Office for National Statistics

Statistical bulletin

# UK natural capital accounts: 2020

Estimates of the financial and societal value of natural resources to people in the UK.

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# 1 . Main points

- In 2018, the asset value of the aspects of UK natural capital we can currently value was estimated to be £921 billion.
- Living near publicly accessible green and blue spaces added £3,146 to the average property price.
- Over 5 billion nature-related visits within the UK were made in 2018, amounting to 10 billion hours.
- There were nearly three times the number of hot days in UK city regions in 2018 compared with 2017; urban green and blue space helps to mitigate the associated costs.

# 2 . Understanding natural capital

The environment is both vast and complicated. At every scale, from the microscopic to the global, there are processes running that support life on Earth and that are being altered by human activity.

This approach focuses on the way the natural world affects people and the economy. It is easiest to start with the goods and services that nature provides, such as fish captured for consumption and country hikes. We can value the benefit to society of those services by estimating any profit from bringing the fish into the market or what the hikers spent to enable them to walk in the country.

Natural capital and natural capital services provide one framework to help us break the environment up into smaller, and more measurable and more understandable components.

Natural capital assets are things that persist and underpin the long-term provision of those natural goods and services, such as mountains hiked in or a breeding fish population. Long term, it is not the number of fish consumed in 2019 that concerns us but the health of the stock of fish and its ability to provide into the future.

The UK natural capital accounts: 2020 remain Experimental Statistics and are not directly comparable with previous accounts. For more information on the methods used please see the Methodology guide.

Several natural capital services, such as flood mitigation and tourism, are not being measured in this article, so the monetary accounts should be interpreted as a partial or minimum value of UK natural capital. New service estimates are being developed and we will endeavour to include these in future accounts.

This bulletin presents 13 service accounts, containing estimates of the quantity and value of services being supplied by UK natural capital. The services are presented by type, which include provisioning, regulatory and cultural. Types of service are defined at the beginning of each section.

# 3 . Provisioning services

Provisioning services are products from nature that meet human needs such as food, water, and materials.

The provisioning services currently included in the UK natural capital accounts are:

## Agricultural biomass

Agricultural biomass includes the value of crops, fodder and grazing. Farmed animals are not included in these estimates as they are considered produced rather than natural assets. The food eaten by farmed animals, such as grass and feed, is included.

## Fish capture

Fish capture includes the value of marine fish taken from mainland UK waters. Aquaculture or farmed fish, like farmed livestock, have been removed from estimates as farmed fish are viewed as a produced asset and not a natural asset.

## Timber removals

Wood production (also referred to as removals) is the harvesting of roundwood (trunk and branch wood) from coniferous (softwood) and broadleaved (hardwood) trees.

## Water abstraction

Water abstracted for public water supply only.

## Mineral extraction

Minerals extraction, largely consisting of construction mineral aggregates.

## Fossil fuel production

Production of crude oil, gas, and coal.

## Renewable energy generation

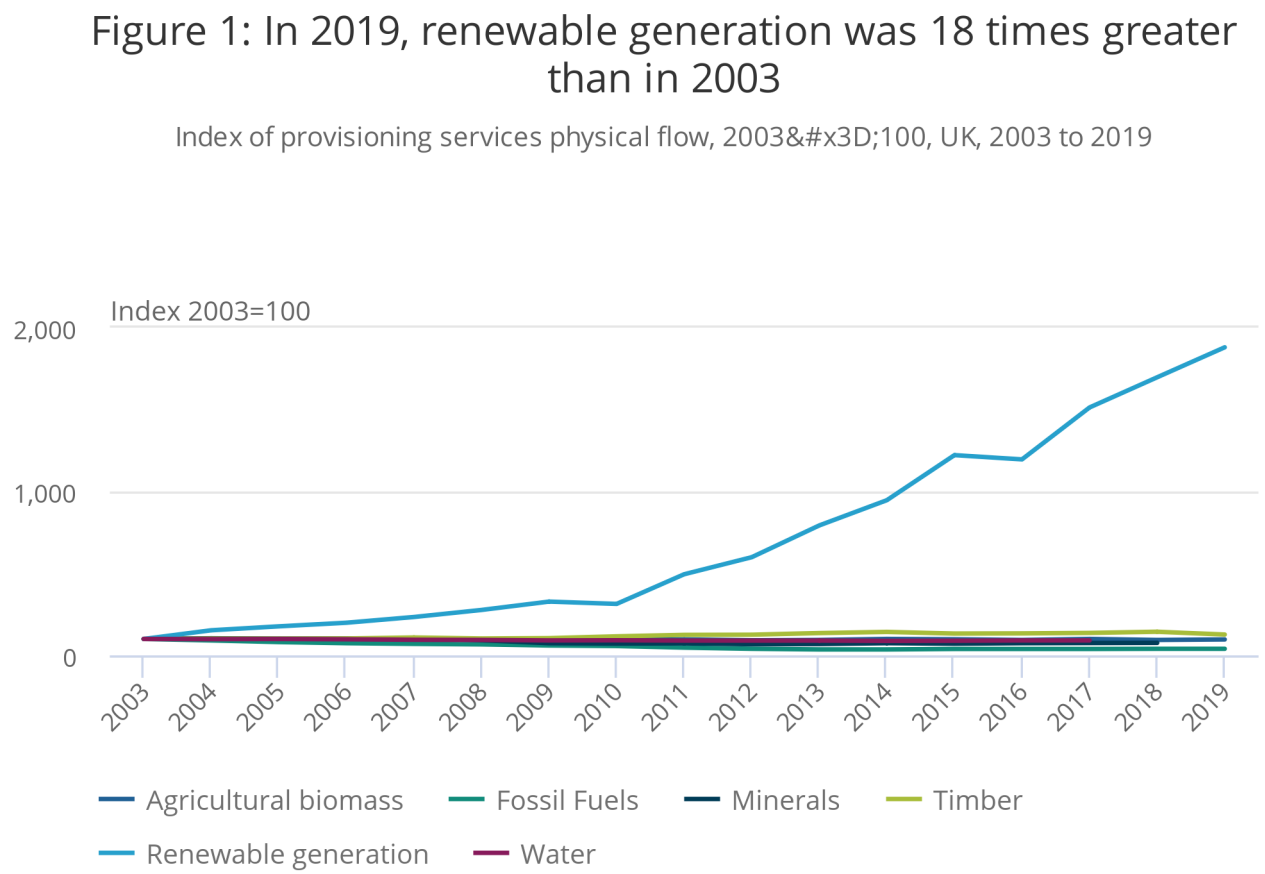
Electricity generated from renewable sources, wind, hydroelectric, solar, wave and tidal.

With year-on-year increases in renewable energy provisioning, the service is approximately 18 times larger in 2019 than it was in 2003. Agricultural biomass, fossil fuels, minerals and water have all seen a reduction in their physical flow from 2003. Fossil fuel provisioning has declined 60% between 2003 and 2019.

We have been working to improve our fisheries statistics, however, more work is needed and care should be taken in interpreting these figures.

**Figure 1: In 2019, renewable generation was 18 times greater than in 2003**

**Index of provisioning services physical flow, 2003=100, UK, 2003 to 2019**




**Source: Office for National Statistics – UK natural capital accounts: 2020**

**Notes:**

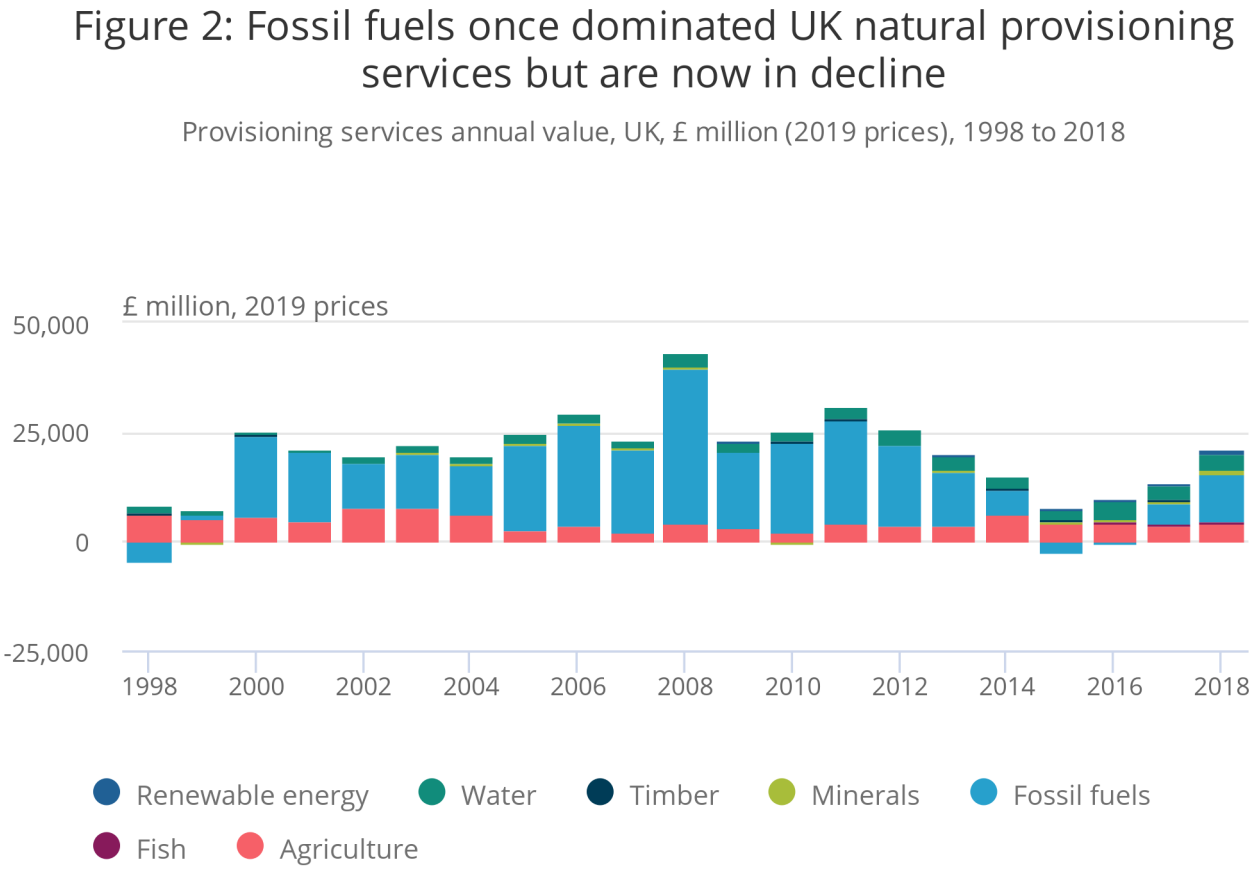
1. Data for 2019 are not available for minerals.
2. Data for 2018 and 2019 are not available for water.
3. Fish capture is excluded as data is unavailable prior to 2015.

Figure 2 shows a time series of the annual valuation for the provisioning services. The total value of all provisioning services has fluctuated throughout 1998 to 2019, mainly because of fluctuations in the unit price of oil and gas provisioning. The annual value of provisioning services saw a 55% increase between 2017 and 2018. The largest increases were in fossil fuels (141%), renewables (77%), and minerals (38%). Only the annual value of fish capture declined (23%).

While fossil fuels still account for most of the overall annual value of provisioning services, their dominance has declined. The production of oil and gas increased by 9% between 2017 and 2018. This, along with a 32% price increase, drove up the value of fossil fuels between 2017 and 2018.

**Figure 2: Fossil fuels once dominated UK natural provisioning services but are now in decline**

**Provisioning services annual value, UK, £ million (2019 prices), 1998 to 2018**




**Source: Office for National Statistics**

**Notes:**

1. Valuations for all provisioning ecosystem services are available from 2015 to 2018 only.

# 4 . Regulating services

As well as tangible provisioning services, natural assets provide several less visible services known as regulating services. These include cleaning the air, sequestering carbon and regulating water flows to prevent flooding.

This section presents four regulating services:

## Carbon sequestration

The removal of climate change gases from the atmosphere is provided by a range of habitats, with woodland being the primary supplier[1].

## Air pollution removal

The removal of air pollutants by vegetation. It is measured in terms of the avoided healthcare costs associated with exposing the public to the pollutants removed.

## Noise mitigation

Vegetation acts as a buffer against noise pollution, in particular road traffic noise. This service is measured in terms of the avoided adverse health outcomes through lack of sleep and annoyance associated with noise.

## Urban cooling

Green and blue space (rivers, lakes, canals) can cool urban environments on hot days, which benefits the economy by mitigating labour productivity loss and reducing the use of air conditioning.

Both carbon sequestration and air pollution removal are carried out by vegetation across a range of habitats, primarily woodland. The capacity for vegetation to remove carbon and pollutants from the air changes with the amount and type of vegetation.

In 2018, 28.1 million tonnes of carbon were sequestered and 1.3 million tonnes of other air pollutants were removed by nature in the UK. The economically measured health benefits per tonne from removing air pollutants are around 13 times greater in 2018 because the pollutants have a larger impact on human health per tonne.

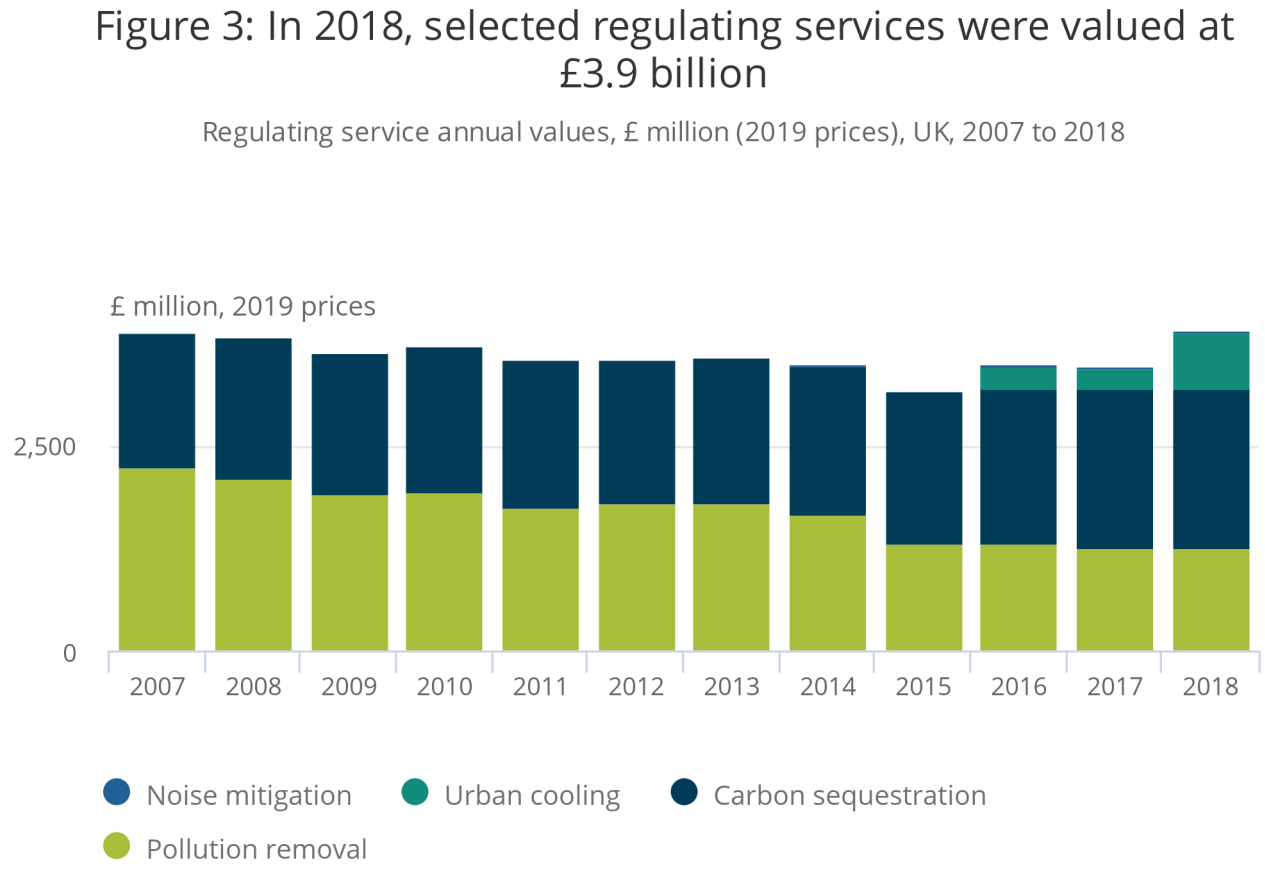
The valuation methods used differ: carbon sequestration is a removal cost, and air pollution removal is a societal cost. We are measuring the value of avoiding spending money on other means of reducing carbon in the atmosphere (for carbon) and the value of treating existing damage (for air pollution). Air pollution removal valuation does not account for the cost of abatement, and carbon sequestration valuation does not consider the global societal impacts of carbon dioxide.

Green and blue spaces in city regions can reduce air temperature on hot days thereby mitigating productivity loss and reducing the use of air conditioning. This is in the context of the number of hot days in the UK increasing annually. In 2018 there were 68 hot days experienced across city regions, nearly triple the number experienced in 2017 (26 days). With hot summers expected to become more common – possibly up to 6.8 degrees Celsius warmer by the 2070s. The value of green and blue spaces in cities is expected to grow significantly in future years.

Hot summers are expected to become more common and up to 6.8 degrees Celsius warmer by the 2070s. The value of green and blue space in cities is expected to grow significantly in future years.

**Figure 3: In 2018, selected regulating services were valued at £3.9 billion**

**Regulating service annual values, £ million (2019 prices), UK, 2007 to 2018**




**Source: Office for National Statistics, Department for Business, Energy and Industrial Strategy, Centre for Ecology and Hydrology, Sourced from Eftec and others (2018) and Met Office**

**Notes:**

1. Pollution removal includes PM10, nitrogen dioxide (NO2), ground-level ozone (03), ammonia (NH3) and sulphur dioxide (SO2).

2. Valuations for noise mitigation and urban cooling are not available before 2014 and 2016 respectively.

### Notes for Regulating services:

1. Because of a lack of data, values related to carbon sequestration by marine ecosystems are not included in the current estimates. Furthermore, peatlands, which are a significant source of emissions, are only partially seen in the data.

# 5 . Cultural services

Cultural services are the non-material benefits people obtain from natural capital, such as recreation, and aesthetic experience.

Nature provides us with a number of cultural services, the value of which can be understood by measuring engagement with the natural environment. This engagement involves visits to green and blue spaces, which are measured through survey responses, and desire to live near to these spaces or with a view of nature, which is measured by the value these features add to house prices.

We separate these cultural services into recreational and aesthetic benefits. Estimates of outdoor recreation refers to people aged 16 years and over and exclude overnight and tourist visits.

In our findings, we measure the monetary value of recreation by looking at both expenditure on outdoor activities and additional expenditure on houses that are near green and blue spaces. These two factors are related because living closer to green and blue spaces enables people to make "free trips" to the natural environment.

The physical flow of recreation measures the amount of time people spend outdoors, rather than how much money people spend, and therefore looks at the non-monetary value of natural spaces.

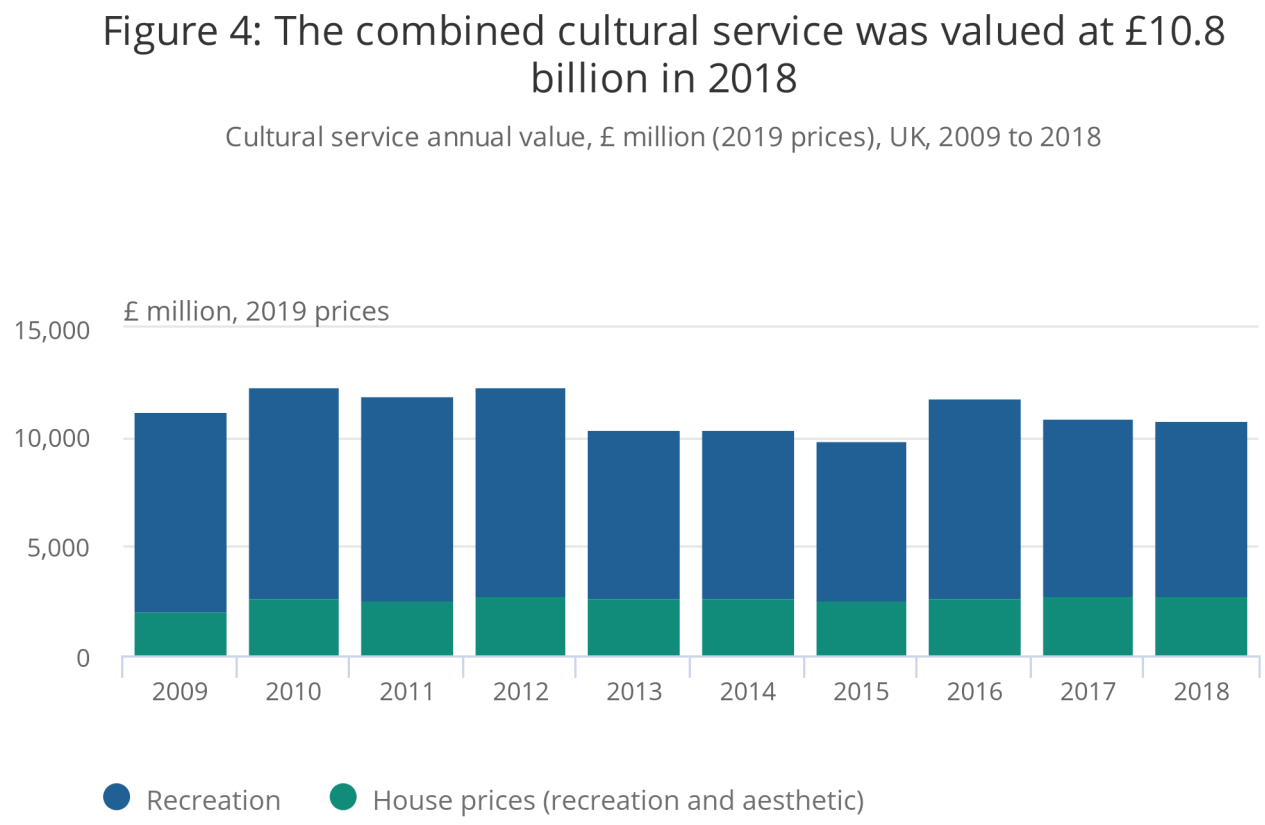
The aesthetic benefits nature provides are also measured by looking at how much value is added to a house that has a view of a green and/or blue space.

Of the two, as fewer houses have such views, recreation has by far the largest value across the time series (2009 to 2018), making up on average £8.5 billion of the total £11.2 billion cultural services provide on average each year.

Figure 4 shows a comparison of recreation and house prices from 2009 to 2018, where the value added to houses by recreational and aesthetic benefits have been combined.

**Figure 4: The combined cultural service was valued at £10.8 billion in 2018**

**Cultural service annual value, £ million (2019 prices), UK, 2009 to 2018**




**Source: Office for National Statistics, Monitor of Engagement with the Natural Environment (MENE) survey, National Survey for Wales and Scotland's People and Nature Survey**

**Notes:**

1. After 2016, aesthetic and recreational annual value in house prices is based on the average percentage increase in house prices from living within 500 metres of green or blue space from 2009 to 2016.

The annual value of recreation in 2018 was estimated at £8 billion (using 2019 prices). Based on expenditure per trip: car running costs, public transport costs, admission costs and/or parking fees.

In the same year, over 10 billion hours of visits were made to the natural environment, which has increased significantly over the time series, which began in 2009 when this was 7.1 billion hours. This increase in time spent in nature is not reflected by an increase in the annual monetary value, which has fluctuated over time. In 2009, recreation was valued at £9 billion, dropping to £7.2 billion in 2015 despite an 11% increase in hours spent. This is due to an overall decrease in expenditure per visit, with travel cost declining and people choosing cheaper outdoor activities.

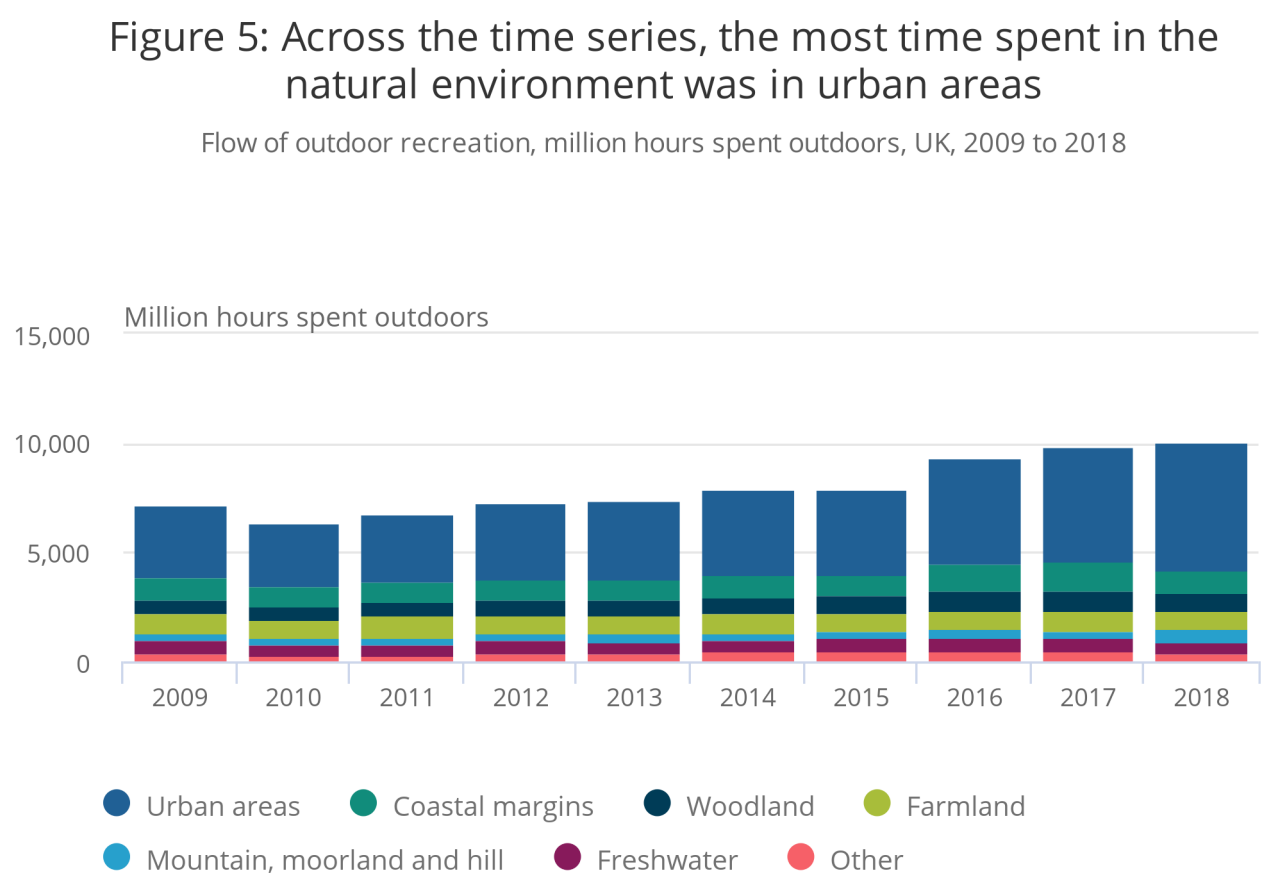
In 2009, recreation was valued at £9 billion, dropping to £7.2 billion in 2015 despite an 11% increase in hours spent. This is because of an overall decrease in expenditure per visit.

Urban areas (parks and gardens) made up the majority of time spent outdoors consistently over the time series, with visits to these areas increasing each year (Figure 5). In 2018, hours spent at urban areas made up 56% of the total time spent outside.

Visits to coastal margins (the seaside) made up the second largest portion (10%) of total hours spent outdoors, and hours spent in woodland areas also gradually increased, almost doubling from 2009 to 2018.

**Figure 5: Across the time series, the most time spent in the natural environment was in urban areas**

**Flow of outdoor recreation, million hours spent outdoors, UK, 2009 to 2018**




**Source: Monitor of Engagement with the Natural Environment Survey, National Survey for Wales, Scotland's People and Nature Survey**

The overall increase in hours spent outside was driven by a large increase in the number of total visits, which went from 3.5 billion in 2009 to 5.1 billion in 2018. This figure was also up from 4.6 billion in 2017.

Across the same time period, the average time spent per visit (including travel time) ranged between 1 hour and 58 minutes in 2018 and 2 hours and 11 minutes in 2016. This small fluctuation in average time spent per visit, despite the gradual increase in total hours spent outside, suggests that people were taking slightly shorter and more frequent trips into the natural environment.

Of the 1 hour and 58 minutes spent on average per visit in 2018, 48 minutes were spent travelling to the location. We calculate the net amount of time spent at a location by subtracting the travel time from the overall (or gross) time spent. Based on this, the average net time spent on recreational visits in the UK in 2018 was 1 hour and 10 minutes.

In some cases, travel to and from a destination could be part of the enjoyment of nature and could influence the choice of travel method. In other cases, the cost of travel represents a willingness to pay for accessing nature and helps determine the value of recreation.

Compared with Scotland and Wales, visits to the coast made up a much smaller portion of total outdoor visits in England. This is likely because most of the of the population in England are further from the coast. This also explains why the overall expenditure per visit was higher in England, most notably so in trips to mountain, moorland and hill areas, which had an average cost of £8.93 compared with £0.88 in Wales and £2.76 in Scotland.

### Recreation and aesthetic value in house prices

It is also possible to determine how much value living near publicly accessible green and blue spaces adds to property prices in urban areas.

A hedonic pricing approach measures the price people are willing to pay to live close to nature among other variables that affect house prices, including the rating of the nearest school, travel to work areas for commuting, and other environmental factors, such as noise and air pollution. For more information on all the variables included in the model and the type of model used, please see the Methodology guide.

To measure added house value from recreation, we take the predicted price of a house that is near urban green and blue space and the predicted price of a house that is not near green and blue spaces and estimate the difference between them.

On average, living within 500 metres of publicly accessible green and blue spaces added £3,146 to property prices in urban areas from 2009 to 2016 (2019 prices), which is about 1.3% of the average property price. This has remained fairly consistent across the time series, ranging from 1.1% to 1.4% of the average house price in each year.

In total, the asset value of these recreational services was measured at £69.8 billion in 2016. This has increased significantly from £56.6 billion in 2009, driven primarily by the general increase in house prices.

Aesthetic services, which refers to a property's view of green or blue spaces, are also measured by looking at the increase in house prices that result from such views. In 2016, this asset was measured at £9.6 billion.

## 6 . Asset valuation

When discussing the asset value of a natural resource, we are referring to the long-term potential of that resource to provide a service to humans. Examples of this would be the level of fish stocks, which can be used as a food source, or the total area of UK forest that can sequester carbon from the atmosphere over a sustained period of time.

To determine the asset value, we therefore need to estimate the flow of services that will be provided by a natural resource over its lifetime, which is known as the asset life. In order to do this, we use the net present value (NPV) approach, taking annual service flows as a basis and then projecting these across the asset life.

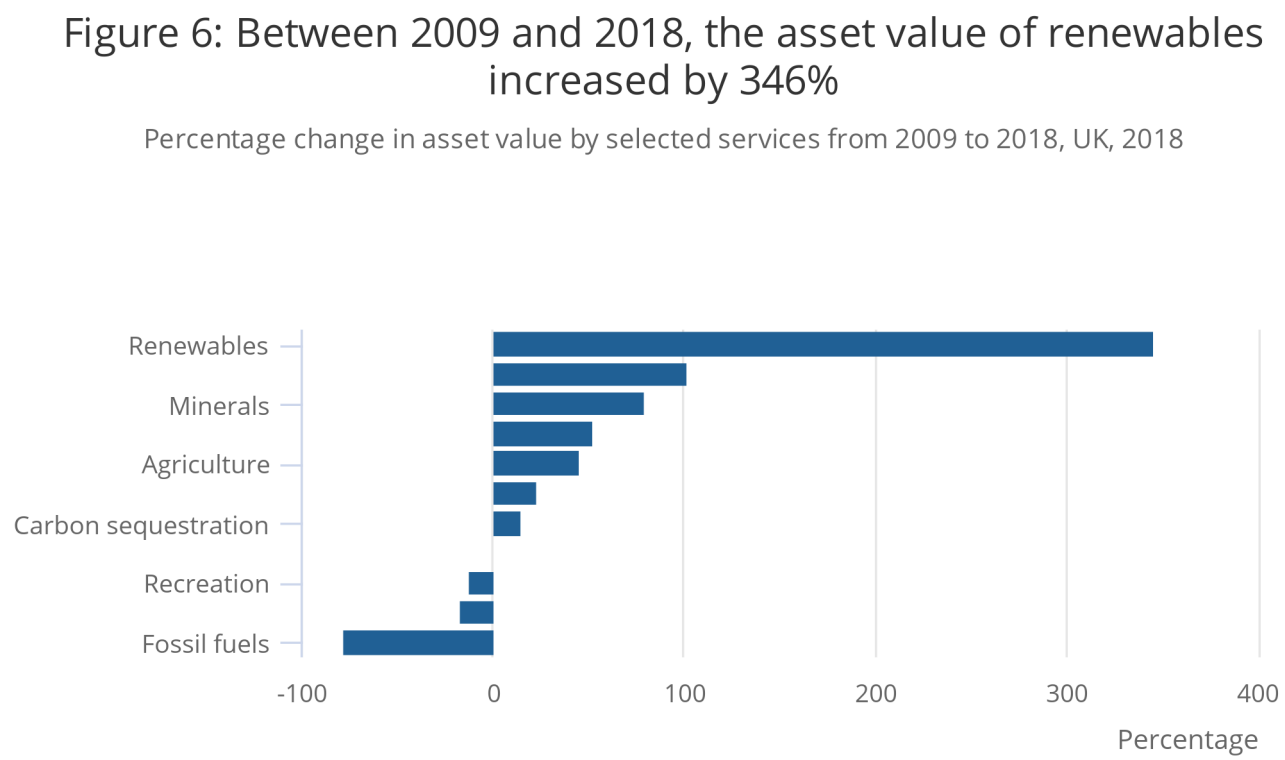
For renewable services, such as those from woodland, a 100-year asset life has been assumed, as these services do not get exhausted over this time period. For non-renewable, abiotic services, whose stock depletes over time, an asset life of 25 years has been assumed. This would include resources such as minerals and fossil fuels.

Once this has been determined, the projected future value of a service is discounted back to the current period, providing an estimate of its capital value at present. For a more detailed explanation of this, see the Methodology guide.

Figure 6 presents the percentage change in UK natural capital asset values between 2009 and 2018 of services for which relevant data are available. Between 2009 and 2018, the asset value of renewables increased by 346%, more than quadrupling during this period. In the same period, fossil fuels have decreased in net present value, by 78%.

**Figure 6: Between 2009 and 2018, the asset value of renewables increased by 346%**

**Percentage change in asset value by selected services from 2009 to 2018, UK, 2018**




**Source: Office for National Statistics**

**Notes:**

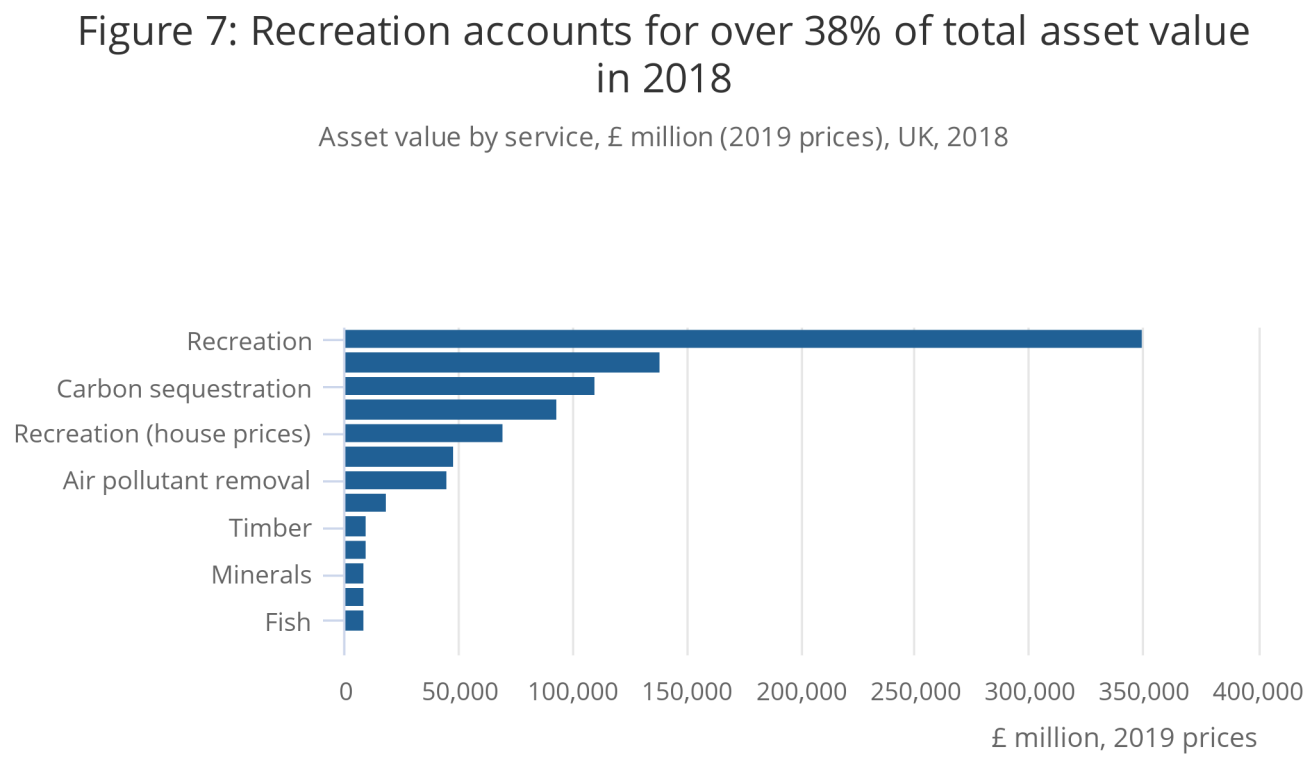
1. Excluding the comparison of asset values for fish capture, urban cooling, and noise mitigation because of data limitations.

Recreation made up the largest proportion of the total UK asset value consistently across the time series, making up 38% in 2018 despite a slight decrease in total value since 2009 (see Figure 6). As a non-material service, recreation is not directly captured in gross domestic product (GDP). Other non-material services, including recreation and aesthetic reflected in house prices and scientific research (cultural services) and carbon sequestration, air pollution removal, noise mitigation, and urban cooling (regulating services), are also not at present directly captured in GDP, despite making up a combined 66% of UK natural capital asset value in 2018.

Other non-material services, including recreation and aesthetic reflected in house prices and scientific research (cultural services) and carbon sequestration, air pollution removal, noise mitigation, and urban cooling (regulating services), are also not directly captured in GDP, despite making up a combined 66% of UK natural capital asset value in 2018.

**Figure 7: Recreation accounts for over 38% of total asset value in 2018**

**Asset value by service, £ million (2019 prices), UK, 2018**




**Source: Office for National Statistics**

# 7 . Natural capital data

[UK natural capital accounts 2020]
Dataset | Released 19 November 2020
Physical (non-monetary) and monetary estimates of services provided by natural assets in the UK between 1998 and 2019.

# 8 . Glossary

## Abiotic services

Abiotic services are the non-living components of the natural environment that provide services to humans, such as fossil fuels.

### Asset

A natural asset is a resource that can generate goods or services to humans into the future. Asset valuation estimates the stream of services that are expected to be produced by the natural resource over a reasonably predictable time horizon.

### Ecosystem services

Ecosystem services are the living (biotic) components of the Earth that provide services to humans, such as woodland.

### Green and blue spaces

Green spaces are outdoor areas such as parks, playing fields, nature reserves, playgrounds and other vegetated land in urban areas that can be used for recreation. Blue spaces are areas of the natural environment populated by water, like rivers, lakes and canals.

### Physical flow

The physical flow of a natural asset is the measure of its output in units appropriate to the good or service. This differs from the annual value and asset value, which measure the monetary value of a natural resource.

## 9 . Measuring the data


The Office for National Statistics (ONS) natural capital accounts are produced in partnership with the Department for Environment, Food and Rural Affairs (Defra). Further details about the natural capital accounting project are also available.

The methodology used to develop these estimates remains under development; the estimates reported in this article are experimental and should be interpreted in this context. Experimental Statistics are those that are in the testing phase, are not yet fully developed and have not been submitted for assessment to the UK Statistics Authority. Experimental Statistics are published to involve customers and stakeholders in their development and as a means of building in quality at an early stage.

The UK natural capital accounts methodology guide:2020 provides a detailed summary of the methodology used to develop the Natural Capital Accounts. This summaries the broad approach to valuation and the overarching assumptions made, as well as giving a more detailed description of the methods used to value the individual components of natural capital and physical and monetary data sources.

We have used a wide variety of sources for estimates of UK natural capital, which have been compiled in line with the guidelines recommended by the United Nations (UN) System of Environmental-Economic Accounting Central Framework and System of Environmental-Economic Accounting Experimental Ecosystem Accounting principles, which are in turn part of the wider framework of the system of national accounts.

As the UN guidance is currently still under development, the Office for National Statistics (ONS) and the Department for Environment, Food and Rural Affairs (Defra) published a summary of the principles underlying the accounts.

We welcome discussion regarding any of the approaches presented via email at natural.capital.team@ons.gov.uk.

# 10 . Strengths and limitations

We have been working to improve our fisheries statistics and more work is needed. We rely on a range of external sources which all involve known uncertainties. For instance, Norway and Faroese landings are excluded from this analysis. The economic data are based on UK fleet data which we also apply to foreign vessels that may face different costs and prices.

In addition, UK boundaries do not perfectly align with the geographical areas of fish capture statistics. For more detail on how fish capture in UK waters is estimated, see the Marine Management Organisation Exclusive Economic Zone Analysis and associated publications.

These experimental accounts are being continually revised to produce the best statistics with the available data and methods. We have identified any limitations of the data as well as ideas for future development.

## Agriculture

The data presented are high quality, long-term assessments of farming as an industry but are a poor proxy for the natural capital assets underpinning it.

Top-down industry-level estimates present difficulties in establishing clear natural capital service logic chains and disaggregation. Condition indicators, or even physical flows of agricultural biomass, cannot readily be related to the estimated valuation of the service.

In the future, the valuation basis is likely to switch to either land rent or farm business income estimates. Either would reduce the total value of agriculture but would enable the development of accounts for drivers of agricultural value such as soil quality and pollinators.

## Fish capture

Net profit per tonne estimates cannot be used to estimate future income as effort per tonne captured is fixed.

We hope to start by moving towards estimating income and cost separately, which may have a minor impact on the overall value. Longer term we hope to estimate asset values using bioeconomic modelling of expected future fish production.

## Fossil fuels

High quality data. No planned change.

## Minerals

High quality data. No planned change.

## Timber

High quality data. No planned change.

## Water abstraction

Similar to agriculture, top-down industry-level estimates present difficulties in establishing clear natural capital service logic chains and disaggregation.

We are exploring alternative methods used to value water provisioning services, with the aim to look at the short-term cost and certainty, and long-term sustainability of the UK's water supply. Our aim is to capture the impact of the changing demand for water, and of climate change on the UK water supply by reporting on current and projected demand and water abstraction levels, weather forecasts and costs of ecologically excessive abstraction, water movements by truck, and restrictions on supply. Long term, we hope to net off the costs of any water restrictions to society from overall industry income.

## Renewables

The resource rent approach is not appropriate for this service long term as we cannot disaggregate renewables from the wider power sector.

One option would be to use data on subsidies and levilised costs of operation to estimate the overall income for the renewables providers. The direction of the change would be uncertain. Another option might be to develop supply and use tables for the renewables sector in the UK.

## Carbon sequestration

When using this analysis, it is important to note that we do not capture all carbon sequestration. Because of a lack of data, values related to carbon sequestration by marine ecosystems are not included in the current estimates. Furthermore, peatlands, which are a significant source of emissions, are only partially seen in the data.

There are also many challenges around the inclusion (net sequestration) or exclusion (gross sequestration) of certain emissions from land use and land change. Currently, gross carbon sequestration is used to calculate the regulating service asset value. If sequestration moved from a gross to a net sequestration basis the value would fall.

No changes in methodology are currently planned but the service may change significantly in future accounts.

## Air pollutant removal

We hope to update the models and data to provide more accurate and timely values. Direction of the change would be uncertain, but it is unlikely to be large.

## Urban cooling

The modelling of urban cooling is relatively simplistic. Longer term it is desirable to use remote sensing temperature data to ground truth our estimates of cooling. If we can move from a relatively simple model to a more precise site-specific prediction, we may also switch to a less conservative valuation price.

### Noise mitigation

High quality noise mapping is only carried out periodically. We hope to use other data to provide yearly estimates of noise production. This would allow us to see expected changes between years but should not have an impact on the scale of the service.

### Recreation

There are unlikely to be any significant methodology changes in the basic travel cost work. However, we do hope to start including tourism spend estimates in excess of short day trips. This may significantly increase the value of recreation.

### Recreation (house prices)

The original data source for advertised house prices is no longer readily available. We will therefore move to actual recorded sale prices. In addition, we need to make more direct estimates of urban and rural house numbers but also include the value of recreation outside of formal parks. The overall impacts of these changes are unknown but could be significant.

### Aesthetic (house prices)

See Recreation (house prices). However, in addition we would need to change the basis on which a "view" is identified, which again will have an uncertain impact on value.

## 11 . Related links

United Nations System of Environmental Economic Accounting Experimental Ecosystem Accounting
Website | Updated as necessary
The SEEA Experimental Ecosystem Accounting constitutes an integrated statistical framework for organizing biophysical data, measuring ecosystem services, tracking changes in ecosystem assets and linking this information to economic and other human activity.

Principles of Natural Capital Accounting
Methodology article | Released 24 February 2017
A background article for those wanting to understand the concepts and methodology underlying the UK natural capital accounts being developed by the ONS and Defra.

One in eight British households has no garden
Article | 14 May 2020
The percentage of homes without a garden is higher among ethnic minorities, with Black people in England nearly four times as likely as White people to have no outdoor space at home.