UK natural capital accounts quality and methods guide

What the UK natural capital accounts cover, how we produce them, and their quality and comparability. Includes definitions and latest, past and upcoming changes.

Contact:
Natural Capital team
natural.capital.team@ons.gov.uk
+44 1633 580051

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Table of contents

1. Overview

2. What the statistics cover

3. Where the data come from and how we produce the statistics

4. Quality of the statistics

5. Changes and their effects on comparability over time

6. Comparability and coherence with other statistics producers

7. Users and uses of these statistics

8. Definitions

9. Related links

10. Cite this page

1 . Overview

The UK natural capital accounts provide estimates of the economic and social value of natural resources to the UK. This guide provides quality and methods information for ourUK annual natural capital accounts bulletins.

Our accounts are compiled in line with the guidelines in the United Nations (UN) System of Environmental-Economic Accounting Ecosystem Accounting (SEEA-EA).

They present:

- the total size of seven broad terrestrial habitats (extent)
- the quantity and value of services supplied from ecosystem services provided by nature on an annual basis (physical and monetary ecosystem service flow accounts)
- the value of the ecosystem services as an asset, which is the stream of services expected to be provided over the lifetime of the asset (monetary asset account)

Our natural capital accounts also feature in the extended accounts in ourUK National Accounts: The Blue Book.

We produce a new time series in each annual bulletin. Time series should not be compared with time series of previous years' publications because of ongoing development of and changes to our methodologies. For more information, go to Section 5: Changes and their effects on comparability over time.

These are official statistics in development. For more information, go to Section 4: Quality of the statistics.

Latest changes to quality and methods

We updated this guide on 5 December 2025 to reflect changes made in our latest UK natural capital accounts: 2025 bulletin. Some important changes to quality and methods include:

- expansion of our urban heat regulating estimates from 11 city regions to local authorities in Great Britain
- changes to our return to produced assets calculation
- new estimates for minerals and metals monetary values by habitat

For more information on latest, past and upcoming changes, go to Section 5: Changes and their effects on comparability over time.

2 . What the statistics cover

We publish our UK natural capital accounts annually. The accounts provide ecosystem services estimates on a calendar-year basis, covering 16 ecosystem services. Each of these is grouped into one of three types of ecosystem service: provisioning service, regulating service, or cultural service.

For each service, we estimate annual value and asset value. For most ecosystem services, we also estimate a physical value. However, we do not estimate a physical flow for urban heat regulating or recreation and aesthetic (house prices). For definitions for each ecosystem service, go to Section 8: Definitions.

Habitat extent

We use the broad habitat classifications from the 2011 UK National Ecosystem Assessment to categorise habitats. Each ecosystem service is allocated to one or more of these eight broad habitats. If we are unable to allocate an ecosystem service to a habitat, this is classed as "other".

The mapping data for these habitats are from the UK Centre for Ecology and Hydrology's (UKCEH's) Land Cover Maps. Each of the 21 Land Cover Map habitat classes are assigned to eight broad habitat classes.

Each ecosystem service may contain unique habitat breakdowns that are particular to that ecosystem service. These breakdowns are described in our UK natural capital accounts – detailed summary tables dataset.

Enclosed farmland

Enclosed farmland includes arable, horticulture and improved grassland. This includes annual crops, perennial crops such as berries and orchards, freshly ploughed land, and higher productivity grasslands.

Woodland

Woodland includes managed plantations, ancient and semi-natural woodlands, and both coniferous and broadleaf (deciduous) woodland.

Mountains, moorland, and heath

Mountains, moorland and heath includes heather, heather grassland and inland rock. These are mountainous, open, and rugged habitats.

Semi-natural grassland

Semi-natural grassland includes acid grassland, calcareous grassland (where the geology below is composed of calcium carbonate), and neutral grassland. These are acidic, alkaline, and neutral habitats, respectively, with low levels of plant species diversity.

Urban

Urban includes suburban and urban habitats, consisting of built structures and other infrastructure.

Freshwater, wetlands, and floodplains

Freshwater, wetlands, and floodplains includes fen, bog, and freshwater. Freshwater bogs are partly drained habitats, including ericaceous (acidic composition) and herbaceous mosses that form over peat-rich soils.

Coastal margins

Coastal margins includes saltmarsh, littoral rock, littoral sediment, supralittoral rock, and supralittoral sediment. Littoral areas are on the shoreline and supralittoral areas are the splash zone above the high-tide mark.

Marine

This broad habitat is saltwater. In our UK accounts, we only show total extent of the seven broad terrestrial habitats. We include marine to show habitat changes between 1990 and 2024, where a terrestrial habitat has become marine or a marine habitat has become terrestrial.

Geographic coverage and granularity of the statistics

All ecosystem services are produced at UK level and at England, Scotland, Wales, and Northern Ireland level, unless otherwise stated.

The exception to this is the urban heat regulating service, which is currently only available for Great Britain; there are no Northern Ireland estimates for this ecosystem service.

Data from each country are used to produce each ecosystem service's country-level estimates, unless specified in this guide. Where data specific to a country (for example, data from Scotland) are not available, the country-level estimates for that country are imputed or estimated from the countries where there is available data.

For five ecosystem services where comparable data are not available, we calculate country-level monetary values by subtracting the Scotland value, which is available, from the UK value and apportioning the residual to England, Wales, and Northern Ireland. These ecosystems are:

- agricultural biomass provisioning
- coal provisioning
- minerals and metals provisioning
- renewable electricity provisioning
- water provisioning

For oil and gas provisioning, production in Wales and Northern Ireland is assumed to be zero because there is minimal oil and gas extracted in these countries. We provide physical flow and monetary values for oil and gas provisioning for UK and Scotland. England values are assumed to be the remainder when Scotland values are deducted from the UK value.

For recreation and aesthetic (house prices), there are only monetary values for England and Wales and we use these to model values for Scotland and Northern Ireland.

Some ecosystem services are produced at a greater granularity than country level, including:

- air pollution regulating physical flows, annual, and asset values, which are produced on a local-authority basis
- greenhouse gas regulating physical flows, annual, and asset values, which are produced on a local-authority basis
- recreation and aesthetic (house prices) annual and asset values, which are produced on anInternational Territorial Level 1-basis (countries, and regions of England)
- urban heat regulating annual and asset values, which are produced for local authorities in Great Britain

Availability of statistics over time

The first year for which statistics are available for each ecosystem service varies and are detailed in this section. Unless explicitly mentioned, this is the start date of physical flows, annual, and asset values.

The ecosystem services that are available from 1998 onwards are:

- agricultural biomass provisioning (annual and asset values only, for all crops)
- coal provisioning
- minerals and metals provisioning (annual and asset values only)
- oil and gas provisioning
- timber provisioning
- woodfuel provisioning
- water provisioning (annual and asset values only)
- greenhouse gas regulating
- urban heat regulating (annual value only)

The ecosystem services available from 1999 onwards are:

- agricultural biomass provisioning (physical flow for all breakdowns, including all crops, barley, feedstocks, grazed biomass, oats, oilseed rape, and wheat)

The ecosystem services available from 2002 onwards are:

- water provisioning (physical flow only)
- urban heat regulating (asset value only)

The ecosystem services available from 2003 onwards are:

- renewable electricity provisioning (physical flow only)
- recreation and aesthetic (house prices)
- recreation (health benefits) – for Scotland only

The ecosystem services available from 2005 onwards are:

- air pollution regulating

The ecosystem services available from 2008 onwards are:

- minerals and metals provisioning (physical flow only)

The ecosystem services available from 2009 onwards are:

- recreation (health benefits) – for UK and for England, Northern Ireland and Wales

The ecosystem services available from 2011 onwards are:

- recreation and tourism (expenditure)

The ecosystem services available from 2014 onwards are:

- noise regulating

The ecosystem services available from 2016 onwards are:

- fish provisioning

3 . Where the data come from and how we produce the statistics

Where the data come from

Most of the data used within our UK natural capital accounts are publicly available and some are specifically produced for and delivered to us. Individual data sources for each ecosystem service are listed in this section.

Data sources for multiple ecosystem services include:

- our UK input-output supply and use tables
- our Capital stocks and fixed capital consumption releases
- data from our Annual Business Survey in our Non-financial business economy datasets
- the Bank of England's Annual average yield from British Government Securities and 10-year nominal par yield
- HM Treasury's (HMT's) GDP deflators at market prices
- HMT's Green book supplementary guidance: discounting guidance
- the Scottish Government's Supply, Use and Input-Output Tables
- the Scottish Government's Quarterly gross domestic product (GDP) statistics

Agricultural biomass provisioning data sources include:

- agricultural data from the Department for Environment, Food and Rural Affairs's (Defra's) Agriculture in the UK datasets
- regional physical flows for barley, oats, oilseed rape, and wheat from Defra's Provisional cereal and oilseed production estimates for England
- the Scottish Government's total income from farming estimates and Defra's total income from farming in the UK; used to assign UK net capital stock for Standard Industrial Classification (SIC) 01 for Scotland based on the ratio of consumption of fixed capital between the UK and Scotland
- agricultural accounts for each nation, including Defra's total income from farming in the UK and total income from farming in England, the Welsh Government's aggregate agricultural output and income, and Northern Ireland's Department of Agriculture, Environment and Rural Affairs's agricultural incomes estimates; used to apportion the remainder of the resource rent, once Scotland has been deducted, based on the gross operating surplus
- grazed biomass calculations are based on livestock numbers and livestock annual roughage requirements provided in Eurostat's Economy-wide material flow accounts (EW-MFA) questionnaire (PDF, 3.0MB)

Coal provisioning data sources include:

- the Department for Energy Security and Net Zero's (DESNZ's) coal production statistics in their Digest of UK Energy Statistics (DUKES); this does not include Northern Ireland, which stopped coal production in 1970

Fish provisioning data sources include:

- the Marine Management Organisation's (MMO's) physical data on marine fish capture (live weight) from the rectangle-level landings data in their UK sea fisheries annual statistics
- spatial data from the EU Commission's Joint Research Centre Scientific, Technical, and Economic Committee for Fisheries, as part of the Fisheries Dependent Information dataset
- the International Council for Exploration of the Sea's (ICES's) stock assessments for all fish species across UK waters; used to estimate the sustainability of fishing
- economics estimates for fleet segments delivered directly from Seafish

Minerals and metals provisioning data sources include:

- physical estimates of mineral extraction delivered directly from the British Geological Survey (BGS)
- our Indicators of house building, UK dataset

Oil and gas provisioning data sources include:

- the North Sea Transition Authority's (NSTA's) Production and expenditure projections for physical estimates of oil and gas production and asset valuation
- the Scottish Government's Oil and gas statistics, which are comparable with the UK NSTA data

Renewable electricity provisioning data sources include:

- DESNZ's data on electricity generated by renewable sources from DUKES
- DESNZ's Energy Trends; used to apportion values for the four countries of the UK using the percentage of electricity generation from renewable sources
- DESNZ's regional renewable and non-renewable installed capacity figures from their Regional Renewable Statistics
- DESNZ's mapping data from their Renewable Energy Planning Data and UK Centre for Ecology and Hydrology's (UKCEH's) 2021 landcover maps to assign solar photovoltaic and onshore wind estimates to habitats

Timber and woodfuel provisioning data sources include:

- Forest Research's (FR's) removals estimates in their Timber statistics
- FR's Coniferous Standing Sales Price Index in their Timber Price Indices statistics
- FR's Forecasts of timber availability; used to estimate the pattern of expected future flows of the service over the asset lifetime
- FR's UK roundwood deliveries; used to separate out woodfuel provisioning by deducting these data from the timber value, to ensure no double counting occurs

Water provisioning data sources include:

- physical data from the Drinking Water Inspectorate (for England), Northern Ireland Water, Scottish Water, Natural Resources Wales (NRW), and Welsh Water Dr Cymru
- Defra's water abstraction tables for data before 2018 for England

Air pollution regulating data sources include:

- atmospheric chemistry and transport model for physical flows from the European Monitoring and Evaluations Program Unified Model for the UK (EMEP4UK), which is provided directly to us
- Defra's Air Quality damage cost guidance
- the Health and Safety Executive's A scoping study on the valuation of risks to life and health: the monetary Value of a Life year (VOLY) report

Greenhouse gas regulating data sources include:

- physical data relating to carbon exchange in the Land Use, Land Use Change and Forestry (LULUCF) sector from the UK National Atmospheric Emissions Inventory's Projections of Emissions and Removals from the LULUCF Sector to 2050/2100 report (PDF, 5.1MB); further information on how this is measured can be found in DESNZ's Mapping greenhouse gas emissions and removals for the land-use, land-use change and forestry sector report (PDF, 6.4MB)
- DESNZ's UK local authority and regional greenhouse gas emissions statistics and Energy and emissions projections
- DESNZ's projected non-traded price of carbon schedule in data table 3 of their Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal for annual value calculations

Noise regulating data sources include:

- data from Defra's Scoping UK Urban Natural Capital Account – Extending noise regulation estimates report

Urban heat regulating data sources include:

- the Centre for Environmental Data Analysis's 1km grid max daily temperature data
- Ordnance Survey's (OS's) Built Up Area (BUA) (February 2025 boundary) dataset
- OS's 2025 built-up area, grouped or dissolved by Local authority 2024 (LA24) boundaries to derive areas by local authority
- OS's MasterMap Networks – Water Layer from 2024
- OS's MasterMap Water Topography Layer from 2024
- OS's MasterMap Greenspace Layer from 2024
- the Ministry of Housing, Communities and Local Government's (MHCLG's) Energy Performance Certificate Local Authority-level data of non-domestic buildings for England and Wales March 2025 dataset
- energy performance data to March 2025 from Scottish Government's Non-domestic Energy Performance Certificates
- our Regional gross value added (balanced) by industry: local authorities by ITL1 region dataset
- FR's Valuing London's Urban Forest project i-Tree Eco London report

Recreation and tourism (expenditure) and recreation (health benefits) data sources include:

- recreation data for England from Natural England's Monitor of Engagement with the Natural Environment (MENE) survey and the People and Nature Survey (PaNS)
- recreation data for Wales from NRW's Welsh Outdoor Recreation Survey (WORS) and the National Survey for Wales (NSW), and NRW and Natural England's People and nature survey Wales (PaNSW)
- recreation data for Scotland from NatureScot's Scottish Recreation Survey (ScRS) and Scotland's People and Nature Survey (SPANS)
- recreation data for Northern Ireland from Outscape's People in the Outdoors Monitor for Northern Ireland (POMNI)
- projected population growth data from our Principle projection – UK summary dataset; used to calculate the asset value
- data from our Living Cost and Food Survey (LCF); used to join different surveys together
- Visit Britain's Great Britain Day Visits Survey (GBDVS) and the Great Britain Tourism Survey (GBTS); used to generate nature-based tourism
- data from our International Passenger Survey (IPS)
- the Northern Ireland Statistics and Research Agency's (NISRA's) Northern Ireland annual tourism statistics
- the quality-adjusted life-year (QALY) in Methods for the estimation of the National Institute for Health and Care Excellence cost-effectiveness threshold paper by Karl Claxton and others; used to generate a monetary estimate for the health benefits service

Recreation and aesthetic (house prices) data sources include:

- HM Land Registry's Price Paid Data on property sales
- our data on imputed rentals for housing in the Consumer trends time series
- the Valuation Office Agency's House Attributes data, which is delivered to us
- OS's Open greenspace map

How we produce the statistics

Ecosystem services estimate the contribution of natural assets in the UK to the economy and society. We process our data for each ecosystem service in the same way.

Each ecosystem service and habitat extent are produced using a Python script that links data sources to produce physical flows and monetary estimates.

We carry out quality assurance checks at every stage of the process, which are described in the How we quality assure the data and statistics section of Section 4: Quality of the statistics.

Annual ecosystem service flow valuation

To estimate an ecosystem service, we calculate annual service flows using a physical measure of its output in units appropriate to the good or service and then apply a valuation. We multiply an estimate of physical quantity by a price for:

- fish and timber provisioning
- greenhouse gas, air pollution, noise and urban heat regulating
- recreation (health benefits), and recreation and tourism (expenditure)

The price we use satisfies one of two accounting conditions. Either it relates, as closely as possible, to contributions provided by the ecosystem to the economy. Or where no market exists, we impute a price that an ecosystem could charge for its services in a theoretical market. These conditions are necessary to integrate and align ecosystem services with services in the national accounts. For example, in the national accounts, woodland timber is an input to the timber sector.

We assign the value of each ecosystem service to the habitat where the value is derived. This is described in detail for each service in the How we produce the statistics for each ecosystem service section of Section 3: Where the data come from and how we produce the statistics.

We produce these annual and asset values on a constant price year to take into account price-level changes over time. We use the latest price year available, which is usually one year behind the year of publication. Since our overall natural capital accounts figures have a two-year lag, this means the price year is a year in front of these overall figures. We use the latest year because it includes the latest price changes and is reflective of latest price level available.

We use a residual value resource rent approach for agricultural biomass, water, minerals and metals, oil and gas, coal, and renewable electricity provisioning.

Resource rent definition and assumptions

The resource rent can be interpreted as the annual return stemming directly from a natural capital asset. This is the surplus value accruing to the extractor or user of a natural capital asset, calculated after all costs, including opportunity costs, have been considered.

We apply variations of this approach, depending on the category of natural capital under assessment. We calculate the resource rent by:

1. calculating gross operating surplus (System of National Accounts basis) as output minus operating costs (which is intermediate consumption, plus compensation of employees, plus other taxes on production), plus other subsidies on production

2. calculating gross operating surplus (resource rent derivation) as gross operating surplus (System of National Accounts basis), minus specific subsidies on extraction, plus specific taxes on extraction

3. calculating resource rent as gross operating surplus (resource rent derivation), minus user costs of produced assets (consumption of fixed capital and return to produced assets)

For the UK, we use data from ourSupply and use tables. We calculate return to produced asset estimates using our industry-based net capital stocks and the Bank of England's 10-year government bond yield. The government bond yield is relatively conservative, compared with rates expected in certain markets, so could therefore overstate the resulting resource rent estimates.

The resource rent method is a widely recognised approach for estimating the economic value of provisioning ecosystem services. However, there are limitations to this method, which are acknowledged in the United Nations (UN) System of Environmental-Economic Accounting Ecosystem Accounting (SEEA-EA) guidance and in our Principles of UK natural capital accounting: 2023 methodology. In particular:

- the application of the method is less recommendable in cases where market structures do not permit the observed market price to incorporate a reasonable exchange value for the relevant ecosystem service; this can lead to smaller or even negative resource rents, compared with a hypothetical scenario in which the market structure incorporated these exchange values

- the level of industry aggregation in the national accounts data used as part of this method, and the lack of a transparent data link between the physical production and value, as outlined in our methodology

- negative resource rent values can occur when the user cost of produced assets is higher than the gross operating surplus; in the natural capital accounts, coal provisioning has had historically negative values, as profits within the coal industry are low

In our UK natural capital accounts: 2025 bulletin, we observe negative values for water provisioning, which the application of the resource rent approach and its limitations can help to explain. More details on this are covered in the Water provisioning methodology subsection of Section 3: Where the data come from and how we produce the statistics.

From the national accounts, we use the most relevant industry classification for the natural asset, since equivalent data for the natural asset may not be available. A limitation of this approach is that we use the industry classification as a proxy for the natural asset itself. Because of how the industry is classified, these data may include wider economic activities than the natural asset itself.

For Scotland, we use estimates of gross operating surplus and taxes less subsidies from the Scottish Government's Supply, Use and Input-Output Tables. As these tables run a year behind the UK input-output supply and use tables, we use Scottish quarterly GDP data to produce estimates to the same timeframe. The estimates for the most recent years are therefore subject to greater uncertainty than earlier years for which we have balanced supply and use tables. This time delay can result in inconsistencies between the Scottish and UK tables. This inconsistency was present in the 2011 estimate for the renewable electricity provisioning service in our UK natural capital accounts: 2025 bulletin. Therefore, we have removed nation breakdowns for 2011 for this service.

Capital stocks statistics for Scotland are not produced. Instead, we apply the ratio of Scotland to UK intermediate consumption from supply-use tables to UK values to derive Scotland’s net capital stock and consumption of fixed capital.

For England, Wales and Northern Ireland, complete supply and use tables are not available. To provide estimates for these countries, we use data from our Annual Business Survey. The best available apportionment by country involves us deducting estimates for Scotland from the UK total, and splitting the remainder across England, Wales, and Northern Ireland according to proportions of gross operating surplus.

Asset valuation

Natural capital asset values measure the stock, or the stream, of services of that natural resource in terms of future expected supply and use over a reasonably predictable time horizon.

The net present value (NPV) approach is recommended by the SEEA-EA. We apply this approach to all ecosystem services to estimate the asset value, except for recreation and aesthetics (house prices). We explain our approach to recreation and aesthetics (house prices) in How we produce the statistics for each ecosystem service. The NPV approach estimates the stream of services that are expected to be generated over the life of the asset. These values are then discounted back to the present accounting period.

There are three main aspects of the NPV method, which are:

- pattern of expected future flows of services
- asset life, which is the period over which the flows of values are expected to be generated
- choice of discount rate

Pattern of expected future flows of services

An important factor in the valuation of natural capital is determining the expected pattern of future flows of services using future expected levels of services in physical terms or future unit prices. When this information is not available, our default assumption is that the current value of the service is constant over the asset lifetime. This is based on averages over the last five years of data.

Asset life

The asset life is the expected time over which the services from a natural resource are expected to be provided. An estimate of the asset life is an important component in the NPV model because it determines the expected term over which the service flows from an asset should be discounted.

We assume a 25-year asset life for non-renewable natural capital assets unless a sufficient level of information on the expected asset lives is available, in which case this is applied in the calculations. We assume renewable natural capital assets have a 100-year asset life.

For more information on the accounting asset lifespan, see the following sections and our Principles of UK natural capital accounting: 2023 methodology.

Choice of discount rate

A discount rate is required to convert the expected stream of monetary flows into a current period estimate of the overall value. A discount rate expresses a time preference, which is the preference for the owner of an asset to receive income now rather than in the future. It also reflects the owner's attitude to risk. The use of discount rates in NPV calculations can be interpreted as an expected rate of return on the environmental assets.

The Office for National Statistics (ONS) and Defra use the social discount rate set out in the HMT's The Green Book (PDF, 1.49MB). In line with this guidance, our estimates assume a 3.5% discount rate for flows projected out to 30 years, then declining to 3.0%, then further to 2.5% after 75 years. For more information on discount rate, see our Principles of UK natural capital accounting: 2023 methodology.

The discount rates applied to air pollution regulation, noise regulation and recreation (health benefits) are based on the Green Book health discount rates. The rationale for this lies in the health-based nature of the ecosystem service and the resulting health benefits derived by society. The future utility benefits associated with these service provisions differ from typical consumption goods because they are unlikely to be characterised by high rates of diminishing marginal utility. This means that future benefits of these services are not expected to decrease substantially as more of them are provided and therefore, lower rates of discounting are appropriate.

Rounding

Our data sources are available to varying levels of detail. We use the full detail available from each data source in our processes and calculations.

We round at the last stage of the processing of data within our Python scripts. We use a “round to even” method. This means when a number is halfway between two units, we round to the nearest even number. We take this approach to avoid the upwards rounding bias that results from always rounding up from five. This reduces bias when these rounded values are used in further calculations.

We use these rounded values to populate our summary and detailed summary tables datasets, and these numbers may be further rounded within our main bulletin. As a result of rounding, some totals within the summary and detailed summary tables may not tally.

However, we use a different rounding approach between our main bulletin and our datasets. Our bulletin is rounded to the nearest whole number. For example, we present monetary values in £ millions, so our estimates are rounded to the nearest £ million. We take this approach for readability and ease of use. This is suitable for those users looking for an overview of our estimates.

Our summary and detailed summary tables datasets are rounded to the nearest individual unit level. For example, if there is a monetary value, it is rounded to the nearest £, while an item measured in tonnes is rounded to the nearest tonne. This provides a consistent level of detail among our various estimates.

For example, the raw, unrounded calculated figure is £15,444,444.44. In our summary and detailed summary tables datasets, this value is presented in £ million but is rounded to the nearest unit level as £15.444444 million. In our bulletin, this value is presented in £ million and rounded to the nearest million as £15 million. Users should note this example is not based on any real value within the natural capital accounts.

Figures in our datasets contain more digits than those in our bulletin. This allows users interested in this further detail to use dataset figures for calculation purposes and comparisons within an ecosystem service. For example, users may want to compare time series changes or different habitat breakdowns within an ecosystem service.

Estimates derived from calculations using these data sources include a degree of uncertainty because the data sources use different unit and rounding levels. This is a limitation in using the extra detail provided within our datasets. This uncertainty is reduced by using data from our bulletin, as they are rounded to a higher level.

Extent of terrestrial broad habitats

Our estimates of extent of terrestrial broad habitats are generated using 25-metre rasterised landcover land parcel data. These data are based on the dominant landcover area and are the best available UK data to map landcover changes over time. However, this estimation differs slightly when compared with actual area estimation from the percentage landcover data.

Data for 2024 are built by the UKCEH with a higher spatial resolution and improved methods than were used for historical data. So, they may not be directly comparable with 1990 data in some areas.

Biotic and abiotic sources of natural capital

Biotic sources of natural capital are sources produced or maintained by living organisms (animals, plants and microbes). These sources are linked to each other, and respond to environmental changes such as pollution, climate change, and land use change. The ecosystem services that are considered biotic for the purposes of our natural capital accounts are:

- agricultural biomass provisioning
- fish provisioning
- timber provisioning
- woodfuel provisioning
- greenhouse gas regulating
- air pollution regulating
- noise regulating
- urban heat regulating
- recreation and tourism (expenditure)
- recreation and aesthetic (house prices)
- recreation (health benefits)

Abiotic sources of natural capital are no longer produced or maintained by the living environment. They include a variety of sources, such as minerals and metals, water, sources of renewable electricity, and oil and gas. The ecosystem services that are considered abiotic for the purposes of our natural capital accounts are:

- oil and gas provisioning
- coal provisioning
- renewable electricity provisioning
- minerals and metals provisioning
- water provisioning

How we produce the statistics for each ecosystem service

This section provides an explanation of the methods used to calculate the physical and monetary values for each ecosystem service.

Agricultural biomass provisioning methodology

Agricultural biomass estimates the value of crops, fodder and grazed biomass provided to support agricultural production.

Cultivated biological resources should be excluded from the UK natural capital accounts according to Principle D2 of our Principles of UK natural capital accounting: 2023 methodology. This is because farmed animals are considered produced rather than natural assets. However, we are unable to exclude them from our monetary estimates because of limitations in the granularity of industry data.

Grazed biomass calculations are based on livestock numbers and livestock annual roughage requirements. Regional physical flows are only included for barley, oats, oilseed rape, and wheat. We use input-output supply and use tables for the UK and Scotland for the gross operating surplus and taxes less subsidies variables in the resource rent calculations.

For Scotland, the UK net capital stock for Standard Industrial Classification (SIC) 01 is apportioned based on the ratio of consumption of fixed capital between the UK and Scotland. We use agricultural accounts for each nation to apportion the remainder of the resource rent, once Scotland has been deducted, based on the gross operating surplus.

We assign estimates to the habitat of enclosed farmland. There may be some value that can be attributed to semi-natural grassland, but we currently do not have data available to separate this out.

Coal provisioning methodology

For the valuation of coal provisioning, we use a residual value resource rent approach. This approach is based on our Input-output supply and use tables and capital stocks data for the Standard Industrial Classification (SIC) division: Mining of coal and lignite (SIC 05). "To calculate England, Wales and Northern Ireland values, we use the Annual Business Survey (ABS). However, the proportions for this industry are too volatile to use because of the small size of this industry across the UK. Instead, we use total production to apportion the remaining UK data across England and Wales, once Scotland has been deducted.

Previously, we used a fixed conversion factor to convert physical flows from tonnes to tonnes of oil equivalent. We now use a dynamic coal conversion factor supplied to us by the Department for Energy Security and Net Zero (DESNZ), as of our UK natural capital accounts: 2024 bulletin. The dynamic coal conversion factor is an annual weighted average of the conversion factors of various types of coal produced that year, such as coke.

We assign coal provisioning estimates to the habitat of mountains, moorland, and heath. Inland rock is included in mountains, moorland, and heath as one of the UKCEH landcover map classifications. As we do not have a subterranean habitat class, the assumption is that mountains, moorland, and heath cover the locations of most coal extraction sites.

Fish provisioning methodology

Fish provisioning estimates the value of marine fish taken from mainland UK waters. We remove aquaculture or farmed fish from estimates as farmed fish are viewed as a produced asset rather than a natural asset according to Principle D2 of our Principles of UK natural capital accounting: 2023 methodology.

Live weight is the weight of fish when removed from the water. We source physical data on marine fish capture from annual statistical rectangle-level landings data. To calculate marine fish capture from UK waters, we use exclusive economic zone (EEZ) statistical rectangle factors from the Marine Management Organisation (MMO). For more detail on how fish capture in UK waters is estimated, see the MMO's UK commercial sea fisheries landings by EEZ of capture report 2019.

We calculate the value of fish caught by multiplying annual net profit per tonne (landed weight) by tonnes of fish captured (live weight) for each species. We calculate net profit per tonne (landed) estimates for marine species by marine areas, provided by Seafish. We use their economic estimates for fleet segments and MMO data on landings by stocks (landed value and landed weight) and landings by stocks and species (in cases where species are not managed by total allowable catches). Landed weight is the weight of a product at the time of landing, regardless of the state in which it has been landed. Landed fish may be whole, gutted and headed, or filleted.

We aggregate data for overall annual valuations of fish provisioning from the four countries of the UK and the UK EEZ. An important limitation of the fish capture provisioning valuation methodology is that landed weight net profits are multiplied by live weight fish capture. Aggregate landed weight is less than live weight and is based on MMO data on live and landed weights of UK vessel landings into the UK. Additionally, the economic data are based on UK fleet data, which we also apply to EU vessels, even though they may face different costs and prices.

Net profit per tonne is not available for all fish species, so not all of the physical flow is valued. Our valuation of fish capture from UK waters is therefore likely to be an underestimate.

We updated the asset value calculation in our UK natural capital accounts: 2024 bulletin to use the five-year average annual value, rather than the annual value for a single year. Average annual values are calculated by species and area, so asset values are available at this level of granularity.

We estimate the sustainability of fishing for species in UK waters using the International Council for the Exploration of the Sea's stock assessments. Their definition of sustainable does not include wider externalities from fishing, such as plastic pollution. Those species estimated to be sustainable are valued using an asset lifetime of 100 years, while those estimated to be unsustainable or unknown are valued over 25 years.

We assign fish provisioning estimates to the marine habitat.

Minerals and metals provisioning methodology

The BGS provide physical estimates of mineral extraction. Up to and including 2014, mineral extraction is based on the annual minerals raised inquiry. Since 2015, BGS have tried to get data from alternative sources, including the Mineral Products Association and the British Ceramics Confederation.

Estimates for the four countries of the UK will not always sum to UK totals because of data limitations. We group these estimates into five categories: construction minerals, clay minerals, fertiliser minerals, salts, and metals.

Construction minerals include:

- sand and gravel
- silica sand
- gypsum
- slate
- chalk
- igneous rock
- limestone
- dolomite
- sandstone

Clay minerals include:

- fireclay
- china clay
- ball clay
- talc
- clay and shale

Fertiliser minerals include:

- barytes
- fluorspar
- polyhalite

Salts include:

- salts
- potash

Metals include:

- tin
- tungsten
- lead
- gold
- silver

Monetary estimates are based on the residual value resource rent approach calculated from the SIC subdivision classes Other mining and quarrying (SIC 08) and Mining of metal ores (SIC 07).

Other mining and quarrying includes extraction from a mine or quarry, dredging of alluvial deposits, rock crushing, and the use of salt marshes. These products are used most notably in construction (such as stone and aggregates), manufacture of materials (such as clay and gypsum), and manufacture of chemicals. This SIC division excludes some aspects of the processing of the minerals extracted. However, crushing, grinding, cutting, cleaning, drying, sorting, and mixing are included. This may inflate the resource rents associated with the pure natural provisioning service.

An important limitation of the resource rent approach is the inability to account for different profits and costs across the types of minerals and metals.

We assign physical estimates to marine habitats and mountains, moorland, and heath habitats. Inland rock is included in mountains, moorland, and heath as one of the UKCEH landcover map classifications. As we do not have a subterranean habitat class, the assumption is that mountains, moorland, and heath cover the locations of most minerals and metals extraction sites.

We have updated our methodology for the minerals and metals service to include monetary estimates for the marine habitat. We assign monetary estimates between both habitats based on the proportion of the habitat's physical flow from our UK natural capital accounts: 2025 bulletin onwards. Previously, all monetary estimates were assigned to mountains, moorland, and heath.

Oil and gas provisioning methodology

Monetary estimates follow a residual value resource rent approach calculated from NSTA’s income and expenditure on UK upstream oil and gas exploration operating and decommissioning activities, published by the NSTA, and net capital stock and consumption of fixed capital data for SIC subdivision class: Extraction of crude petroleum and natural gas (SIC 06) from our capital stock data.

Consumption of fixed capital and cost of capital is estimated through an apportionment of our capital stocks data for SIC 06, using relative operating expenditure reported by the NSTA and Scottish Government, respectively.

For Wales and Northern Ireland, oil and gas provisioning are assumed to be zero. Therefore, we calculate the estimate for England to be the remainder, once the value for Scotland is deducted from the UK total.

Infrastructure for the extraction of oil and gas must be decommissioned at the end of the oil and gas field’s economic life and the costs are incurred at the end of an asset's lifetime. This distortion of the cost profile has a downward impact on the resource rents in later years. We adjust decommissioning costs so they vary according to total income generated in each year, while maintaining the total value of the costs. The distribution of these costs mirrors total income as it changes over time and results in a smoother time series.

For Scottish and English estimates, we apportion the UK projections based on the relative five-year average of oil and gas production for the latest five-years. Annual five-year averages of unit resource rent (average resource rent divided by average production) are applied to production projections.

We assign oil and gas provisioning estimates to the marine habitat.

Renewable electricity provisioning methodology

To estimate renewable electricity physical flows, we use DESNZ's regional electricity generation figures, which provide information on electricity generation by renewable source by country.

The UK physical flow figures include electricity generation by "other sites", which are "sites that have not been attributed to a region so that data related to individual companies are not disclosed". As such, the country-level physical flow figures do not include electricity generation by "other sites", and their sum does not equal the UK figure. Therefore, users should not compare country-level physical flow data directly with UK physical flow data.

We exclude bioenergy from our estimates to avoid double counting of valuation with timber removals and agricultural biomass.

For the UK figures, we produce monetary estimates using the resource rent approach applied to data from our Supply and use tables. This is done initially for the whole group (SIC 35.1: Electricity power generation, transmission, and distribution). As a second step, we split the production of electricity using the relevant class (SIC 35.11: Production of electricity) based on turnover data from the ABS, published in our Non-financial business economy, UK dataset.

For Scotland, to calculate monetary values using the resource rent (RR) approach, we use Gross Operating Surplus and taxes less subsidies from Scottish supply and use tables (SUT), but apportion net capital stock and consumption of fixed capital for SIC 35.1 starting from the UK values, as these are not available for Scotland. To do so, we use the ratio of Scotland and the UK's total installed capacity for electricity generation from DESNZ's regional renewable statistics. The resource rent for Scotland's SIC 35.1 is then calculated, before we apportion to SIC 35.11 using turnover from the regional ABS. For more details on the RR approach for Scotland please see the Resource rent definition and assumptions section.

For England, Wales and Northern Ireland, we deduct the value for Scotland for SIC 35.11 from the value for the UK. The remainder is then apportioned across the countries using the country proportion of gross operating surplus for SIC 35.11 from the regional ABS.

To estimate the value of the production of electricity from renewable sources at the country level, we apply the percentage of electricity generation that comes from renewable sources to the monetary values of electricity production.

We calculate the overall UK monetary valuation for this service by summing the estimates for the four countries to accurately reflect the value derived from renewable energy provision across the UK.

An important limitation is the lack of data reflecting the profits and cost for electricity generation from renewable sources, as opposed to other electricity generation.

To calculate physical and monetary flows for each habitat, we assign total physical flow estimates for renewable energy provisioning to habitats based on technology used for power generation:

- hydroelectric to freshwater, wetlands, and floodplains
- solar photovoltaic to enclosed farmland, semi-natural grassland, urban, and mountains, moorland, and heath
- wave and tidal to marine
- offshore wind to marine
- onshore wind to enclosed farmland, semi-natural grassland, and mountains, moorland, and heath

As previously mentioned, since UK physical flow includes "other sites", while the country level do not, the habitat-level, country-level figures will not sum to UK habitat physical flow figures.

To calculate monetary annual and asset value by habitat, we:

- calculate the proportion of electricity generated by each habitat within each country and the UK separately, using the physical flow data

- multiply these country habitat proportions by the specific UK and country-level annual values and asset values

Since the UK physical flow breakdowns include electricity generated by "other sites", which are not included in the country-level data, there will be differences between the sum of the four countries by habitat and UK monetary values by habitat.

Users can compare monetary values for different habitats within the same country as these values are calculated using the same country-level habitat proportions. Users can compare habitat-level monetary value between the four countries because these are estimated using similar approaches.

However, country-level habitat breakdowns should not be compared with the equivalent UK-level habitat breakdowns. This is because the UK proportion of electricity by habitat generated includes "other sites", which are unavailable on a country-basis for the country-based estimates.

Timber andwoodfuelprovisioningmethodology

We take timber removals estimates and convert them from green tonnes to cubic metres (m3)overbarkstanding, using aconversion factorof 1.222 for softwood and 1.111 for hardwood.

The stumpage price is the price paid per standing tree – including the bark and before felling – from a given land area. We generate annual flow values by multiplying the stumpage price and the physical amount of timber removed.

Asset valuations use forecasts of timber availability to estimate the pattern of expected future flows of the service over the asset lifetime. We updated the asset value calculation in our 2024 publication to use the five-year average stumpage price, rather than the stumpage price for a single year, according to the principles set out inour Principles of UK natural capital accounting: 2023 methodology.

The timber datacontainall uses of timber, includingwoodfuel. To separate outwoodfuelprovisioning, we source UK roundwood deliveries data and deduct this from the timber value, to ensure no double counting occurs. Data forwoodfuelare only available from 1994, so timber estimates from before 1994 include somewoodfuelprovisioning.

We assign estimates for timber andwoodfuelprovisioning to the woodland habitat.

Water provisioning methodology

The service of water provisioning estimates the value of public water supply.

We source physical data for water provisioning for each country. No industry water data are available for Scotland, so we only include data for public water supply, to maintain consistency. Removing industry data also avoids double counting with the valuation of hydropower.

Monetary estimates are based on the residual value resource rents calculated for the SIC subdivision class Water collection, treatment and supply (SIC 36).

We assign water provisioning estimates to the freshwater, wetlands, and floodplains habitat.

We use data from the National Accounts (Gross Operating Surplus and Net Capital Stocks) for the SIC 36: Water collection, treatment and supply. This covers a wider measure of the water industry activities than just water supply, which is what we aim to measure. However, data specific to water supply are not available. As a result, our estimates do not only reflect the underlying value of the natural capital asset or the profitability of the industry to which the natural capital asset belongs. Our estimates may be best interpreted as the value of the economic activity of the wider sector we use (SIC 36).

Furthermore, the application of this method to a regulated industry, such as the UK water industry, also incurs the limitations described in the Resource rent definition and assumptions subsection of Section 3: Where the data come from and how we produce the statistics.

Water is free for water companies to access and the water industry is highly regulated. So, the industry is expected to observe a market price that is smaller than if it were unregulated. This can lead to smaller resource rent value that can fluctuate into negative values because of variability in bond yield.

We are considering further developing our methods for water valuation based on our collaboration with the Economic Statistics Centre of Excellence (ESCoE). ESCoE's Measurement of Natural Capital project aims to improve methodologies for the valuation of natural resources. A main focus of the project is measuring the contribution of water, as described in their Putting a price on nature: Rethinking Water Ecosystem Accounting blog .

Air pollution regulating methodology

Our air pollution regulation methodology has been developed in consultation with UKCEH. The methodology is described in full in the Developing estimates for the valuation of air pollution removal in ecosystem accounts: Final report for Office of National Statistics article by Laurence Jones and others.

Physical flows use the atmospheric chemistry and transport model from the European Monitoring and Evaluation Program Unified Model for the UK (EMEP4UK). This model generates pollutant concentrations directly from emissions and dynamically calculates pollutant transport and deposition, while considering meteorology and pollutant interactions.

EMEP modelled air pollution removal by UK vegetation for 2007, 2015 and 2019, and then modelled to create values for 2030 to estimate a future year of air pollution removal. For remaining years (where government concentration data are available through the UK's Automatic Urban and Rural Network), figures are fed into the model to generate estimates for changes in air pollutant concentrations caused by vegetation. When no pollution concentration data are available, we assume concentrations fall by a constant rate until they reach 2030 values for all pollutants except sulphur dioxide (SO2).

For SO2, the current concentrations are already lower than the 2030 estimates, so we instead hold the latest data constant until 2030. The asset values are calculated over 100 years and incorporate the trajectory from 2007 to 2011 to 2015 and 2030 and then hold 2030 levels of service constant for subsequent years.

Health benefits are calculated from the change in pollutant concentration to which people are exposed. Damage costs per unit of exposure are then applied to the benefiting population at the local authority level for the following avoided health outcomes:

- respiratory hospital admissions
- cardiovascular hospital admissions
- loss of life years, in terms of long-term exposure effects from particulate matter 2.5 (PM2.5) and nitrogen dioxide (NO2)
- deaths, in terms of short-term exposure effects from ozone (O3)

For the method of how damage costs are calculated, please see Defra's Air Quality damage cost update 2019 report (PDF, 1.13MB).

We assign air pollution regulating estimates to habitats based on the rates of deposition for different habitat types.

Greenhouse gas regulating methodology

Greenhouse gas regulating estimates the value of the removal of greenhouse gases, in carbon dioxide equivalent (CO2e), from the atmosphere by habitats in the UK.

Estimates presented represent net values. Our greenhouse gas regulating estimates reflect the sequestration and emissions of greenhouse gases. Full details about what is measured in the service and why, can be found in Section 5: Physical accounts of our Principles of natural capital accounting: 2023 methodology.

Physical data related to the Land Use, Land Use Change and Forestry (LULUCF) sector are delivered to us from DESNZ. Further information on how DESNZ measure this can be found in their Mapping greenhouse gas emissions and removals for the land-use, land-use change and forestry sector report (PDF, 6.4MB). It is not possible with current inventory data to estimate the gross carbon sequestration benefits of nature.

We map Territorial Emissions Statistics (TES) sectors to the following habitats:

- Other Land use, land use change and forestry is mapped to other
- bioenergy crops and cropland mineral soils under Land Use Change (LUC) is mapped to enclosed farmland
- forestry is mapped to woodland
- grassland mineral soils under LUC is mapped to semi-natural grassland
- peatland is mapped to freshwater, wetlands, and floodplains
- settlement is mapped to urban

The capacity for habitats to remove greenhouse gases from the air depends on the habitat type and extent. Local greenhouse gas regulating estimates are produced through local authority modelling of national estimates and are not specific to the land management of each authority.

To estimate the annual value, we multiply the physical flow by a carbon price. The carbon price used in calculations is based on the projected non-traded price of carbon schedule. Carbon prices are available from 2020 to 2050. Prices before 2020 and after 2050 are deflated or inflated, respectively, by 1.5% annually.

Noise regulating methodology

Noise regulating estimates the value of vegetation that acts as a buffer against noise pollution, such as from road traffic.

We determine the number of buildings located near vegetation that would provide a reduction in the volume of noise using Defra's analysis of noise-regulating benefits of natural capital, spatial population data, and a UKCEH landcover map. The health impacts and nuisance associated with noise are used alongside the number of buildings to create an annual value. The single year of data provided for 2014 is carried forward to create a flat time series measured on a constant-price level.

For a detailed methodology on how noise mitigation estimates were produced, please see Defra's Scoping UK Urban Natural Capital Account – Extending noise regulation estimates report. Further methodological development is required to provide improved annual valuations.

We assign noise regulating estimates to the urban habitat.

Urban heat regulating methodology

Urban heat regulating estimates the value of green spaces (for example, woodlands, private gardens, parks, and grassland) and blue spaces (for example, rivers, canals, lakes and ponds) that can cool down built-up environments on hot days. Hot days are defined as days with a maximum temperature of 28 degrees Celsius and above. The benefits of this include, but are not limited to, limiting loss of labour productivity and reducing air conditioning use. These avoided costs are considered in our estimates.

This methodology was originally developed for Defra's Scoping UK Urban Natural Capital Accounts – Extension to develop temperature regulation estimates report. We have made several developments since adopting this method.

We now include data for local authorities in Great Britain, using 2024 boundaries. We use built-up areas, rather than strictly urban environments, to include heat regulating services in smaller settlements.

We obtain the boundaries of built-up areas using Ordnance Survey (OS) data within each local authority and use a distance-based approach to expand the perimeter. This allows us to capture large green spaces like parks and large blue spaces like lakes, which we obtain from OS Greenspace and Water Network data, that would otherwise not be included in built-up areas.

We adopted this approach to avoid boundary overlap issues that came with using buffers and to apply a consistent approach across local authorities. The green space areas included in the estimate are woodlands and parks and grass (that are larger than or equal to 200 square metres) that are within 100 metres distance from the built-up area. This distance measure was not applied to private gardens (that are larger than or equal to 200 square metres) as these are mainly within the built-up area extent.

We use a 30-metre distance threshold for area estimation of blue spaces. These include rivers, canals longer than or equal to 25 metres, and ponds that are larger or equal to 700 square metres. The 100-metre and 30-metre distance thresholds were chosen based on the cooling decaying distance of large woodlands and blue spaces, as specified by the Economics for the Environment Consultancy (Eftec) and for proximity reasons to the built-up area boundary.

We estimate the proportion of the built-up area that is green and blue spaces for each local authority, and we estimate a cooling effect based on the size and type of these spaces.

The cooling effect of green and blue spaces reduces the loss of productivity because of high temperatures. Estimates of that loss vary by industry because some industries are affected more by heat than others. The methodology for estimating loss of productivity caused by high temperatures is described in the Climate change, heat stress and labour productivity: A cost methodology for city economies article by Hélia Costa and others.

We can estimate the proportion of each local authority experiencing a hot day using data on the maximum temperature each day from the Met Office in 1-kilometre squares. We add these proportions together over the year. We then multiply them by:

- the productivity saved because of the cooling effect
- the gross value added (GVA) of each industry in each local authority from our regional GVA data

We also adjust for the adaptations people make during hot weather, such as behaviour changes like working only at cooler times of day. These changes mean less productivity is lost at high temperatures than it otherwise might be. However, this only applies to specific industries (for example, working at cooler times of day in construction or using air conditioning in offices)

The cooling effect of green spaces also leads to less air conditioning use. To estimate the value of this at the local authority level, we combine an existing value for Greater London with the floor area of air conditioned businesses from Energy Performance Certificate (EPC) data. This is used as a proxy for estimating the air conditioning savings from nature. The estimated value is moved onto constant prices using the GDP deflator. This accounts for energy costs saved and carbon emissions avoided. However, a main limitation is that this work only provides an estimate for London for one year and is a fixed value that does not vary with time.

To obtain estimates for energy cost saved by not using air conditioning for each local authority, we calculate relative estimates based on the proportion of green and blue spaces and air conditioned floorspace in each local authority. We can also obtain a value for carbon emissions avoided in each local authority. We currently assume that although there is less use of air conditioning value on cooler days, some use occurs regardless of the number of hot days.

Adding together the effects of productivity loss avoided and air conditioning gives our combined annual value. For the asset value, we use a discount rate of 100 years. Additionally, we account for the expected effects of climate change in this asset value. We use UK climate projections to identify how maximum daily temperatures are projected to increase across the UK by 2080 and calculate the expected additional loss of productivity.

We assign urban heat regulating estimates to the urban habitat, because all green and blue spaces involved are either within built-up areas or within a set distance of a built-up area.

Recreation and tourism (expenditure) methodology

Recreation and tourism (expenditure) estimates the amount spent to enable people’s visits to the natural environment. This includes spending on transport, car parking and admission costs. For example, in the absence of a ticket to access a public beach, the cost of a bus ticket represents the cost of a trip, so this is taken as a proxy for the value of accessing the site.

The total estimates combine separate estimates of nature-based tourism and outdoor recreation. Tourism estimates include day visits longer than three hours, overnight trips, and visits from international travellers to the UK. To avoid double counting, estimates of recreation include only day visits that are three hours or shorter.

We use data from multiple surveys for England, Northern Ireland, Scotland, and Wales to generate our outdoor recreation estimates.

For England, we use annual recreation data from Natural England's MENE and PaNS surveys. We use LCF data as a proxy series to join MENE and PaNS without a step change, because of differences in the level of reported expenditure between the two surveys. This involves linking LCF spend items to PaNS expenditure items and using LCF growth rates between 2019 and 2020 to impute a 2020 expenditure value for PaNS. PaNS data are applied as growth rates to the imputed 2020 value, generating a consistent timeseries. Non-expenditure data do not feature a step change. Changes to survey design and mode means that MENE and PaNS are not directly comparable across all variables.

For Scotland, we use data from the ScRS and SPANS surveys to produce estimates of outdoor recreation for Scotland. Unlike ScRS, SPANS excludes questions relating to respondents’ expenditure during their last outdoor recreation visit. To produce estimates of Scottish outdoor recreation expenditure beyond 2012, we created a statistical model. Using comparable MENE and ScRS data, this model examines the relationship between English and Scottish per-visit expenditure on a habitat basis. We use linear interpolation to produce estimates of Scottish recreation from 2014 to 2019. Data from PaNS are used as a proxy series to impute missing years from 2020 onwards.

For Wales, we use data:

- from the WORS for 2014 to 2015
- from recreation-based questions asked in the NSW for 2016 to 2017 and 2018 to 2019
- from the PaNSW for 2021 to 2023

For Northern Ireland, we compile estimates of outdoor recreation from the POMNI. This survey began in 2020 to 2021. For Wales and Northern Ireland, we use data from MENE and PaNS as a proxy series to impute missing years and generate a full timeseries from 2011 onwards.

To generate our nature-based tourism estimates, we use data from:

- the GBDVS and the GBTS, which both collect annual data from 2011 to present, with a pause in 2020
- the LCF as a proxy series to impute expenditure estimates in 2020
- the IPS, which collects data annually for international visitors
- NISRA's Annual tourism statistics

For the GBDVS, we use the 3 hours or more leisure day visits definition, whereas Visit Britain report on the tourism day visits definition as standard.

A limitation of the GBDVS data we use to generate tourism expenditure estimates is that we must make some assumptions about how to correctly apportion spend between activities.

Respondents' spending from GBDVS data is attributed to all types of activities completed in their visit, rather than being separated out among each individual activity. This can lead to an overestimation of the amount of tourism spending because the same spending could be double counted among various activities that were undertaken.

To remove the double counting of spending, we use data from ad hoc questions added to a single round of the GBDVS. These questions asked respondents about the importance of the different activities within broader visit activities. We use proportions derived from these to reduce the amount of double counting of spending between activity types.

There is less double counting within the activity spending estimates because of changes made to the GBDVS between 2019 and 2021. However, the proportions we use to remove the effect of double counting have remained unchanged. As a result, the survey data are subject to more double counting removal than they may require. This may lead to an underestimate for tourism from 2019 onwards. We aim to review our approach to apportioning activities to reflect the changes made to the GBDVS.

Visit Britain conducted a methods review of the GBDVS and GBTS data in 2024 and this has been completed for data from 2022 onwards. As a result, recreation and tourism (expenditure) ecosystem service estimates from 2022 onwards are not comparable with data from before 2022.

For more detail on how our tourism estimates were produced, please see Defra's Tourism values for Natural Capital Accounts – NR0176 and our UK natural capital accounts: Tourism – methodology.

We assign estimates for recreation and tourism (expenditure) to habitats based on the types of natural places visited by respondents within their survey responses. Habitat-disaggregated estimations may not sum to overall totals because the habitat-visited question may be asked less frequently compared with other questions. This may result in smaller sample sizes, leading to greater variability in estimations.

For broad habitat classifications by country, please see Section 2: Habitats in our Health benefits from recreation methodology, natural capital, UK.

For the asset valuation of outdoor recreation, we use projected population growth calculated from population statistics in our Principal projection – UK summary dataset over a 100-year asset lifetime.

Many outdoor recreation visits involve no expenditure, such as walking to a local park. We acknowledge that the expenditure-based method provides an underestimation of the value provided by visits to the natural environment. However, our services recreation (house prices) and recreation (health benefits) estimates capture some of this additional value.

Recreation (health benefits) methodology

Recreation (health benefits) estimates the number of people gaining health benefits from regular recreation and the monetary value associated with this. This service attempts to value the positive effect on health and well-being from trips in natural environments by estimating the avoided health costs associated with these visits.

We count individuals who have gained health benefits from nature as those who have visited nature for 120 minutes in a week. We calculate the number of people gaining these benefits using the recreation-based surveys also used in our recreation and tourism (expenditure) estimates. The monetary value of health benefits from recreation come from the Methods for the estimation of the National Institute for Health and Care Excellence cost-effectiveness threshold article by Karl Claxton and others. This cost-saving approach concluded that £13,000 of NHS resources adds one quality-adjusted life year (QALY) to the lives of NHS patients (in 2008 prices).

Details about the methodology underpinning the health benefits gained from recreation can be found in the Exposure to nature subsection of Section 2: Methods used in our Health benefits from recreation methodology, natural capital, UK.

We assign estimates for recreation (health benefits) to habitats based on the types of natural places visited by respondents within their survey responses.

Recreation and aesthetic (house prices) methodology

Recreation and aesthetic values for house prices include the additional value of houses that are near green (land) and blue (water) spaces. This enables people to make free trips to the natural environment and adds value to a property with a view of a green or blue space.

Using current data and modelling approaches, the effect of greenspace proximity and visual amenity cannot be separated. Estimates relate to urban properties only. These are defined as built-up areas with a population of 5,000 or greater.

We use data from the VOA, HMLR and OS to estimate the effect of proximity to public green space on house prices. Updated data from HMLR now allow us to produce estimates up to 2022. We produce a unique house-level dataset by linking data with machine learning techniques, which is then applied to flexibly model house prices.

To estimate the average effect of green and blue spaces on house price, we estimate the difference between the predicted price, based on the real data, and the predicted price if there were no green and blue spaces (the “no-nature” scenario). We calculate this value for all houses with property information from the VOA (not just those that have sold) to produce an asset value.

To simulate the no-nature scenario, we set the area of private gardens, functional greenspace, other natural land, and blue space within a 500-meter radius to zero. We set the distance to functional greenspace to the average distance to functional greenspace in the region. We also cap the distance to the sea to a maximum value of 2,000 metres. These are combined to give an aggregated "effect of nature". We also estimate the effect of private gardens and public nature.

The annual value is based on the average percentage increase in house prices from nature, multiplied by our imputed and actual rental data. To calculate the 2023 value, we have projected values based on the 2022 estimates. The asset value is the aggregate difference between the effect of nature and the no-nature scenario.

A limitation of this method is that HMLR data are only available for England and Wales. Scotland and Northern Ireland (and therefore the UK) are modelled using property transaction data for England and Wales between 2003 and 2022. We are considering future developments to extend our modelling to include data from Scotland's Land Information Service.

We assign recreation and aesthetic (house prices) estimates to the urban habitat.

4 . Quality of the statistics

Statistical designation

These statistics are labelled as “official statistics in development”. They are based on information from multiple data sources. We are developing how we collect the data and produce the statistics.

We are working towards improving the quality of these statistics and achieving official statistic status by March 2027, as described in Annex C3.4: Environmental economy of our The plan for ONS economic statistics report.

If the statistics meet trustworthiness, quality and value standards based on user feedback, we will remove the “official statistics in development” label to publish under the “official statistics” label.

Once we have completed the developments, we will review the statistics with the Statistics Head of Profession in view of progressing towards accredited statistics status by end 2028 to 2029.

To gain accredited official statistics status, the Statistics Head of Profession will request an independent review by the Office for Statistics Regulation (OSR), who will confirm they comply with the standards of trustworthiness, quality and value in the Code of Practice for Statistics and that they can be published as “accredited official statistics”.

If they do not meet trustworthiness, quality and value standards, we will further develop them.

We will inform users of the outcomes of any internal or OSR reviews and any changes.

How we quality assure the data and statistics

1. We perform quality assurance at each stage of the statistical production process.

2. We validate data that we input from the various data sources.

3. We analyse changes and revisions in the source data that we are aware of, querying any unexpected changes.

4. Once these input data are checked and the code is run, we quality assure our outputs to ensure that the statistics appear appropriate, compared with previous years and recent economic and environmental trends.

5. After producing our detailed and summary data tables, we also carefully quality assure them, along with commentary included in our UK natural capital accounts bulletins.

6. Once the bulletin and data tables are complete and quality assured, they are circulated internally for feedback.

7. Environmental and national accounts experts and subject-matter experts within government peer review our data tables and new methods, which allows us to gather feedback and use their knowledge and expertise to inform our final outputs.

Strengths and limitations

Strengths

- Our natural capital accounts are the only UK ecosystem accounts statistics with coverage of the 16 ecosystem services for the entire UK and each nation.

- Our natural capital accounts follow the United Nations (UN) System of Environmental-Economic Accounting Ecosystem Accounting (SEEA-EA) guidance where possible; more information on the principles underpinning the accounts is in our Principles of UK natural capital accounting: 2023 methodology.

- Our accounts are an extension of (or "satellite" to) the National Accounts, which are produced within the UN System of National Accounts (SNA) framework.

- We use more than 70 data sources from a wide range of providers, over half of which are accredited official statistics; the rest of our data sources are in development, ad hoc, or have not yet gone through the statistics accreditation process.

Limitations

- It is impossible to fully calculate the value of the natural environment in economic terms, as we are limited to the data and methods that are currently available on the appropriate physical and monetary valuations of natural capital services; our accounts do not provide a complete valuation, and they should be interpreted as a partial or minimum value.

- As we improve our methods and data sources, we also revise our methodology, so our latest accounts should not be compared with previous editions; we are gradually improving our estimates so that revisions are successively smaller each year.

- It is not always straightforward to interpret a higher or lower annual or asset value in natural capital accounts, for example, if society produces less pollution, trees remove lower quantities of pollutants and this reduces the value of the air pollution regulating ecosystem service, resulting in a lower estimate of natural capital; a reduction in pollution would generally be considered a benefit, even if it results in a lower natural capital accounting value.

- The natural capital accounts are published with a two-year lag after the reference year, because of data availability; some ecosystem services have a smaller (one-year) lag where more timely sources are available.

- Some ecosystem services contain volatile annual values, especially for services where the prices in the market can and do rapidly change; prices in the oil and gas market in particular can cause fluctuations in the annual value of oil and gas, while the physical flow and asset values for oil and gas are relatively stable, so we have separated these and other abiotic ecosystem services from biotic ecosystem services in our 2025 bulletin.

European Statistical System Quality Dimensions

The Office for National Statistics (ONS) has developed Guidelines for measuring statistical quality based on the five European Statistical System (ESS) Quality Dimensions. These are:

- relevance
- accuracy and reliability
- timeliness and punctuality
- comparability and coherence
- accessibility and clarity

We have integrated these considerations into this guide.

5 . Changes and their effects on comparability over time

Latest changes

We have implemented several methodological changes in our UK natural capital accounts: 2025 bulletin. These changes are ordered by date, with the most recent first.

Expanded coverage of urban heat regulating estimates

The urban heat accounts are now produced for local authorities (LAs) in Great Britain, using the 2024 boundaries. Other changes also include:

- higher resolution temperature data in hot days calculations
- LA-level gross value added (GVA) data by region
- new air conditioned floorspace data
- updated built-up area boundaries and green and blue space distance calculations

Changes to the return to produced assets calculation

We have updated our return to produced assets calculation to better reflect how we capture price changes over time. Return to produced assets are part of the calculation for annual, and therefore asset, values for:

- agricultural biomass provisioning
- oil and gas provisioning
- water provisioning
- minerals and metals provisioning
- coal provisioning
- renewable electricity provisioning

New minerals and metals monetary estimates by habitat

We have updated our calculation method for minerals and metals to include monetary values of the marine habitat, in addition to existing mountains, moorland, and heath monetary estimates.

Our latest accounts cannot be compared with previous accounts because of changing methods and an expanding portfolio of ecosystem services measured. We apply the latest methods developed across all years in our latest accounts to give a consistent time series.

Past changes

These past changes were included in our UK natural capital account: 2024 bulletin.

Change in asset value calculation

The UN System of Environmental-Economic Accounting (SEEA) guidance states that asset values should begin from the year after the current year, which is expressed as "year t plus 1". We changed our methods to only include future years.

Five-year rolling average for timber and fish

We used the five-year rolling average method for the asset valuation instead of using the stumpage price (timber) and annual value (fish) of a single year. This brings the methodology in line with other services.

New conversion factors for coal provisioning

We started using a dynamic-conversion factor instead of a fixed-conversion factor. This is effectively an annual weighted average of the conversion factors of various types of coal produced that year, such as coke. We have added a new conversion data file and applied it to calculate the physical flows.

Changes to estimation of future sulphur dioxide projections

We used previous modelling of pollution concentration from the UK Centre for Ecology and Hydrology (UKCEH) for 2015 and 2030 in our UK natural capital accounts: 2023 bulletin. Our method uses the ratio between the pollutant concentrations between these years. The UKCEH provided new 2015 values for the 2024 accounts by rerunning the European Monitoring and Evaluation Programme (EMEP) and using the ratio to generate new 2030 estimates. We then linearly interpolate the government pollution concentration data for the latest year until it reaches the 2030 estimate.

The latest government concentration data for sulphur dioxide (SO2) dipped below the 2030 estimated value, so applying the method made SO2 increase slightly between 2021 and 2030. We rolled forward the latest SO2 value until 2030, after discussion with UKCEH.

Changes to habitat categories for greenhouse gas regulating

The Department for Energy Security and Net Zero (DESNZ) stated in 2024 that the Territorial Emissions Statistics (TES) sectors will replace the National Communication (NC) sectors in all their publications, starting with their Final UK greenhouse gas emissions national statistics: 1990 to 2022 release. We updated our habitat categories to match the TES sectors published by DESNZ.

Changes to the recreation and aesthetics (house prices) time series

We included new data from HM Land Registry, allowing us to produce more complete estimates for each property up to 2022. We have also included more up to date Valuation Office Agency (VOA) data, which previously ran to 2017.

Inclusion of data from the People and Nature Survey for Wales for the first time

Our tourism and recreation (expenditure) and recreation (health benefits) estimates included data covering 2021 to 2022 from the People and Nature Survey for Wales. This replaced data that were previously imputed using data for England.

Upcoming changes

As we continue to develop our natural capital accounts statistics, we will outline future changes in this section, which will be updated alongside our upcoming publications.

6 . Comparability and coherence with other statistics producers

We use a consistent method and approach across the time series for each ecosystem service included in our UK natural capital accounts bulletins. This allows users to compare estimates over time and between geographic boundaries for most ecosystem services within the same set of natural capital annual accounts.

Each of our ecosystem services is produced using a unique method that is applied across all estimated years. However, some ecosystem services use data sources that change or are only available in certain years. Users should be aware that some year-on-year changes could be because of modelling changes, rather than real trends from the source data.

United Nations System of Environmental-Economic Accounting Ecosystem Accounting

The United Nations (UN)System of Environmental-Economic Accounting Ecosystem Accounting (SEEA-EA) measurement approach is broadly comparable with ours, but be aware of the following differences.

Office for National Statistics	UN SEEA-EA
Includes abiotic resources	Excludes abiotic resources (these are included in the SEEA Central Framework instead)
Includes eight broad habitats, according to land cover maps from the UK Centre for Ecology and Hydrology	Includes habitat types levels one to three, according to the International Union for Conservation of Nature (IUCN) Global Ecosystem Typology 2.0
Measures carbon sequestration and emissions	Measures carbon sequestration and storage
Publishes negative figures for ecosystem services	Recommends that ecosystem services should be valued at zero when a net flux of emissions causes more emissions to be released than removed

7 . Users and uses of these statistics

- Our natural capital accounts statistics are delivered and published as part of our UK National Accounts: The Blue Book releases and our UK inclusive wealth and income accounts releases.
- The Department for Environment, Food and Rural Affairs (Defra) builds on our natural capital accounts in their Enabling a Natural Capital Approach guidance, which provides guidance to policy- and decision-makers on valuing the natural environment for people and the economy; they also use our statistics to draw out broader policy-relevant lessons in their annual Nature at work for people in the economy report.
- The Scottish Government uses our natural capital accounts for Scotland in their Summary of Scottish Data from UK Natural Capital Accounts publication.
- The Office for Environmental Protection (OEP) uses our natural capital accounts to track progress in improving the natural environment in their annual reports, in accordance with Environment Act targets, interim targets, and the Environmental Improvement Plan 2023.
- Other users include academics, businesses (including environmental consultancies), researchers, charities, and the media.

8 . Definitions

Annual value

The annual value of a natural asset is a measure of its annual monetary value that the ecosystem service provides.

Asset value

Natural capital asset values measure the stock, or the stream of services of that natural resource in terms of future expected supply and use over a reasonably predictable time horizon.

Cultural services

Cultural services are the non-material benefits we get from interacting with ecosystems through recreation and tourism, and their associated health benefits.

The UK natural capital accounts include the following cultural services:

- recreation and tourism (expenditure), which estimates the amount spent to enable visits to the natural environment, such as transport, car parking, and admission costs
- recreation (health benefits), which estimates the number of people gaining health benefits from regular recreation and the monetary value associated with this
- recreation and aesthetic values for house prices, which are the additional expenditure on houses that are near to or contain green (land) and blue (water) spaces, enabling people to make free trips to the natural environment and adding value to a property by a view of a green or blue space

Physical flow

The physical flow of a natural asset is the measure of its output in units appropriate to the goods or services.

Provisioning services

Provisioning services refer to tangible goods that people can harvest, extract, or derive from the environment, such as food, water, energy, and materials.

The UK natural capital accounts include the following provisioning services:

- agricultural biomass provisioning, which estimates the value of crops, fodder, and grazed biomass provided to support agricultural production
- coal provisioning, which estimates the value of the production of coal
- fish provisioning, which estimates the value of marine fish taken from mainland UK waters
- minerals and metals provisioning, which estimates the value of the extraction of minerals and metals to support production, largely consisting of extraction aggregates
- oil and gas provisioning, which estimates the value of production of crude oil and gas
- renewable electricity provisioning, which estimates the value of electricity generated from renewable sources like wind, hydroelectric, solar, and wave and tidal
- timber and woodfuel provisioning, which estimates the value of wood production (also referred to as removals), which is the harvesting of roundwood (trunks and branches) from coniferous (softwood) and broadleaved (hardwood) trees
- water provisioning, which estimates the value of public water supply

Regulating services

Regulating services help to maintain the quality of the environment we rely on.

The UK natural capital accounts include the following regulating services:

- air pollution regulating, which estimates the value of the removal of air pollution by habitats in the UK
- greenhouse gas regulating, which estimates the value of the removal of greenhouse gases, in carbon dioxide equivalent (CO2e), from the atmosphere by habitats in the UK
- noise regulating, which estimates the value of vegetation that acts as a buffer against noise pollution, such as from road traffic
- urban heat regulating, which estimates the value of green spaces (for example, parks) and blue spaces (for example, lakes) that can cool urban environments on hot days

9 . Related links

UK natural capital accounts: 2025
Bulletin | Released 5 December 2025
Estimates of the economic and social value of natural resources to the UK's economy and people.

Enabling a Natural Capital Approach (ENCA)
External website | Last updated 18 July 2023
Guidance for policy and decision makers to help them consider the value of a natural capital approach from the Department for Environment, Food and Rural Affairs.

Marine and coastal margins natural capital accounts, UK: 2025
Bulletin | Released 8 August 2025
Natural capital accounts estimating the extent, condition, and annual and asset value of biotic (living) and abiotic (non-living) ecosystem services for marine and coastal margins habitats in the UK.

Woodland natural capital accounts, summary tables, UK: 2025
Dataset | Released 14 February 2025
Detailed data breakdown of financial and societal value of woodland natural resources in the UK.

10 . Cite this page

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