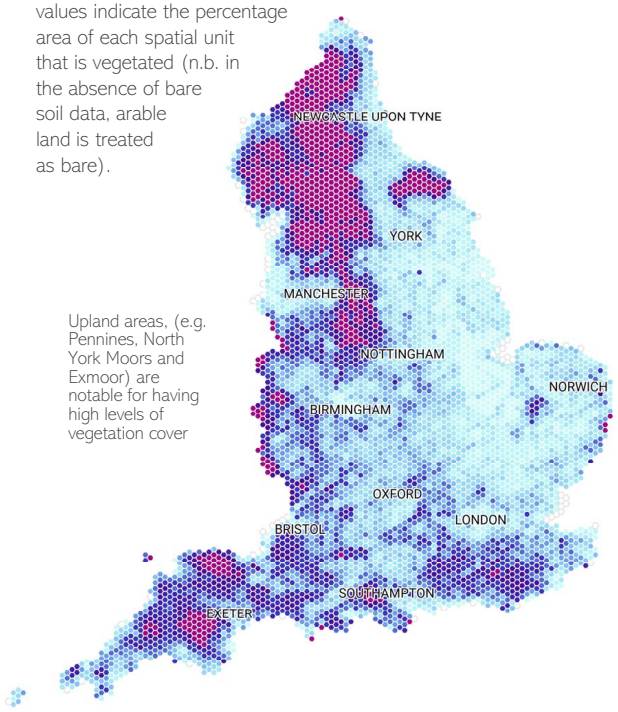


Hexagon values: 0.78 – 6.75; Outliers: 6.75 – 9.81

S W A N M F P H C Vegetation Cover/Bare Soil (ID: 63)

A dataset that accurately describes the national distribution of bare soil is not available. The ratio of vegetated to non-vegetated surfaces is illustrated here using CEH's Land Cover Map 2015. The values indicate the percentage area of each spatial unit that is vegetated (n.b. in the absence of bare soil data, arable land is treated as bare).

Upland areas, (e.g. Pennines, North York Moors and Exmoor) are notable for having high levels of vegetation cover



Hexagon values: 0 – 95%; Outliers: 95 – 100%

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUALITY: CULTURAL

There are a number of habitat characteristics that influence the degree of cultural value they provide to society. If accessible, well managed habitats can significantly enhance the mental and physical health of visitors and residents. Habitats and the biodiversity they support have an intrinsic value, beyond the services they deliver to human beings. They can hold an emotional or spiritual value to individuals or communities. The cultural benefits provided by habitats are often difficult to measure as they are less tangible than other benefits provided by nature.

Biodiversity is an important factor influencing the delivery of cultural services. A natural habitat with high species richness has the potential to offer valuable aesthetic, recreational or educational services. The presence of rare or flagship species (such as wetland bitterns and the grey seals of England's coasts) is also important and may generate revenue for the local economy through tourism. Habitats often contain designated heritage assets and boundary features that have remained in place for centuries and accrue tremendous historical value. Public Rights of Way facilitate the delivery of cultural services in habitats that would otherwise be inaccessible to most.

Ecosystem Services

The indicators on the following page have been selected to measure how the quality of habitat influences the cultural ecosystem services they provide.

Cultural Services

Practices related to: experiential (e.g. wildlife watching) & physical use (e.g. walking); scientific/educational (subject matter of research, education, in-situ and ex-situ); aesthetic (e.g. art, poetry, writing); spiritual and/or emblematic (e.g. emblematic or sacred plants and animals).

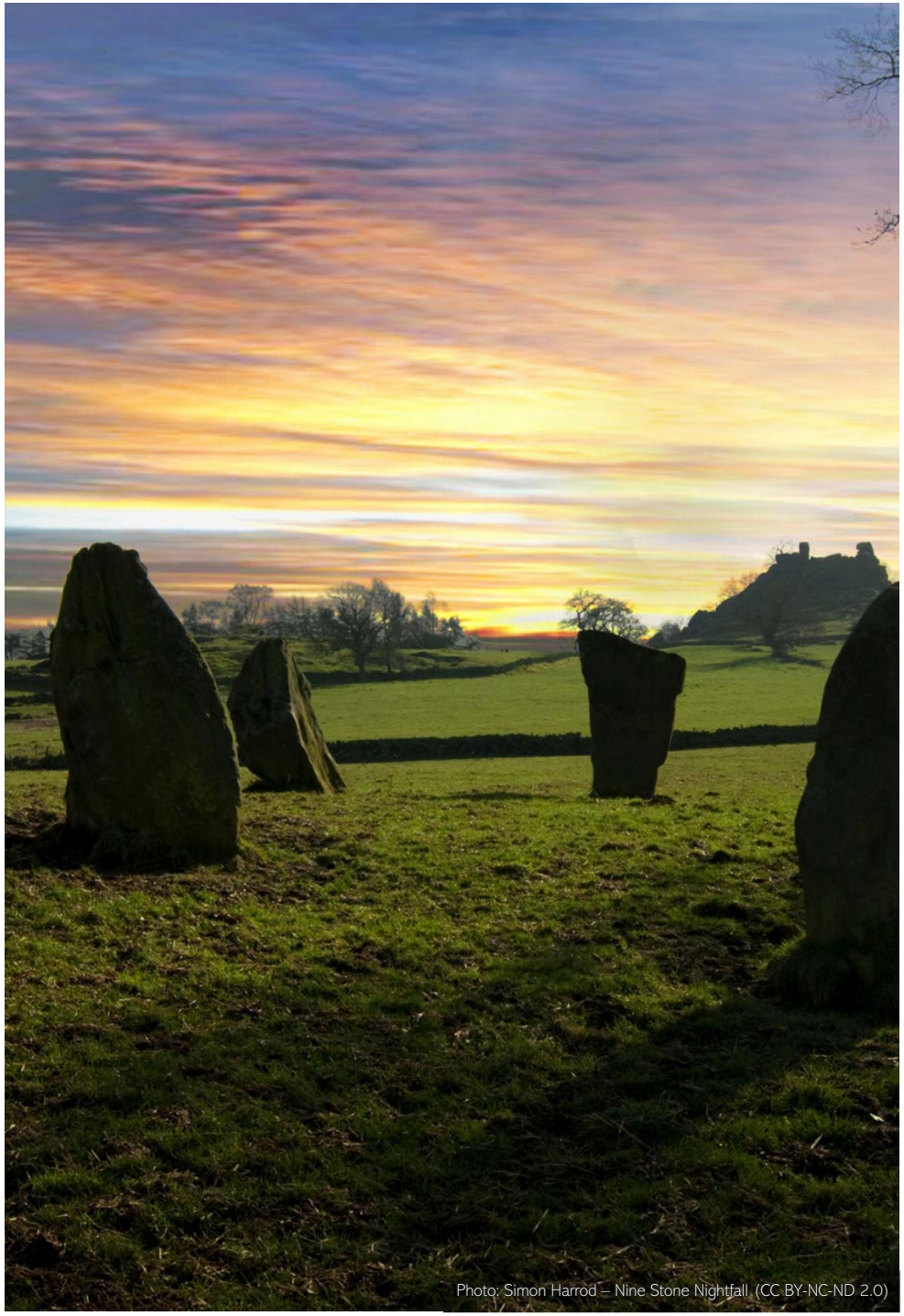
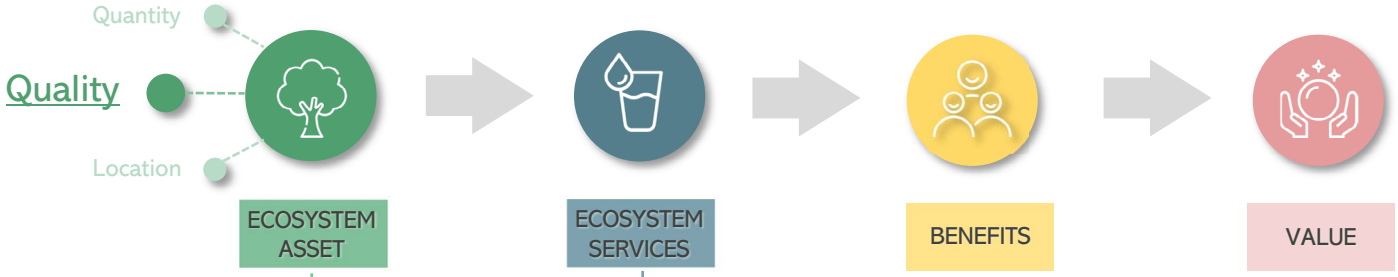


Photo: Simon Harrod – Nine Stone Nightfall (CC BY-NC-ND 2.0)

Asset Quality Indicators - Cultural

This page illustrates how the indicators for habitat quality (cultural) are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.



	Indicator ↓	Habitat Types ↓	Cultural services	Geodiversity services
Nature	Naturalness of watercourses	Fr / MMH	●	
	Favourable condition of SSSIs/geosites/MPAs	All + Geodiversity	●	●
Culture and History	Designated historic environment assets	All	●	
Quietness	Tranquility	Fr / Fa / Gr / MMH / Co	●	
Accessibility	Public Rights of Way	Fr / Fa / Gr / MMH / Wo / Ur / Co	●	

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET QUALITY

Indicators of habitat quality: Cultural

Map Key

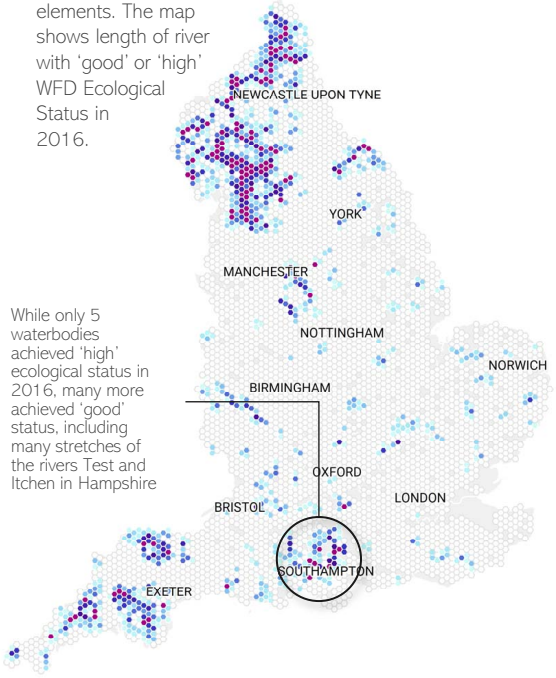
Indicator value:

- Outliers (>90th percentile)
- High
- 10 equal interval classes
- Low
- 0
- No data / not applicable

25 km²
2,500 ha

C Naturalness of Watercourses (ID: 64)

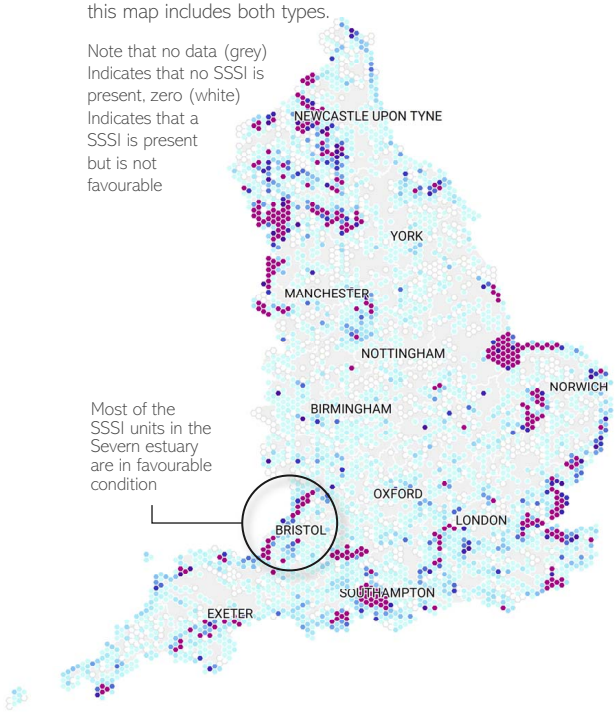
WFD river 'ecological status' describes how the quality of a river compares to its natural 'reference' condition. It is based on biological quality elements, supported by physico-chemical and hydromorphological quality elements. The map shows length of river with 'good' or 'high' WFD Ecological Status in 2016.



Hexagon values: 0 – 12 km; Outliers: 12 – 25 km

C G Favourable Condition of SSSIs (ID: 65)

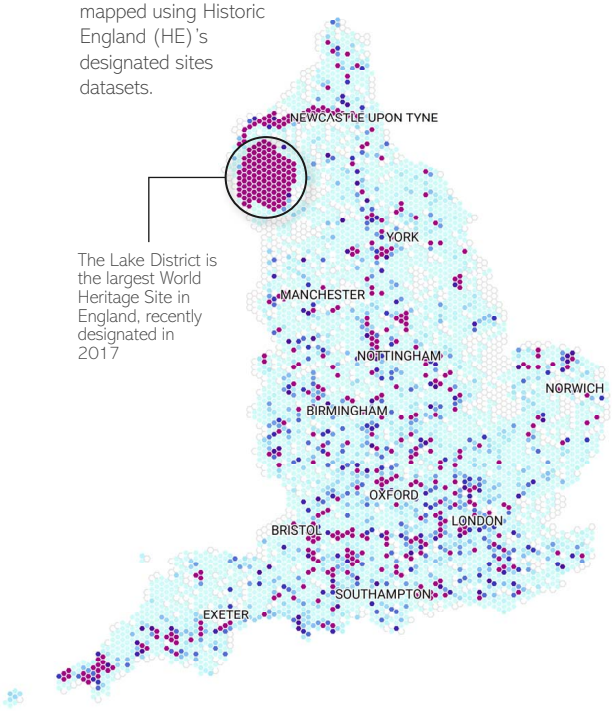
Area of SSSIs with 'favourable' condition status mapped using Natural England's SSSI Units dataset. SSSIs are designated for both geological and biological features, this map includes both types.



Hexagon values: 0 – 3.6 km²; Outliers: 3.6 – 25 km²

C Designated Historic Environment Assets (ID: 66)

Area of designated historic environment assets (world heritage sites, scheduled monuments, parks and gardens, battlefields) mapped using Historic England (HE)'s designated sites datasets.



Hexagon values: 0 – 2.2 km²; Outliers: 2.2 – 25.0 km²

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET QUALITY

Indicators of habitat quality: Cultural

Map Key

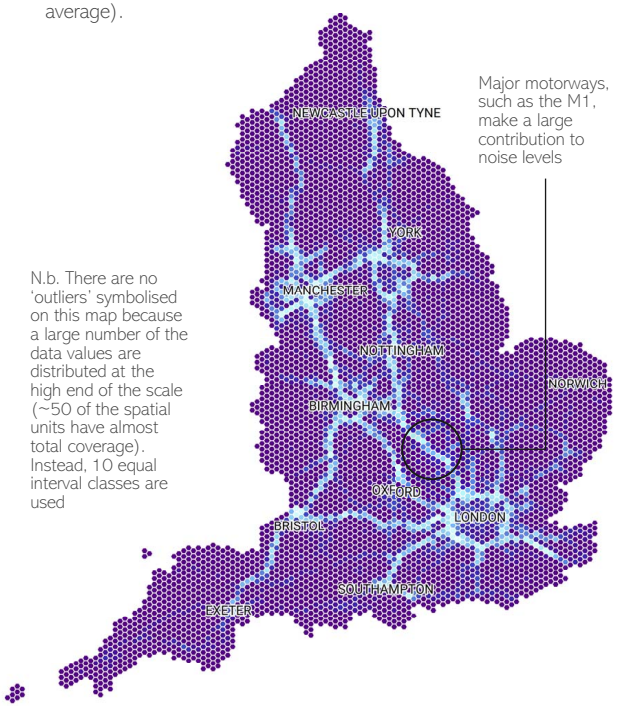
Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

25 km²
2,500 ha

C Tranquility (ID: 67)

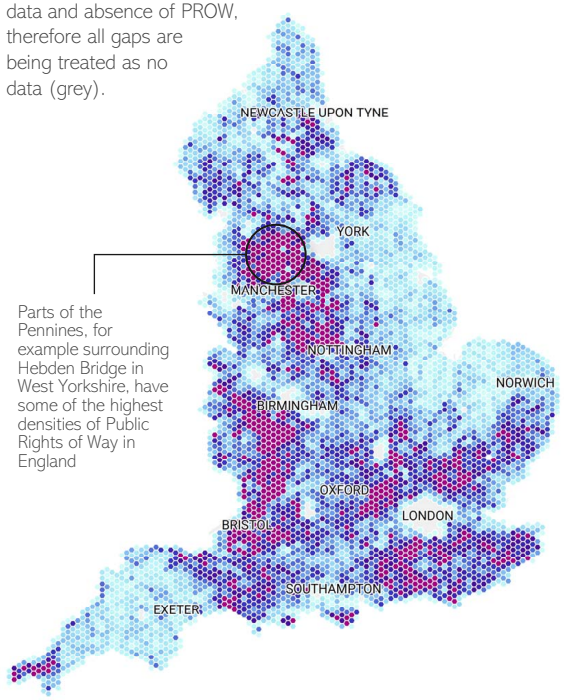
This map indicates areas of noise tranquility mapped using Defra's 2012 modelled noise map (combined road and rail, 24hr annual average).



Hexagon values: 0 – 25 km² (see note on data distribution)

C Public Rights of Way (ID: 68)

Length of Public Right of Way mapped by combining open Local Authority datasets. N.b. for small areas it is difficult to differentiate between no data and absence of PROW, therefore all gaps are being treated as no data (grey).



Hexagon values: 0 – 60 km; Outliers: 60 – 205 km

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ASSET LOCATION

Photo: © Westcountry Rivers Trust – Penpont, Cornwall.
Reproduced with permission.

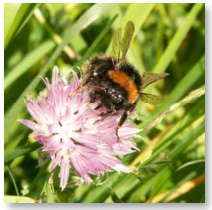
ASSET LOCATION

Previous chapters have described how the quantity and the quality of habitats influence the level of ecosystem services that those habitats provide, and subsequently the benefits received by society. This chapter describes how the location of habitats can also have a significant impact on ecosystem service provision. It is important to understand how the location of habitats in relation to other features in the landscape or beneficiaries, influences the level of service provision and also the number of people that benefit.

Habitats can reduce pollution of rivers and lakes by intercepting and filtering surface water runoff, but only if they are positioned along the transfer pathway between the pollution source and the receiving water bodies. Located in the right place, they can also reduce downstream flood risk by storing or slowing the flow of water and improve air quality by filtering the air.

Ecosystem Services

The following are key ecosystem services that can be assessed using the asset location indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).



Pollination &
Seed Dispersal

Maintenance of Nursery Populations & Habitats

Biodiversity-thriving plants and wildlife

Pest & Disease Control

Asset Location Indicators

This page illustrates how the indicators for asset location are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

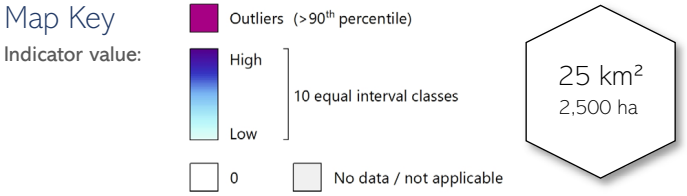
Indicator	Habitat Types	Pollination and seed dispersal	Maintenance of nursery pops and habitats	Pest and disease control
Patch size, shape and edge - Total habitat area, average patch size and number of patches	Fr / Fa / Gr / MMH / Wo / Ur	•	•	•

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ASSET LOCATION

Indicators describing the location of habitats

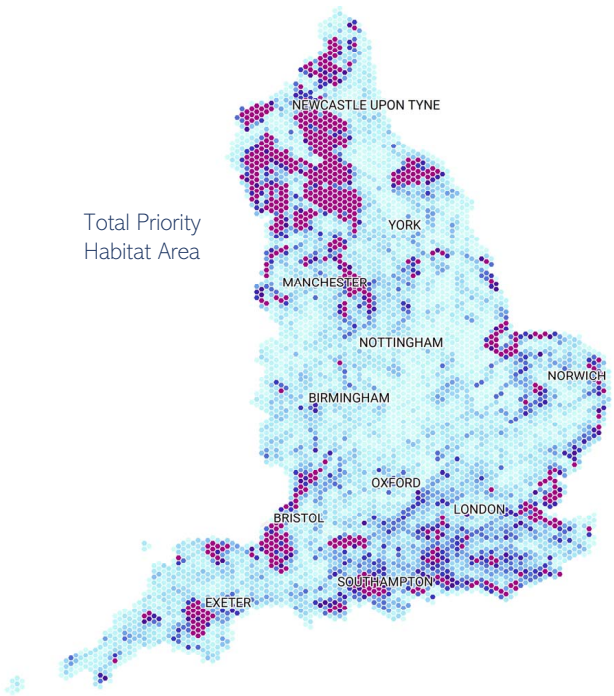


Patch Size, Shape and Edge (ID: 69)

P H D

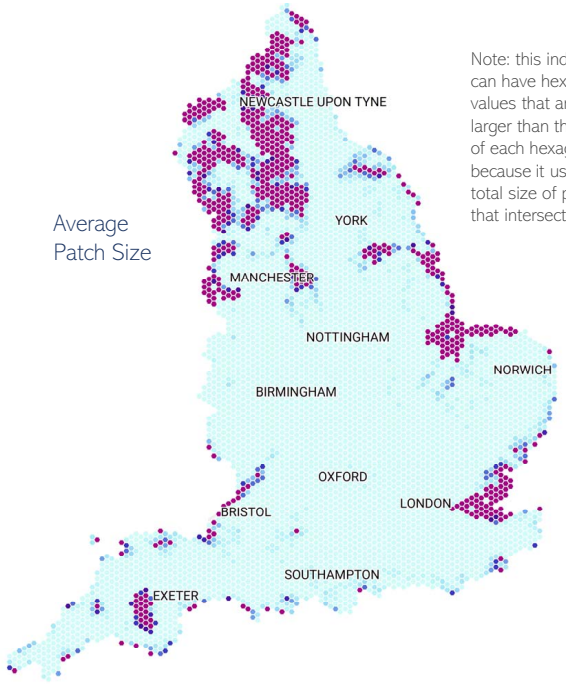
This is a difficult indicator to map for all habitat types combined and at a national scale. Factors such as habitat type, area, patch size and proximity should be considered. A combination of maps are included here to show average patch size, number of patches and total habitat area for each spatial unit, using Natural England's Priority Habitats Inventory.

Total Priority Habitat Area



Hexagon values: 0 – 11.1 km²; Outliers: 11.1 – 25 km²

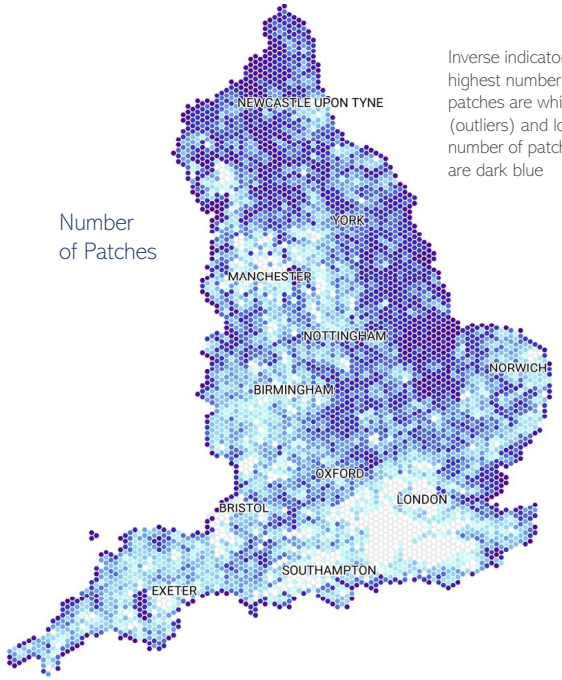
Average Patch Size



Note: this indicator can have hexagon values that are larger than the size of each hexagon because it uses the total size of patches that intersect each

Hexagon values: 0 – 1.3 km²; Outliers: 1.3 – 193.6 km²

Number of Patches



Inverse indicator – highest number of patches are white (outliers) and lowest number of patches are dark blue

Hexagon values: 1 – 169; Outliers: 169 – 1071 (n.b. as this is an inverse indicator the outliers are shown in white)

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- M Materials from plants, animals and algae
- W Wild animals, plants, algae and outputs
- P Plant-based energy
- A Aquaculture
- C Cultivated crops
- S Water supply
- R Reared animals and outputs

Regulating:

- W Water quality
- A Air quality
- N Noise regulation
- M Mass stabilisation
- F Flood protection
- P Pollination and seed dispersal
- H Maintenance of nursery pops and habitats
- D Pest and disease control
- C Climate regulation

Cultural:

- C Cultural services

Geodiversity:

- G Geodiversity services

ECOSYSTEM SERVICE FLOW

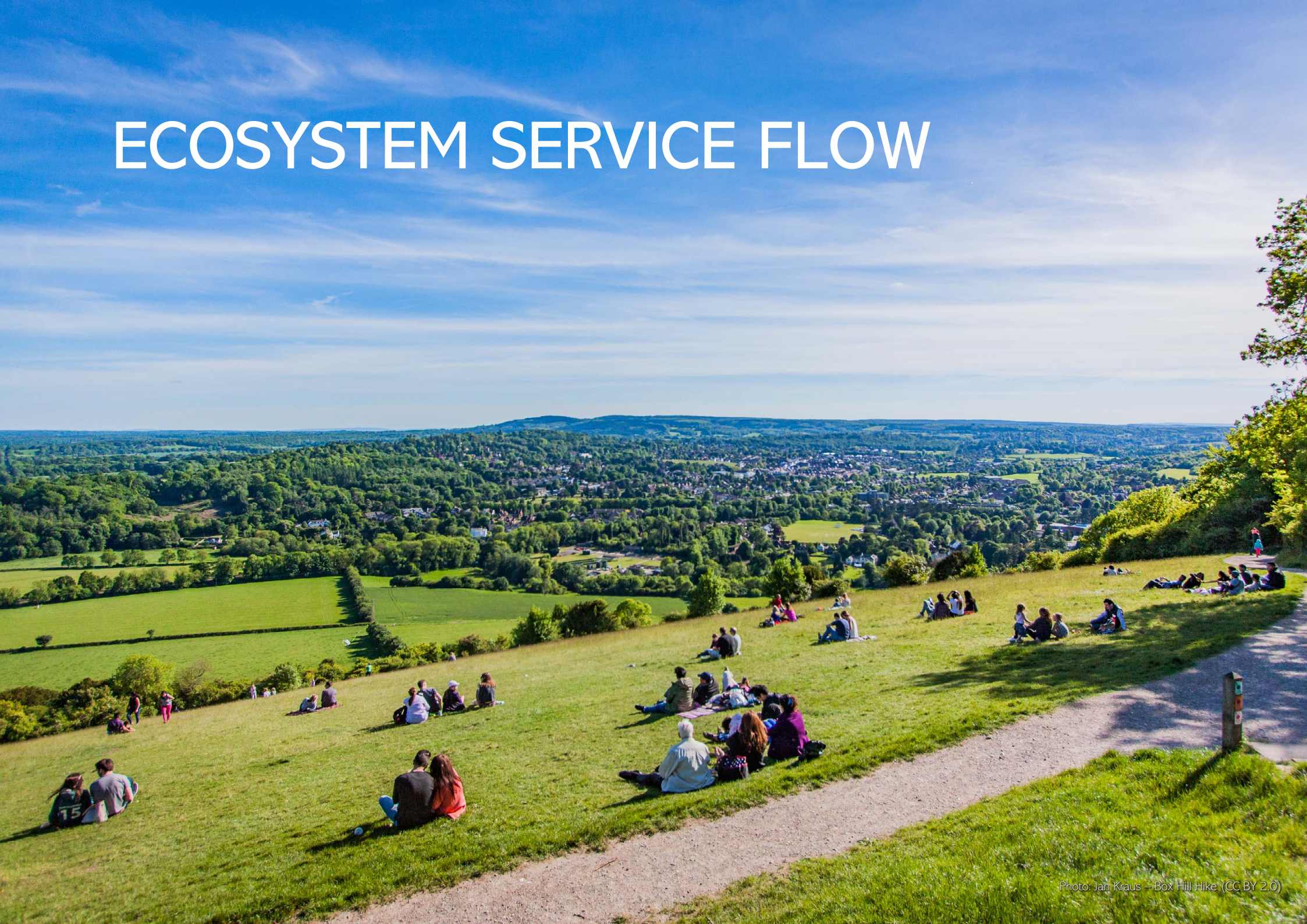


Photo: Jan Kraus – Box Hill Hike (CC BY 2.0)

ECOSYSTEM SERVICE FLOW

Thus far, this atlas has focused on the state of natural capital assets. The final part of the assessment looks at the flow of ecosystem services from habitats to humans and attempts to measure and map this process, for specific services, across the country.

The flow of ecosystem services is often difficult to measure as there are usually numerous factors that influence the service in question. For example, for water quality it is difficult to separate out improvements produced by riparian woodland from other factors, especially pollution inputs. Natural England's Natural Capital Indicators Project (2018) identified a number of indicators and datasets for ecosystem service flow, though many of these were not feasible to map at a national scale. The following pages show maps that attempt to describe a selection of these ecosystem services, including water available for abstraction and carbon storage.

Ecosystem Services

The following are key ecosystem services that can be assessed using indicators (shown on the following page). Following the Natural Capital Indicators Project, the services are based on the Common International Classification of Ecosystem Services (CICES Version 4.3).

Materials from Plants, Animals & Algae

Timber, hay and other materials

Water Supply

Water for drinking & non-drinking purposes

Climate Regulation

Global, regional & local climate regulation

Ecosystem Service Flow Indicators

This page illustrates how the indicators for ecosystem service flow are connected to ecosystem services, benefits and value, as shown in the logic chain below. The Natural England Natural Capital Indicators report only produced logic chains for key ecosystem services from each broad habitat type, therefore the matrix below shows the short-list indicators for the key ecosystem services, which were possible to map.

Indicator ↓	Habitat Types ↓	Materials from plants animals and algae	Water supply *	Climate regulation
Production of timber, paper and other wood products	Wo	●		
Amount of water available for abstraction	Fr / MMH		●	
Carbon sequestered and greenhouse gases fixed	All			●

Habitat types: Fr – Freshwater, Fa – Farmland, Gr – Grassland, MMH – Mountains, Moor and Heath, Wo – Woodland, Ur – Urban, Co – Coastal, Ma - Marine

* Ecosystem service that was considered for freshwater catchments

ECOSYSTEM SERVICE FLOW

Indicators describing the flow of ecosystem services from habitats

Map Key

Indicator value:

- Outliers (>90th percentile)
- High
- Low
- 10 equal interval classes
- 0
- No data / not applicable

25 km²
2,500 ha

(M) Production of Timber, Paper & Other Wood Products (ID: 70)

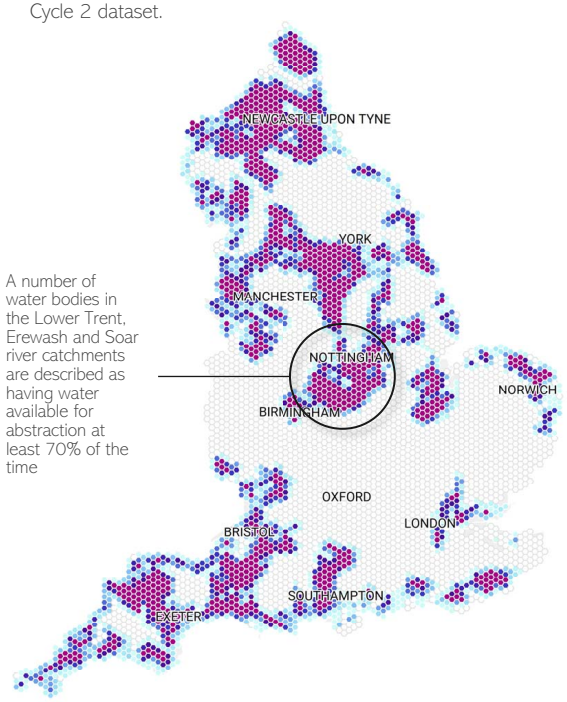
Due to the absence of a spatial dataset for mapping timber production, the table below describes the amount of wood production in the UK and England in 2017. Statistics are derived from Forestry Commission's Forestry Statistics 2018.

	UK	England
Wood Production (thousand green tonnes)		
Total	11,653	-
Total softwood	10,915	2,048
Total hardwood	738	-
Sawmills (count)		
Total	164	88
Consumption of softwood by mills (thousand green tonnes)		
Total	6,848	2,095
Inputs for integrated pulp and paper mills (thousand green tonnes)		
Total	503	-
UK roundwood	442	-
Sawmill products	61	-

Source: Forestry Commission – Forestry Statistics 2018, Ch2: UK-Grown Timber

(S) Amount of Water Available for Abstraction (ID: 71)

Area of land where surface water is available for abstraction at least 70% of the time, mapped using EA's Water Resource Availability and Abstraction Reliability Cycle 2 dataset.



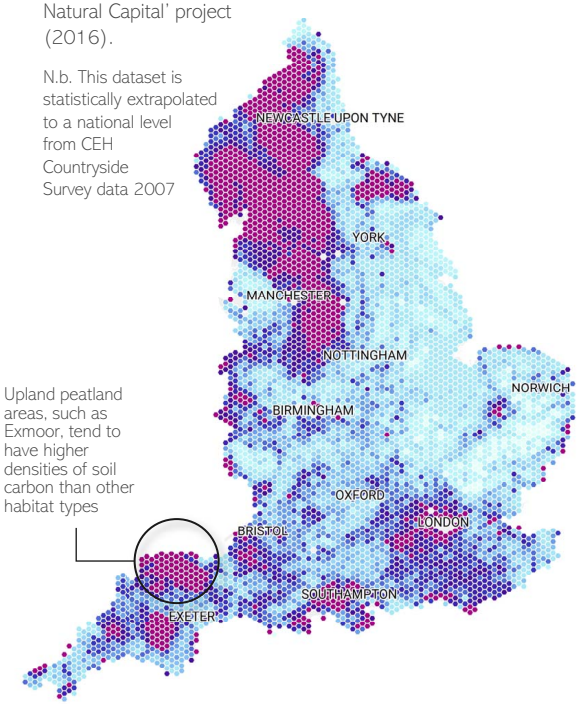
A number of water bodies in the Lower Trent, Erewash and Soar river catchments are described as having water available for abstraction at least 70% of the time

Hexagon values: 0 – 24 km²; Outliers: 24 – 25 km²

(C) Carbon Sequestered & Greenhouse Gases Fixed (ID: 72)

Mean estimates of carbon density in topsoil (0-15cm depth) – tonnes per hectare, mapped using data produced from Natural England and CEH's 'Mapping Natural Capital' project (2016).

N.b. This dataset is statistically extrapolated to a national level from CEH Countryside Survey data 2007



Upland peatland areas, such as Exmoor, tend to have higher densities of soil carbon than other habitat types

Hexagon values: 45.7 – 73.7 t; Outliers: 73.7 – 93.8 t

Note: All maps are © Natural England, 2019. Data sources and attributions for each map are listed on pages 96 and 97.

Ecosystem Services Key

The coloured circles denote the key ecosystem services that are associated with each indicator

Provisioning:

- (M) Materials from plants, animals and algae
- (W) Wild animals, plants, algae and outputs
- (P) Plant-based energy
- (A) Aquaculture
- (C) Cultivated crops
- (S) Water supply
- (R) Reared animals and outputs

Regulating:

- (W) Water quality
- (A) Air quality
- (N) Noise regulation
- (M) Mass stabilisation
- (F) Flood protection
- (P) Pollination and seed dispersal
- (H) Maintenance of nursery pops and habitats
- (D) Pest and disease control
- (C) Climate regulation

Cultural:

- (C) Cultural services

Geodiversity:

- (G) Geodiversity services

Photo: Alex White – Easdale Tarn, Lake District (CC BY-NC 2.0)

DATA SOURCES, ABBREVIATIONS & ATTRIBUTIONS

Dataset Sources

Note: Numbers in pink show which maps/indicators the dataset was used to create

Centre for Ecology & Hydrology (CEH)

- **Land Cover Map 2015** (13, 14, 20, 63)

  LCM2015 © NERC (CEH) 2011. Contains Ordnance Survey data © Crown Copyright 2007.
  Rowland, C.S.; Morton, R.D.; Carrasco, L.; McShane, G.; O'Neil, A.W.; Wood, C.M. (2017) Land Cover Map 2015 (25m raster, GB). NERC Environmental Information Data Centre. https://doi.org/10.5285/bb15e200-9349-403c-bda9-b430093807c7

- **UK Lakes Portal** (3, 21)

  UK Lakes Database © Centre for Ecology and Hydrology

- **Inventory of reservoirs amounting to 90% of total UK storage** (21)

  Durant, M.J.; Counsell, C.J. (2018). Inventory of reservoirs amounting to 90% of total UK storage. NERC Environmental Information Data Centre. https://doi.org/10.5285/f5a7d56c-cea0-4f00-b159-c3788a3b2b38

Department for Environment, Food & Rural Affairs (Defra)

- **Strategic Noise Mapping** (67)

  © Defra

EMODnet / Natural England / Defra

- **Intertidal mudflats layer for England** (39)

  Contains Defra information © Defra - Project MB0102

Environment Agency

The following datasets were used in this atlas:
© Environment Agency and/or database right

- **Detailed River Network** (9)
- **Saltmarsh Extents** (40)
- **WFD Water Body Water Status** (52, 55, 57, 64)
- **Reasons for Not Achieving Good Database** (53)
- **WFD River Waterbodies Cycle 1 & 2** (6, 23)
- **WFD Groundwater Bodies Cycle 2** (51)
- **Surface Water Resource Availability and Abstraction Reliability Cycle 2** (71)
- **Risk of Flooding from Rivers and Sea** (1)
- **Invasive Non Native Species Survey** (60)
- **Potential Sites of Hydropower Opportunity** (54)

Forestry Commission

- **National Forest Inventory** (11, 27, 28, 29, 36)

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Historic England

The following datasets were used in this atlas: © Historic England [2019]. Contains Ordnance Survey data © Crown copyright and database right [2019]

- **Scheduled Monuments** (66)
- **World Heritage Sites** (66)
- **Registered Battlefields** (66)
- **Registered Parks and Gardens** (66)

Joint Nature Conservation Committee (JNCC)

- **UKSeaMap 2018** (48, 49, 50)
  © Joint Nature Conservation Committee
- **Potential Annex 1 Reefs** (46)
  © Joint Nature Conservation Committee

Map/Indicator List

Asset Quantity

1 Active flood plain
2 Coastal & floodplain grazing marsh
3 Lakes & standing waters
4 Lowland Fens
5 Lowland raised bog
6 Rivers
7 Modified waters eg reservoirs and canals
8 Reedbeds
9 Ponds
10 Blanket bog
11 Woodland
12 Other semi-natural habitats
13 Arable & horticulture
14 Improved grassland
15 Orchards & top fruit
16 Hay meadows
17 Other semi-natural grasslands
18 Blanket bog
19 Dwarf shrub heath
20 Inland rock, scree and pavement (above the moorland line)
21 Lakes and reservoirs (above moorland line)
22 Mountain heath and willow scrub
23 Rivers (above moorland line)
24 Semi-natural grassland (above moorland line)
25 Upland flushes fens and swamps
26 Wood pasture (above moorland line)
27 Woodland (above moorland line)
28 Broadleaved, mixed & yew woodland
29 Coniferous woodland
30 Ancient woodland
31 Priority woodland habitats
32 Blue space
33 Green space: not semi-natural
34 Open mosaic habitats
35 Semi-natural habitats
36 Woodland, scrub and hedge
37 Beach
38 Coastal lagoons
39 Mudflats
40 Salt marsh
41 Sand dunes
42 Sea cliff
43 Shingle
44 Intertidal rock
45 Maerl beds
46 Reefs
47 Sea grass beds
48 Shallow subtidal sediment
49 Shelf subtidal sediment
50 Subtidal rock

Asset Quality

51 Natural aquifer function
52 Naturalness of flow regime
53 Lack of physical modifications of water bodies
54 River continuity – lack of obstructions
55 Chemical status of water bodies
56 Nutrient status of soil/sediment
57 Nutrient status of water bodies
58 Soil carbon/organic matter content
59 Soil biota
60 Invasive non-native species
61 Naturalness of biological assemblage
62 Presence & frequency of pollinator (larval & adult) food plants
63 Vegetation cover/bare soil
64 Naturalness of watercourses
65 Favourable condition of SSSIs
66 Designated historic environment assets
67 Tranquility
68 Public Rights of Way

Asset Location

69 Spatial configuration of habitats, in relation to maintenance of habitats and species populations

Ecosystem Service Flow

70 Production of timber, paper and other wood products
71 Amount of water available for abstraction
72 Carbon sequestered and greenhouse gases fixed

Dataset Sources

Note: Numbers in pink show which maps/indicators the dataset was used to create

Natural England

The following datasets were used in this atlas: © Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2019]

- **Priority Habitat Inventory** (2, 4, 5, 8, 10, 12, 15,16, 17, 18, 19, 22, 24, 25, 31, 35, 38, 41, 42, 43, 69)
- **SSSI Units** (65)
- **Open Mosaic Habitat (Draft)** (34)
- **Wood Pasture and Parkland** (26)
- **Open Marine Evidence GDB** (44, 45, 47)
- **Ancient Woodlands** (30)

Natural England & Centre for Ecology & Hydrology (CEH)

- **Natural Capital Maps** (56, 58, 59, 61, 62, 72)

  Contains data supplied by © NERC - Centre for Ecology & Hydrology. © Natural England copyright.

Office for National Statistics (ONS)

- **Built-up Areas (December 2011) Boundaries V2** (32, 35, 36)

  Contains National Statistics data © Crown copyright and database right [2019]. Contains OS data © Crown copyright and database right [2019]

Ordnance Survey

The following datasets were used in this atlas: Contains Ordnance Survey data © Crown copyright and database right [2019]

- **VectorMap District** (7, 9, 32, 37)
- **Open Green Space Layer** (33)
- **Boundary-Line™**

Rural Payments Agency (via MAGIC)

- **Moorland Line (England)** (20, 21, 23, 24, 26, 27)

  Contains Rural Payments Agency data © Crown copyright and database right [2019]

  N.b. Dataset used as a guide for identifying habitats above the moorland line.

Public Rights of Way Data – Multiple Sources

The rights of way data is derived from multiple sources, directed from the rowmaps website: www.rowmaps.com

All datasets used have open licenses (terms equivalent to OS Opendata License or Open Government License). The following Local Authorities produced data that was used to map rights of way in England (68)

- Barnsley Metropolitan Borough Council
- Bath & North East Somerset Council
- Bedford Borough Council
- London Borough of Bexley
- Birmingham City Council
- Blackburn with Darwen Borough Council
- Blackpool Council
- Bolton Council
- BCP Council
- Bracknell Forest Council
- City of Bradford Metropolitan District Council
- Brighton & Hove City Council
- Bristol City Council
- London Borough of Bromley
- Buckinghamshire County Council
- Bury Council
- Calderdale Council
- Cambridgeshire County Council
- Central Bedfordshire Council
- Cheshire East Council
- Cheshire West and Chester Council
- Cornwall Council
- Cumbria County Council
- Derbyshire County Council
- Devon County Council
- Doncaster Council
- Dorset Council
- Dudley Metropolitan Borough Council
- Durham County Council
- East Riding of Yorkshire Council
- East Sussex County Council
- Essex County Council
- Gateshead Council
- Gloucestershire County Council
- Hampshire County Council
- Herefordshire Council
- Hertfordshire County Council
- Hull City Council
- Isle of Anglesey County Council
- Isle of Wight Council
- Kent County Council
- Kirklees Council
- Knowsley Metropolitan Borough Council
- Lake District National Park
- Lancashire County Council
- Leicester City Council
- Leicestershire County Council
- Lincolnshire County Council
- Manchester City Council
- Medway Council
- Norfolk County Council
- North Lincolnshire Council
- North Somerset Council
- North Yorkshire County Council
- Northamptonshire County Council
- Northumberland County Council
- Nottingham City Council
- Nottinghamshire County Council
- Oldham Council
- Oxfordshire County Council
- Peterborough City Council
- Plymouth City Council
- Bournemouth, Christchurch and Poole Council
- Portsmouth City Council
- Reading Borough Council
- Redcar and Cleveland Borough Council
- Rochdale Borough Council
- Rotherham Metropolitan Borough Council
- Rutland County Council
- Salford City Council
- Sefton Council
- Sheffield City Council
- Shropshire Council
- Slough Borough Council
- Somerset County Council
- South Gloucestershire Council
- Southampton City Council
- St Helens Council
- Staffordshire County Council
- Stockport Metropolitan Borough Council
- Stockton Council
- Suffolk County Council
- Surrey County Council
- Tameside Metropolitan Borough Council
- Thurrock Council
- Torbay Council
- Trafford Council
- Wakefield Council
- Walsall Council
- Warrington Borough Council
- Warwickshire County Council
- West Berkshire Council
- West Sussex County Council
- Wigan Council
- Wiltshire Council
- Royal Borough of Windsor and Maidenhead Council
- Wirral Council
- Wokingham Borough Council
- Worcestershire County Council
- City of York Council

Map/Indicator List

Asset Quantity

1 Active flood plain
2 Coastal & floodplain grazing marsh
3 Lakes & standing waters
4 Lowland Fens
5 Lowland raised bog
6 Rivers
7 Modified waters eg reservoirs and canals
8 Reedbeds
9 Ponds
10 Blanket bog
11 Woodland
12 Other semi-natural habitats
13 Arable & horticulture
14 Improved grassland
15 Orchards & top fruit
16 Hay meadows
17 Other semi-natural grasslands
18 Blanket bog
19 Dwarf shrub heath
20 Inland rock, scree and pavement (above the moorland line)
21 Lakes and reservoirs (above moorland line)
22 Mountain heath and willow scrub
23 Rivers (above moorland line)
24 Semi-natural grassland (above moorland line)
25 Upland flushes fens and swamps
26 Wood pasture (above moorland line)
27 Woodland (above moorland line)
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Map of Environment Agency & Natural England Areas

The map below shows the joint Environment Agency – Natural England administrative areas; the boundaries that are used for the habitat area summary tables and charts.

Datasets:
Ordnance Survey – **Boundary-Line™**

Environment Agency – **Administrative Boundaries - Environment Agency and Natural England Public Face Areas**

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Abbreviations

NE	Natural England
Defra	Department for Environment, Food & Rural Affairs
CICES	Common International Classification of Ecosystem Services
EA	Environment Agency
CEH	Centre for Ecology & Hydrology
WFD	Water Framework Directive
OS	Ordnance Survey
FC	Forestry Commission
AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
UK NEA	UK National Ecosystem Assessment
LCM2015	Land Cover map 2015
NFU	National Farmers Union
STEAM	Scarborough Tourism Economic Activity Model
AML	Above Moorland Line
RPA	Rural Payments Agency
ONS	Office for National Statistics
JNCC	Joint Nature Conservation Committee
EUNIS	European University Information Systems
SWMI	Significant Water Management Issue
INNS	Invasive Non-Native Species
SSSI	Site of Special Scientific Interest
PROW	Public Right of Way