

Forestry Statistics 2021

Chapter 4: Carbon

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United Kingdom

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Country

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The Research Agency of the
Forestry Commission

Forest Research is the Research Agency of the Forestry Commission and is the leading UK organisation engaged in forestry and tree related research.

The Agency aims to support and enhance forestry and its role in sustainable development by providing innovative, high quality scientific research, technical support and consultancy services.

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Introduction

This chapter contains information on:

- carbon in forests;
- carbon sequestration;
- the Woodland Carbon Code; and
- public attitudes to forestry and climate change.

Estimates for England, Wales, Scotland and Northern Ireland are included, where possible, in addition to UK totals. International comparisons of carbon stocks are provided in the International Forestry chapter. Further information on the data sources and methodology used to compile the figures is provided in the Sources chapter.

All of the statistics presented in this chapter have been previously released.

A copy of all carbon tables can be accessed in spreadsheet format from the Data Downloads web page at www.forestresearch.gov.uk/tools-and-resources/statistics/data-downloads/.

In addition to the statistics presented here, information on UK forests and climate change is available from "Combating Climate Change - a role for UK forests" (The Read Report), an independent assessment of the science published in November 2009 and available at www.forestresearch.gov.uk/documents/2062/SynthesisUKAssessmentfinal.pdf.

Key findings

The main findings are:

- The total carbon stock in UK forests is estimated to have increased, from around 3.2 billion tonnes of carbon dioxide equivalent in 1990 to 4.0 billion tonnes of carbon dioxide equivalent in 2020.
- Around one half (51%) of the total UK forest carbon stock in 2020 is in Scotland (2.0 billion tonnes of carbon dioxide equivalent), 36% in England (1.5 billion tonnes), 8% in Wales (0.3 billion tonnes) and 4% in Northern Ireland (0.2 billion tonnes).
- The net annual rate of carbon dioxide accumulation by UK forests is projected to fall from around 18 million tonnes CO₂ in total in 2020 to around 10 million tonnes CO₂ by 2040.
- A total of 302 projects had been validated to the Woodland Carbon Code at 31 March 2021, covering over 15 thousand hectares and projected to sequester 5.7 million tonnes of carbon dioxide over their lifetime.

4.1 Forest carbon stock

Forest carbon stock is the amount of carbon that has been sequestered from the atmosphere and is now stored within the forest ecosystem, mainly within living biomass and soil, and to a lesser extent also in dead wood and litter.

Table 4.1a presents estimates of UK forest carbon stock that were compiled in 2018 for submission to international organisations. The total carbon stock stored within UK forests is estimated to have increased, around 3.2 billion tonnes of carbon dioxide equivalent in 1990 to 4.0 billion tonnes of carbon dioxide equivalent in 2020 (Table 4.1a). The carbon stored in forest soils accounts for around 70% of total forest carbon stock.

Table 4.1a UK forest carbon stock

	million tonnes of carbon dioxide equivalent				
	1990	2000	2010	2015	2020
Carbon in above-ground biomass	376	482	586	630	674
Carbon in below-ground biomass	135	174	211	227	242
Carbon in dead wood	130	138	143	147	149
Carbon in litter	165	175	182	188	190
Soil carbon ^{1, 3}	2,366	2,533	2,629	2,726	2,761
Total forest carbon	3,172	3,502	3,750	3,918	4,016

Source: Forest Research

Notes

1. Carbon in soil depth 0 to 100 cm.
2. To convert tonnes carbon dioxide equivalent (CO₂e) to tonnes carbon (C), multiply by 12/44.
3. Changes in soil carbon stocks over the period can be attributed to changes in UK forest area.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

Around one half (51%) of the estimated total UK forest carbon stock in 2020 is in Scotland (2.0 billion tonnes of carbon dioxide equivalent), 36% in England (1.5

billion tonnes), 8% in Wales (0.3 billion tonnes) and 4% in Northern Ireland (0.2 billion tonnes).

Table 4.1b Forest carbon stock by country, 2020

million tonnes of carbon dioxide equivalent

	England	Wales	Scotland	Northern Ireland	UK
Carbon in above-ground biomass	338	64	259	13	674
Carbon in below-ground biomass	122	23	93	5	242
Carbon in dead wood	61	14	68	5	149
Carbon in litter	80	18	85	7	190
Soil carbon ¹	864	217	1,545	134	2,761
Total forest carbon	1,465	337	2,050	165	4,016

Source: Forest Research

Notes

1. Carbon in soil depth 0 to 100 cm.
2. To convert tonnes carbon dioxide equivalent (CO_{2e}) to tonnes carbon (C), multiply by 12/44.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

4.2 Carbon sequestration

Forest carbon sequestration is the process of increasing the carbon content of the forest through processes that remove carbon dioxide from the atmosphere (i.e. photosynthesis). Once sequestered the carbon is stored in the forest within living biomass, soil and litter and contributes to the forest carbon stock. The forest carbon sink describes the natural reservoir that accumulates and stores sequestered carbon. The forest carbon sink is dynamic and can gain (e.g. sequestration by photosynthesis) and lose (e.g. emission by forest fires) carbon. The forest carbon sink is quantified as the net annual accumulation of carbon (carbon sequestration) by living biomass, soils and litter in forests.

The figures presented in Table 4.2 and Figure 4.2 represent the net annual accumulation of carbon dioxide by UK forests, taking into account carbon emissions due to timber harvesting, forest wildfires and deforestation.

The net annual rate of carbon dioxide accumulation by UK forests is projected to fall from around 18 million tonnes CO₂ in total in 2020 to around 10 million tonnes CO₂ by 2040 under a central scenario (Table 4.2 and Figure 4.1).

The figures in Tables 4.2 and 4.3 are restricted to woodland and carbon stored in harvested wood products (HWPs) is not included in these figures. However, carbon associated with HWPs is included in the UK's greenhouse gas inventory and Energy and Emissions Projections.

Table 4.2 Net annual change in carbon (CO₂ equivalent)¹ in UK woodlands

million tonnes of carbon dioxide equivalent

Year	England	Wales	Scotland	Northern Ireland	UK
1990	6.1	1.5	6.8	0.6	15.0
1995	7.0	1.6	7.4	0.6	16.5
2000	7.9	1.6	8.1	0.6	18.2
2005	8.2	1.6	8.5	0.6	19.0
2010	8.5	1.6	8.7	0.6	19.5
2015	8.3	1.2	8.0	0.6	18.2
2020	8.2	1.2	7.6	0.6	17.5
2025	7.6	1.3	6.2	0.5	15.6
2030	6.8	1.3	4.1	0.5	12.8
2035	5.9	1.5	2.9	0.5	10.8
2040	5.0	1.6	2.6	0.6	9.8
2045	4.2	1.7	3.3	0.6	9.8
2050	3.8	1.6	4.6	0.5	10.6

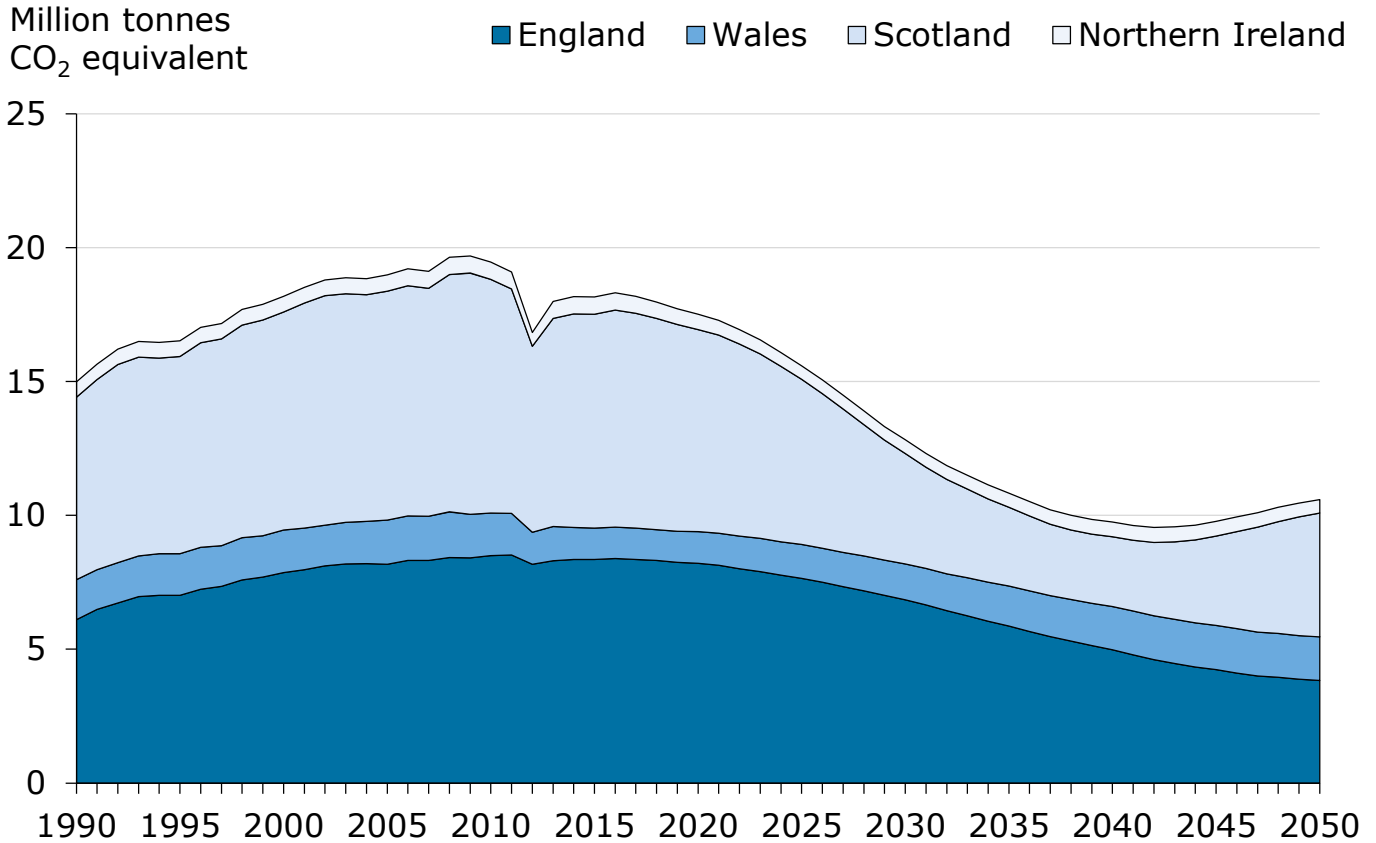
Source: UK Greenhouse gas inventory: inventory and projections dataset (June 2020)

Notes:

1. Net annual accumulation of carbon in forests by woody biomass, soils and litter. Adjusted for losses from deforestation and forest wildfires. Excludes changes in UK harvested wood products.
2. Emissions and sequestration can be presented as tonnes carbon or tonnes carbon dioxide (CO₂). To convert from tonnes CO₂ to tonnes carbon multiply by 12/44.
3. Future predictions of carbon uptake assume that felled woodland will be replanted when felled, and that planting of new woodland will follow a central projection (as used for the Energy and Emissions projections) whereby future planting is only included where policy and funding are in place.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

Figure 4.1 Net annual change in carbon (CO₂ equivalent)¹ in UK woodlands



Source: UK Greenhouse gas inventory: inventory and projections dataset (June 2020)

Notes:

1. Net annual accumulation of carbon in forests by woody biomass, soils and litter. Adjusted for losses from deforestation and forest wildfires. Excludes changes in UK harvested wood products.
2. Emissions and sequestration can be presented as tonnes carbon or tonnes carbon dioxide (CO₂). To convert from tonnes CO₂ to tonnes carbon multiply by 12/44.
3. Future predictions of carbon uptake assume that commercial conifer plantations will be replanted when felled, and that planting of new woodland will follow a central projection (as used for the Energy and Emissions projections) whereby future planting is only included where policy and funding are in place.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

4.3 Woodland Carbon Code

The Woodland Carbon Code is a voluntary standard, introduced in July 2011, for woodland creation projects that make claims about the carbon they sequester (take out of the atmosphere).

All projects must be placed on the UK Woodland Carbon Registry. Their claims about potential carbon sequestration are validated by an independent certification body. Validated projects are then verified on a regular basis to confirm the progress of carbon sequestration.

Further information on Woodland Carbon Code projects is provided in the Sources chapter and at www.woodlandcarboncode.org.uk/.

Table 4.3a provides annual data on projects registered under the Woodland Carbon Code. The table provides information on the number of projects, area of woodland covered by the projects and the total projected carbon sequestration over the lifetime (up to 100 years) of the projects.

A total of 302 projects had been validated (including those that had also been verified) to the Woodland Carbon Code at 31 March 2021, covering over 15 thousand hectares and projected to sequester 5.7 million tonnes of carbon dioxide over their lifetime.

Of the validated projects, 94 were also verified by the end of March 2021. These projects cover around 2.8 thousand hectares and are projected to sequester 1.3 million tonnes of carbon dioxide over their lifetime.

A total of 708 projects were registered under the Woodland Carbon Code at 31 March 2021, covering around 32 thousand hectares of woodland and projected to sequester 11.1 million tonnes of carbon dioxide.

Table 4.3a Woodland Carbon Code projects¹ in the UK

	Verified	Validated only	Awaiting validation	Total
Number of projects				
March 2017	3	140	107	250
March 2018	37	119	83	239
March 2019	70	117	79	266
March 2020	88	151	124	363
March 2021	94	208	406	708
Area of woodland (hectares)				
March 2017	148	4,993	11,028	16,170
March 2018	1,578	3,680	10,868	16,125
March 2019	2,404	5,856	9,134	17,394
March 2020	2,633	9,372	2,962	14,967
March 2021	2,841	12,281	16,662	31,785
Projected carbon sequestration² (thousand tonnes of carbon dioxide equivalent)				
March 2017	79	2,385	3,476	5,940
March 2018	713	1,790	3,285	5,788
March 2019	1,093	2,331	2,760	6,184
March 2020	1,207	3,480	1,121	5,809
March 2021	1,299	4,442	5,368	11,109

Source: Provisional Woodland Statistics: 2021 Edition

Notes:

1. Projects can be validated/ verified individually or come together as part of a group. The statistics presented here show the number of projects validated or verified whether they were put through the process individually or as part of a group.
2. Figures for carbon sequestration indicate the total projected sequestration of the projects over their lifetime of up to 100 years, and include the amount claimable by a project plus the amount allocated to a shared "buffer" in case of unanticipated losses.

Awaiting validation: when a project or group is undergoing assessment by a certification body.

Validated: the initial evaluation of a project or group against the requirements of the Woodland Carbon Code. Upon completion a project/group will receive a 'Validation Opinion Statement'. The project/group will then be certified for a period of up to 5 years.

Verified: Verification is the evaluation of a project as it progresses to confirm the amount of CO₂ sequestered to date as well as that it continues to meet the requirements of the Code.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

Together, all validated (including verified) projects were predicted to sequester 4,531 thousand tonnes of carbon dioxide in Scotland, 981 thousand tonnes in England, 218 thousand tonnes in Wales and 11 thousand tonnes in Northern Ireland over their lifetime (Table 4.3b).

Table 4.3b Woodland Carbon Code projects¹ at 31 March 2021

	England	Wales	Scotland	Northern Ireland	UK
Number of projects					
Awaiting validation	165	55	181	5	406
Validated only	60	24	123	1	208
Verified	39	3	51	1	94
Total validated	99	27	174	2	302
Total	264	82	355	7	708
Area of woodland (hectares)					
Awaiting validation	3,645	629	12,329	60	16,662
Validated only	1,390	399	10,478	14	12,281
Verified	402	52	2,379	9	2,841
Total validated	1,793	451	12,857	22	15,123
Total	5,438	1,079	25,186	82	31,785
Projected carbon sequestration² (thousand tonnes of carbon dioxide equivalent)					
Awaiting validation	1,545	197	3,603	22	5,368
Validated only	762	185	3,487	8	4,442
Verified	220	33	1,044	3	1,299
Total validated	981	218	4,531	11	5,741
Total	2,527	415	8,134	33	11,109

Source: Provisional Woodland Statistics: 2021 Edition

Notes:

1. Projects can be validated/ verified individually or come together as part of a group. The statistics presented here show the number of projects validated or verified whether they were put through the process individually or as part of a group.
2. Figures for carbon sequestration indicate the total projected sequestration of the projects over their lifetime of up to 100 years, and include the amount claimable by a project plus the amount allocated to a shared "buffer" in case of unanticipated losses.

Awaiting validation: when a project or group is undergoing assessment by a certification body.

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Verified: Verification is the evaluation of a project as it progresses to confirm the amount of CO₂ sequestered to date as well as that it continues to meet the requirements of the Code.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

4.3 Public Opinion of Forestry - climate change

Forest Research has conducted similar surveys of public attitudes to forestry and forestry-related issues every two years since 1995. The most recent set of surveys was conducted in 2021 (in Scotland, Wales, and across the UK as a whole) and 2019 (in Northern Ireland). The full results are available on our website at www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/public-opinion-of-forestry/.

In the UK survey in 2021, questions were asked to gauge the public's agreement on climate change issues, including on the management of UK forests in response to the threat of climate change (Table 4.4). Some of the public views presented below do not reflect expert opinion.

There were high levels of agreement (respondents stating that they agreed or strongly agreed) with the statements:

- "A lot more trees should be planted", supported by 83% of the UK public in 2021; and
- "Different types of trees should be planted that will be more suited to future climates", supported by 72% in 2021.

Conversely, there were much lower levels of agreement with the statements:

- "No action is needed, let nature take its course", supported by 30% in 2021; and
- "Trees should not be felled under any circumstances, even if they are replaced", supported by 36% in 2021.

Table 4.4 Management of UK forests in response to the threat of climate change

percent of respondents who agree or strongly agree

	2013	2015	2017	2019	2021
A lot more trees should be planted	86	80	84	88	83
Different types of trees should be planted that will be more suited to future climates	71	67	76	78	72
Trees should not be felled in any circumstances, even if they are replaced	22	25	26	29	36
No action is needed, let nature take its course	18	22	24	26	30

Source: UK Public Opinion of Forestry Surveys.

Base: Figures for 2021 are based on all respondents who had visited woodland in the last few years (approximately 3,500). Figures for earlier years are based on all respondents (approximately 2,000).

Notes:

1. The range of uncertainty around any result should be no more than $\pm 3.5\%$ (for surveys with around 2,000 respondents). To compare results over time, a difference of at least 5 percentage points (for surveys each with around 2,000 respondents) is required to indicate that there is a significant difference.

These figures are outside the scope of National Statistics. For further information see the Sources chapter.

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