

NFI woodland ecological condition in Scotland: classification results

National Forest Inventory

Issued by: National Forest Inventory, Forestry Commission,
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Date: Feb 2020

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Summary

The National Forest Inventory (NFI) for Great Britain provides information concerning the size, distribution and composition of forests and woodlands including woodland ecological condition. Data enabling the calculation of 15 ecological condition indicators were measured as part of the NFI survey cycle 2010-2015 and compared to a benchmark of a stand of ancient semi-natural woodland (ASNW) in good condition. This enabled woodland stands to be classified as favourable, intermediate or unfavourable in terms of their ecological condition. These results can be calculated by woodland type, habitat type, country and region.

This report contains the classification results broken down by woodland type (native, non-native and 'near-native and fragments'). A series of complementary reports has been produced to describe the methodology used, to set out the underpinning statistics on the condition indicators and classes, and to summarise the results. Figure 1.1 illustrates the report and data products available.

For a brief summary of the work or for full details of the methodology please refer to:

- *NFI Woodland ecological condition in Great Britain: Executive Summary*
- *NFI Woodland ecological condition in Great Britain: Methodology*

For the statistical results for other countries please refer to:

- *NFI Woodland ecological condition in [country¹]: Statistics*

For the classification results for the individual British countries please refer to:

- *NFI Woodland ecological condition in [country¹]: Classification Results*

Results for individual priority woodland habitat types can be found in the supporting data:

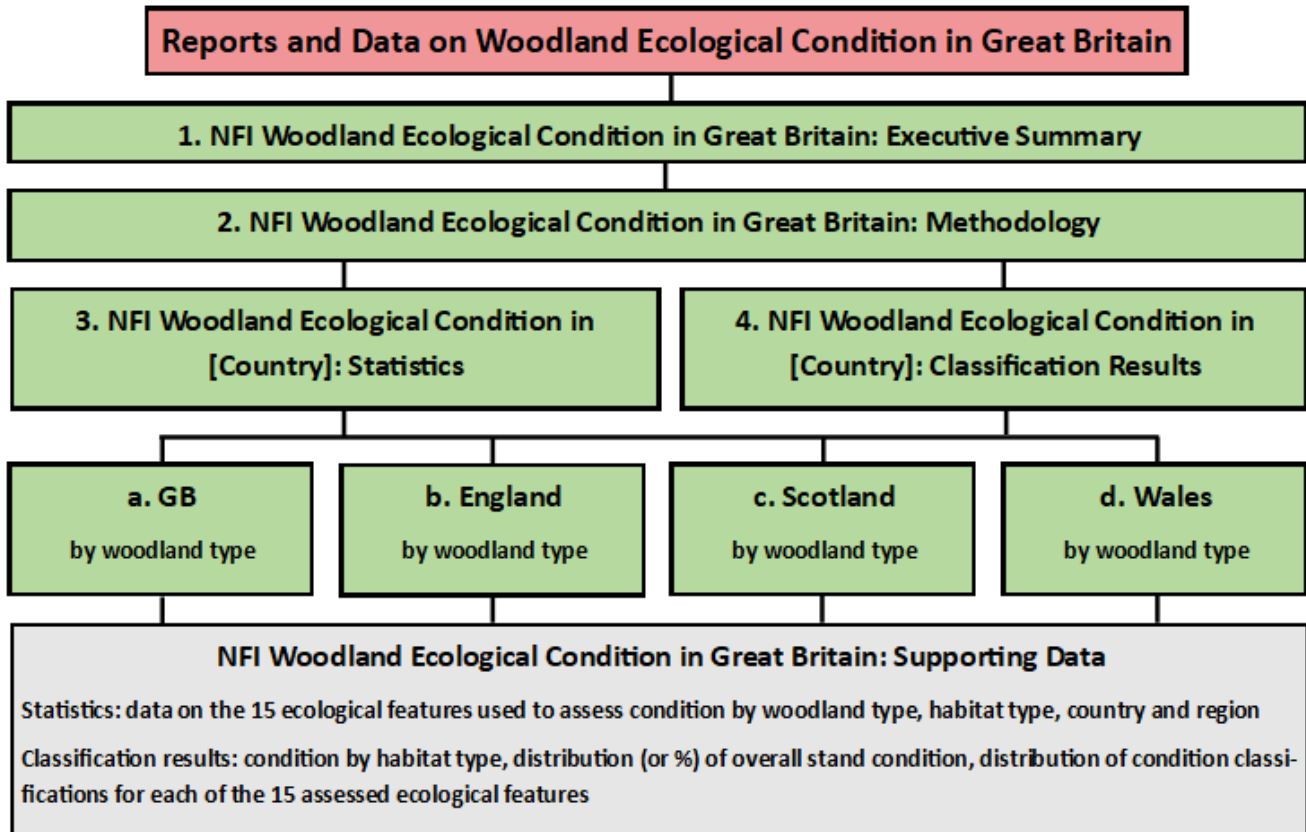
- *NFI Woodland Ecological Condition in [country]: Supporting Data²*

¹ There are four separate reports; Great Britain, England, Scotland and Wales

² Supporting/additional data is available in Excel spreadsheets

NFI woodland condition classifications

Figure 1.1 A schematic diagram to illustrate the link between all the reports published by the NFI on the study of woodland ecological condition in Great Britain.



Notes: [green boxes] = published reports; [grey box] = detail available in supporting spreadsheets; [pink box] = over-arching theme. GB = Great Britain.

Ten reports have been published in relation to woodland ecological condition, namely; executive summary, methodology, statistics and classification results:

1. The Executive Summary spans all three topics presenting an overview of the methodology, key results and sign-posting to more detail;
2. The methodology describes the survey methodology and the calculation of the condition scores;
3. The statistics reports describe the key statistical results, one for each of the three countries and Great Britain, broken by native woodland type¹ and;
4. The classification results describe woodland ecological condition (as calculated by the NFI Condition Calculator, see Methodology) one for each of the three countries and Great Britain by woodland type.

¹ The written reports cover native woodland type, the supplementary data includes regional breakdowns and statistics and classification by priority habitat types as well.

Key findings:

- The total area of native woodland in Great Britain is estimated at around 1.51 million hectares, which is circa 500 thousand hectares or 50% higher than reported in previous estimates (see page 15, Table 3.2).
- The total area of native woodland in Scotland is estimated at around 443 thousand hectares, which is circa 132 thousand hectares or 40% higher than reported in the previous Native Woodland Survey of Scotland (NWSS) estimate. The majority of this difference is NFI finding existing smaller pieces of habitat, outwith the NWSS definition of native woodland.
- 14 thousand hectares or 3% of native woodland area in Scotland is in the top category of favourable condition¹.
- 409 thousand hectares or 94% of native woodland area in Scotland is in intermediate condition².
- 11 thousand hectares or 2.5% of native woodland area in Scotland is in unfavourable condition.
- The principle reason for woods falling into unfavourable or intermediate condition is due to the fragmentation of woods, low levels of older trees and of veteran trees. For example 99% of native woodland area in Scotland is in unfavourable condition for the presence of veteran trees.
- Other factors such as herbivore damage have added to the number of stands in unfavourable or intermediate condition in Scotland:
 - Herbivore damage is found in many stands, with 49% of woodland area is in unfavourable condition for this factor.
 - Deadwood levels are unfavourable for 81% of native woodland.
 - 7% of native woodland area has unfavourable status for invasive species.
 - 3% of native woodland area has unfavourable status for pests and diseases.
- 92% of woodland area in Scotland score intermediate for regeneration (stand-level) and 8% favourable. There is no unfavourable category for this indicator.
- 24% of native woodland area in Scotland is in favourable condition for the number of native species within their canopy.
- 35% of native woodland area in Scotland is in favourable condition for vertical canopy structure.
- 81% of native woodland area in Scotland is in favourable condition for 'nativeness' of canopy.

¹ Section 11, Table 11.1 summarises the WEC indicators and thresholds used to classify stands as favourable, unfavourable and intermediate.

² With only one reference point of NFI woodland ecology measurements taken currently, no assessment of condition trends, whether declining or improving, can be made. Future reports utilising the second NFI cycle will address this.

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1 Introduction

Scottish woodlands are dynamic entities and their ecological condition changes in response to factors such as changing woodland management, general land use practices and climate change. There is a growing requirement across government, non-governmental organisations and the private sector for a better understanding of the ecological condition of Scottish woodlands, which can be used to inform the targeting of resources and woodland management in support of biodiversity and ecological resilience.

This is the most extensive direct field-based assessment of woodland ecological condition to have been carried out in Scotland, covering both native and non-native woods. The study has been run in combination with the [National Forest Inventory](#) (NFI) that records the size, distribution and composition of woodland in Great Britain.

1.1 Aim

The purpose of this report is to present the area and proportion of woodland in three woodland ecological condition classes (favourable, intermediate, unfavourable) for native, non-native and 'near-native and fragments' woodland in Scotland. Classification results by woodland habitat type are available in the supporting Excel tables.

1.2 The importance of understanding the ecological condition of Scotland's woodlands

There are several drivers for monitoring woodland ecological condition. The primary objective is to provide government with statistics that reflect woodland ecological condition and the main factors that impact condition, so that they can make informed decisions concerning the current state of woodland ecological condition and its management. Secondly, it is the UK's national and international requirement to monitor woodland condition. The UK government signed the following global and pan-European (EU) agreements in 1992 which led to commitments concerning the protection of biodiversity:

- The global Convention on Biological Diversity (CBD: <https://www.cbd.int>). Contracting parties are required to develop and enforce national strategies to identify, conserve and protect existing biodiversity. Article 7 of the convention focuses on the requirement to monitor biodiversity.
- The EU Habitats Directive (Directive 92/43/EEC) aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on its Annexes to a favourable conservation status (JNCC, 2018). Article 17 of the directive specifically requires members to report an assessment of the conservation status of species and habitats listed on the Annexes of the Directive every 6 years.

1.3 Measuring ecological condition

The [National Forest Inventory](#) (NFI) field survey assesses a large, stratified random sample of woodlands across GB on a 5-year rolling cycle using a standardised protocol. Detailed data on various attributes are collected from approximately 15,100 one-hectare sample squares that are partially or entirely covered by forest, including clear-felled areas, according to the woodland map. The first cycle ran from 2010 to 2015 and the second cycle commenced in 2015 (to be completed in 2020). The survey provides an extensive, in-depth and spatially explicit record of our forests and woodlands.

This report provides a brief overview of the methodology used to assess woodland condition using the first cycle of NFI survey data, but full details are provided in the complementary report, 'NFI woodland ecological condition in Great Britain: Methodology'.

To assess the ecological condition of the NFI survey woodlands, 15 woodland ecological condition (WEC) indicators were devised, reviewed and agreed by the NFI WEC working group, a group of specialists from Natural Scotland, Forestry Commission, Forestry England, Scottish Forestry, Scottish Natural Heritage, Natural Resources Wales and the Welsh Government:

1. Age distribution of trees
2. Herbivore damage
3. Invasive plant species
4. Number of native trees
5. Occupancy of native trees
6. Open space
7. Proportion of favourable land cover
8. Woodland regeneration (stand-level) ¹
9. Woodland regeneration (square-level)
10. Tree health
11. Vegetation and ground flora
12. Woodland vertical structure
13. Veteran trees
14. Volume of deadwood
15. Total area of woodland

Alongside the WEC indicators listed above (i.e. stand-level indicators), total woodland area and woodland area loss were designated as population-level indicators (i.e.

¹ Component group = Homogeneous areas that are too small (<0.05 ha) to practically map as a discrete section using Geographic Information System (GIS) software in the field, but with most of the same defining characteristics as a section. Section = within each sample square, the forest was stratified into different woodland stands or 'sections'.

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national-level indicators) and are reported upon and evaluated separately (see [Forestry Statistics](#)) to the condition classification results reported here. The national-level estimates were derived from the NFI woodland map, augmented by the NFI fieldwork. Both the national-level indicators and stand-level indicators are pertinent to the overall, national picture of habitat condition and should be considered together.

1.3.1 The NFI Map: an overview

Data on the location and extent of all forests and woodlands in the UK (≥ 0.5 hectares) is created, stored and maintained by the National Forest Inventory (NFI) as a [digital woodland map](#). The map provides current and historical information on the distribution, type and size of forests and woodland in the UK. The digital woodland map is produced using aerial photography, satellite imagery and administrative records and updated annually.

1.3.2 NFI woodland sample evaluation: an overview

NFI sample squares were located within the NFI mapped area using a stratified random approach. Surveyors classify the area within each one hectare NFI sample square into forest and non-forest. The forested area(s) within the sample square are then further stratified into smaller units of homogenous canopy type based on differences in features such as woodland habitat and tree species, or more subtle factors such as condition and thinning history. Such contiguous 'units' of woodland are referred to as 'stands' for the purposes of these reports. Within each forest stand, information on species, age, management regime and other data is collected to enable assessment of each of the 15 ecological indicators described above.

Typically, there are multiple stands which may also be further divisible within each sample square. This means, from the circa 15,000 sample squares covered by the NFI, 33,000 forest stands in Great Britain have been assessed for ecological condition, of which circa 6,000 sample squares and circa 14,900 forest stands were in Scotland. Within each stand two or three 100 m² (0.01 hectare) circular plots were randomly located. Within each of these circular plots, stocking was assessed and species, age, grid location and diameter at breast height (DBH) was recorded for all trees ≥ 4 cm DBH. A total of 650,000 trees were measured, of which 240,000 trees were measured in Scotland. Transects were also conducted within each circular plot to assess the volume of lying deadwood, seedlings and saplings.

Each of the sample squares are marked on the ground with metal pegs and their exact location recorded by GPS to allow for quality assurance checks and future assessment. All field measurements and information are subject to quality assurance checks.

1.3.3 Ecological condition classification

The NFI WEC working group established a process for using the WEC indicator data to classify and score woodlands according to their expected condition. Briefly, the process developed involves the following steps:

1. Collect data on the WEC indicators as part of the NFI field survey.
2. Supply statistics on these indicators e.g. 'x% of woodland stands showed evidence of regeneration'.
3. Using ancient semi-natural woodland (ASNW) in good condition as a benchmark (see below), define thresholds for classifying woodland stands into 'favourable', 'intermediate' or 'unfavourable' status for each WEC indicator (NB there is no 'unfavourable' category for stand-level regeneration).
4. Assign numerical scores to these categories and combine these scores for all WEC indicators to provide an overall condition status score for each woodland stand.
5. Define thresholds to apply to the combined scores in order to classify woodland stands into overall 'favourable', 'intermediate' or 'unfavourable' status.
6. Supply information on the classification and scores of woodlands e.g. 'x% of woodland stands were classified as being in favourable condition for the regeneration indicator'.
7. Use the results from the first survey cycle as a baseline against which changes in condition can be measured for monitoring purposes using data from future surveys.

The indicators and classification thresholds were selected with reference to other work (e.g. the Common Standards Monitoring approach for protected sites (JNCC, 2003)), the best available scientific evidence, expert opinion and each country's current policy needs and targets. For example, to determine a 'favourable' level of seedlings, saplings and small trees, a combination of published evidence and expert opinion was used. Details of thresholds used can be found in the methodology report.

1.3.4 Extrapolating NFI field survey statistics to a reporting area

The data collected within each survey sample square (used for the 15 WEC indicators), the derived scores and the classifications, were extrapolated and aggregated to the areas of woodland recorded in the NFI map (e.g. woodland type) using standard statistical survey methodology (refer to methodology report for more information). The classifications of each stand can also be extrapolated up to any sub class of woodland area, such as woodland type or habitat type (minimum size approx. 30, 000 ha, depending on variance within the population and what is being reported) and in turn broken down by any geographic area, such as by country or NFI region, as in this report. This report presents the results for different woodland types (native, near-native and fragments', non-native) for Scotland, results specifically for England, Wales and GB are

presented in companion reports (Figure 1.1). Results for individual priority woodland habitats are available in the supplementary data.

1.3.5 The NFI Condition Calculator: an overview

To report on condition using the NFI data an analytical tool was developed, referred to herein as the NFI 'Condition Calculator'. This tool allows the detailed data recorded in each NFI survey square to be analysed alongside the NFI woodland map and other data. It automatically produces the stand-level condition results per woodland type and aggregated statistics for the reporting area. The advantages of establishing an automated reporting tool are that results can be generated on demand using a consistent approach. The Condition Calculator will therefore allow the data from future cycles of the NFI to be analysed using the same procedures, enabling reliable comparisons for reporting on change.

1.3.6 Woodland and woodland type definitions

Woodland

An area of land over 0.5 hectares in extent, with 20% or more tree canopy cover, or the potential to achieve that based upon established trees.

Native woodland

Stands with 50% or more native tree species occupancy in the upper canopy that either:

- Form a discrete woodland parcel with a minimum area of 0.5 ha.
- Form a woodland stand with a minimum area of 0.1 ha that is part of a woodland that is 0.5 ha or larger.

Non-native woodland

Stands with less than 40% native species occupancy sitting within a woodland of any size.

Near native and fragments

Stands that fail to meet the criteria for native or non-native woodland specified above are classified as 'near native and fragments'. Defining this category allows all woodland area to be assessed and reported on for its ecological condition status. Pinpointing these areas of woodland may help inform targeted restoration, as they may represent previously native woodland area that has been overplanted with non-natives.

The near native and fragments woodland type can be subdivided into two subclasses:

1. **Near native:** have a native canopy cover of somewhere between 40% to 49% and thus are 'nearly' native.
2. **Fragments:** have 50% or more native tree species occupancy in the upper canopy but fall under the minimum size threshold of 0.1 ha, falling in the size range 0.05 ha to 0.099 ha.

Not determinable

Areas classified as 'not determinable' apply to woodland areas that cannot be classified due to insufficient tree or other attribute information, such as areas without canopy cover and clear-fell sites with a weak vegetation layer. These form less than 0.5% of the whole woodland population.

2 Results

Presented here are the scores of the woodland ecological condition assessment of woodland in Scotland by woodland type. Given the large volume of data gathered in this study it was decided that the reports would focus on results by country and woodland type. Results by habitat type and region are available in the supporting data Excel spreadsheets.

The nominal baseline date for estimates is an average of 2013 (mid-point of the survey) and the time period over which the full series of field samples were collected was January 2010 to January 2016.

All areas are rounded to the nearest 100 hectares. In some breakdowns, the estimates in the body of the table may not sum to the quoted total because each individual value, including the total, has been independently generated by the estimation procedure used for results from the NFI sample survey.

2.1 Standard error

Along with these estimates, associated sampling standard errors have also been calculated and reported, giving a measure of accuracy, conditional upon the underlying assumptions. The sampling standard error will account for random variation arising from the selection of the sample and random measurement errors. However, standard error will not account for any systematic biases in the field measurements but it is unlikely that any substantial biases of this nature are present in the survey data because the quality assurance processes account for this. Any standard error greater than 25% is reported in amber text and represents a lower degree of assurance in the estimates.

3 Woodland habitat type and woodland native type

This is the first assessment classifying woodland by habitat type for each country and by region.

Table 3.1 Area of woodland by habitat type for each country and region of GB

| Region | Lowland beech/yew woodland | Lowland mixed deciduous woodland | Native pine woodlands | Non native pinewood | Upland birchwoods (Scot); birch dominated upland oakwoods (Eng, Wal) | Upland mixed ashwoods | Upland oakwoods | Wet woodland | Wood pasture & parkland | Broadleaf habitat NOT classified as priority | Non-native coniferous woodland | Clearfelled and transition | TOTAL |
|--------------------------|----------------------------|----------------------------------|-----------------------|---------------------|--|-----------------------|-----------------|----------------|-------------------------|--|--------------------------------|----------------------------|------------------|
| | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) |
| GB | 61,925 | 908,666 | 123,577 | 37,932 | 133,528 | 53,685 | 103,088 | 169,403 | 10,895 | 53,020 | 1,292,115 | 97,456 | 3,045,290 |
| ENGLAND | 54,482 | 747,508 | 0 | 0 | 11,220 | 31,907 | 44,027 | 77,789 | 7,730 | 19,401 | 327,536 | 21,967 | 1,343,568 |
| North West England | 2,980 | 45,578 | 0 | 0 | 4,004 | 5,101 | 9,351 | 8,081 | 264 | 4,356 | 39,085 | 2,608 | 121,408 |
| North East England | 1,409 | 23,494 | 0 | 0 | 3,628 | 4,965 | 1,513 | 5,008 | 15 | 2,058 | 73,895 | 1,518 | 117,503 |
| Yorkshire and the Humber | 3,680 | 59,873 | 0 | 0 | 1,421 | 3,241 | 5,192 | 5,704 | 280 | 3,847 | 35,511 | 1,235 | 119,984 |
| East Midlands | 724 | 70,148 | 0 | 0 | 431 | 2,390 | 5,219 | 5,619 | 798 | 1,017 | 14,758 | 1,474 | 102,577 |
| East England | 3,739 | 94,807 | 0 | 0 | 0 | 309 | 840 | 13,497 | 1,178 | 1,101 | 34,368 | 4,468 | 154,305 |
| South East England | 24,700 | 245,410 | 0 | 0 | 0 | 1,758 | 323 | 9,761 | 4,946 | 2,740 | 49,670 | 5,582 | 344,890 |
| South West England | 15,133 | 138,219 | 0 | 0 | 1,336 | 8,337 | 15,586 | 23,212 | 154 | 2,459 | 54,579 | 3,021 | 262,036 |
| West Midlands | 2,116 | 69,980 | 0 | 0 | 401 | 5,805 | 6,004 | 6,906 | 95 | 1,824 | 25,671 | 2,060 | 120,863 |
| SCOTLAND | 1,018 | 81,946 | 123,577 | 37,932 | 120,087 | 14,634 | 32,934 | 63,439 | 2,679 | 21,396 | 819,388 | 69,861 | 1,388,891 |
| North Scotland | 0 | 4,034 | 31,642 | 16,626 | 25,848 | 1,269 | 4,764 | 9,243 | 0 | 2,007 | 106,962 | 21,110 | 223,503 |
| North East Scotland | 208 | 12,417 | 66,236 | 20,387 | 20,054 | 616 | 1,176 | 9,182 | 204 | 2,567 | 92,691 | 6,889 | 232,627 |
| East Scotland | 512 | 14,974 | 17,287 | 556 | 14,586 | 1,937 | 3,438 | 5,795 | 468 | 2,199 | 67,269 | 4,707 | 133,728 |
| South Scotland | 96 | 41,681 | 1,424 | 0 | 13,874 | 7,128 | 6,206 | 19,591 | 2,007 | 8,413 | 310,353 | 14,625 | 425,398 |
| West Scotland | 201 | 8,840 | 6,988 | 364 | 45,725 | 3,685 | 17,351 | 19,627 | 0 | 6,209 | 242,113 | 22,531 | 373,635 |
| WALES | 6,424 | 79,211 | 0 | 0 | 2,221 | 7,144 | 26,126 | 28,175 | 486 | 12,224 | 145,192 | 5,628 | 312,831 |

Notes: 1. The wood pasture area in the above table only relates to wood pasture as defined by NFI as woodland; i.e. woodland must be over 0.5 hectares in extent, over 20% canopy cover and 20 m in width to qualify. Although there is no agreed British definition of wood pasture, some wood pasture includes land that contains less than 20% canopy cover. This estimate will therefore be a low estimate of the true value of wood pasture. 2. Area includes a revision to underlying total woodland area (this will be revised in Forestry Facts and Figures Sept 2020). Comparisons with woodland area should not be made as woodland area is defined differently to woodland habitat (with woodland area being greater than habitat area due to the treatment of land uses like open space and clear-fell).

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Table 3.2 Area of woodland by woodland type for each country and region of GB

| Region | Native | Near native & fragments | Non native | Not determinable | Total |
|--------------------------|------------------|-------------------------|------------------|------------------|------------------|
| | Area (ha) | Area (ha) | Area (ha) | Area (ha) | Area (ha) |
| GB | 1,507,105 | 56,776 | 1,461,267 | 19,629 | 3,044,777 |
| ENGLAND | 914,095 | 29,459 | 398,186 | 1,706 | 1,343,446 |
| North West England | 73,932 | 2,329 | 45,152 | 421 | 121,834 |
| North East England | 36,201 | 3,005 | 77,982 | 149 | 117,338 |
| Yorkshire and the Humber | 68,954 | 3,783 | 46,837 | 271 | 119,845 |
| East Midlands | 73,964 | 2,305 | 26,272 | 37 | 102,577 |
| East England | 107,595 | 3,323 | 43,206 | 181 | 154,306 |
| South East England | 280,796 | 6,494 | 57,302 | 308 | 344,901 |
| South West England | 186,732 | 4,654 | 70,192 | 205 | 261,782 |
| West Midlands | 85,920 | 3,566 | 31,243 | 134 | 120,863 |
| SCOTLAND | 442,611 | 20,313 | 908,259 | 17,205 | 1,388,388 |
| North Scotland | 94,541 | 3,303 | 119,908 | 5,751 | 223,503 |
| North East Scotland | 111,260 | 3,781 | 115,197 | 2,248 | 232,485 |
| East Scotland | 48,860 | 2,647 | 80,049 | 2,171 | 133,728 |
| South Scotland | 78,739 | 7,026 | 336,526 | 2,709 | 425,000 |
| West Scotland | 109,211 | 3,556 | 256,579 | 4,327 | 373,672 |
| WALES | 150,399 | 7,004 | 154,822 | 718 | 312,943 |

Notes: 1. Woodland types are defined in Section 1.3. 2. Area includes a revision to underlying total woodland area (this will be revised in Forestry Facts and Figures Sept 2020). Comparisons with woodland area should not be made as woodland area is defined differently to woodland habitat (with woodland area being greater than habitat area due to the treatment of land uses like open space and clear-fell)

This is the first assessment of the extent of native woodland and priority habitat type, across the whole of Scotland, based on a balanced stratified random sample of woodlands. There have been two previous assessments of native woodland extent; The Native Woodland Survey of Scotland (NWSS) and an analysis carried out using National Vegetation Classification (NVC) survey information. NWSS is a census of native woods, with a nominal date of 2012, which identified and mapped the location, extent, type and condition of all of Scotland's native and nearly native woods, as well as plantations on ancient woodland sites (PAWS). As two relatively recent assessments, the NFI and NWSS estimates broadly align, although some differences emerge due to the different methodologies used. In comparison, JNCC created estimates of the area of priority habitat types in 2008 using National Vegetation Classification (NVC) data and 2,648 samples taken in ancient and recent woods throughout Britain (Rodwell 1991). Differences between these and the NFI results largely arise from the lower sample size and non-random sampling associated with the NVC dataset. In general, due to the methodological differences, direct comparisons between the three datasets should not be made.

4 Stand-level condition classification results for native woodland area in Scotland

Table 4.1 Area of native woodland stands in Scotland classified as favourable, intermediate or unfavourable for each of the 15 WEC indicators

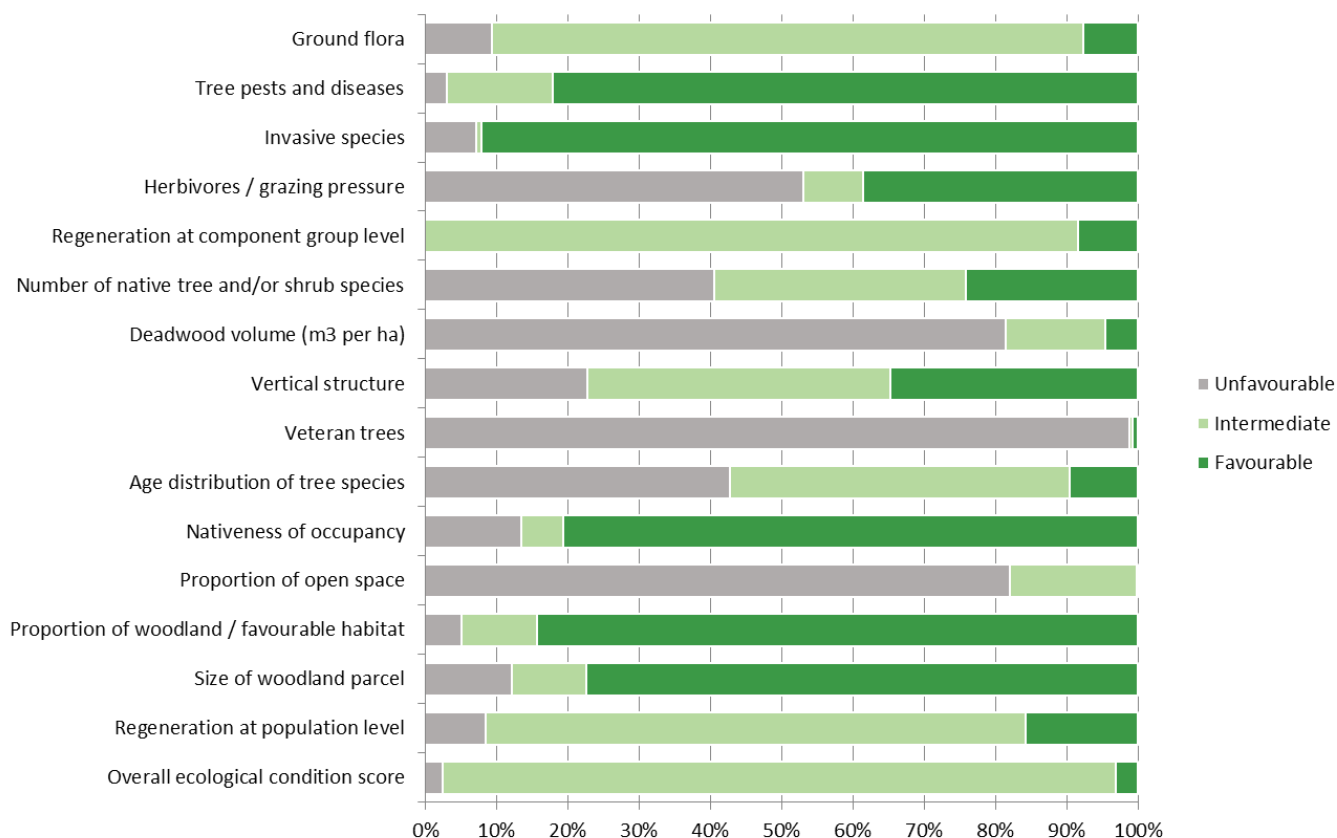
| Native | Unfavourable | | Intermediate | | Favourable | |
|---|---------------|------|---------------|------|---------------|------|
| | Area (000 ha) | SE% | Area (000 ha) | SE% | Area (000 ha) | SE% |
| Ground flora | 41.2 | 5.3 | 367.4 | 1.9 | 34.1 | 6.9 |
| Tree pests and diseases | 13.2 | 9.2 | 66.0 | 4.8 | 363.5 | 1.9 |
| Invasive species | 31.8 | 7.5 | 3.3 | 22.8 | 407.5 | 1.7 |
| Herbivores / grazing pressure | 234.9 | 2.7 | 36.6 | 5.0 | 171.1 | 3.0 |
| Regeneration at component group level | 0.0 | - | 405.0 | 1.7 | 37.6 | 6.2 |
| Number of native tree and/or shrub species | 179.1 | 2.8 | 156.6 | 3.9 | 106.9 | 3.3 |
| Deadwood volume (m3 per ha) | 360.5 | 1.9 | 61.6 | 4.8 | 20.4 | 8.1 |
| Vertical structure | 100.6 | 5.9 | 188.2 | 2.8 | 153.9 | 2.8 |
| Veteran trees | 436.8 | 1.6 | 2.3 | 25.2 | 3.5 | 24.1 |
| Age distribution of tree species | 189.3 | 3.2 | 211.1 | 2.5 | 42.3 | 6.0 |
| Nativeness of occupancy | 59.5 | 4.5 | 25.9 | 7.4 | 357.2 | 1.9 |
| Proportion of open space | 355.9 | 2.0 | 77.2 | 4.0 | 0.7 | 51.0 |
| Proportion of woodland / favourable habitat | 22.5 | 25.4 | 46.8 | 6.3 | 373.3 | 1.7 |
| Size of woodland parcel | 53.8 | 11.8 | 46.4 | 5.9 | 342.3 | 1.9 |
| Regeneration at population level | 37.3 | 6.9 | 335.4 | 2.0 | 69.9 | 4.6 |
| Overall ecological condition score | 10.8 | 53.3 | 409.3 | 1.6 | 13.8 | 11.4 |

Notes:

1. SE = standard error. Amber text = values with SE >25%.
2. Native is defined in Section 1.3.6.
3. Woodland ecological condition classification categories and indicators are defined in the methodology report.
4. For more information refer to the methodology report.
5. Classification thresholds for ground flora; favourable, unfavourable and intermediate are adjusted for different woodland NVC types, with 'more' being expected of nutrient rich types than nutrient poor types.

NFI woodland condition classifications

Figure 4.1 The proportion of each woodland ecological condition class, for each WEC indicator in native woodland stands in Scotland



Notes:

1. Native is defined in Section 1.3.6
2. Woodland ecological condition classification categories and indicators are defined in methodology report.
3. For more information refer to the methodology report.
4. Classification thresholds for ground flora; favourable, unfavourable and intermediate are adjusted for different woodland NVC types, with 'more' being expected of nutrient rich types than nutrient poor types.

5 Stand-level condition classification results for near native woodland and fragments in Scotland

Table 5.1 Area of near-native woodland and fragments in Scotland classified by woodland ecological condition for each of the 15 WEC indicators

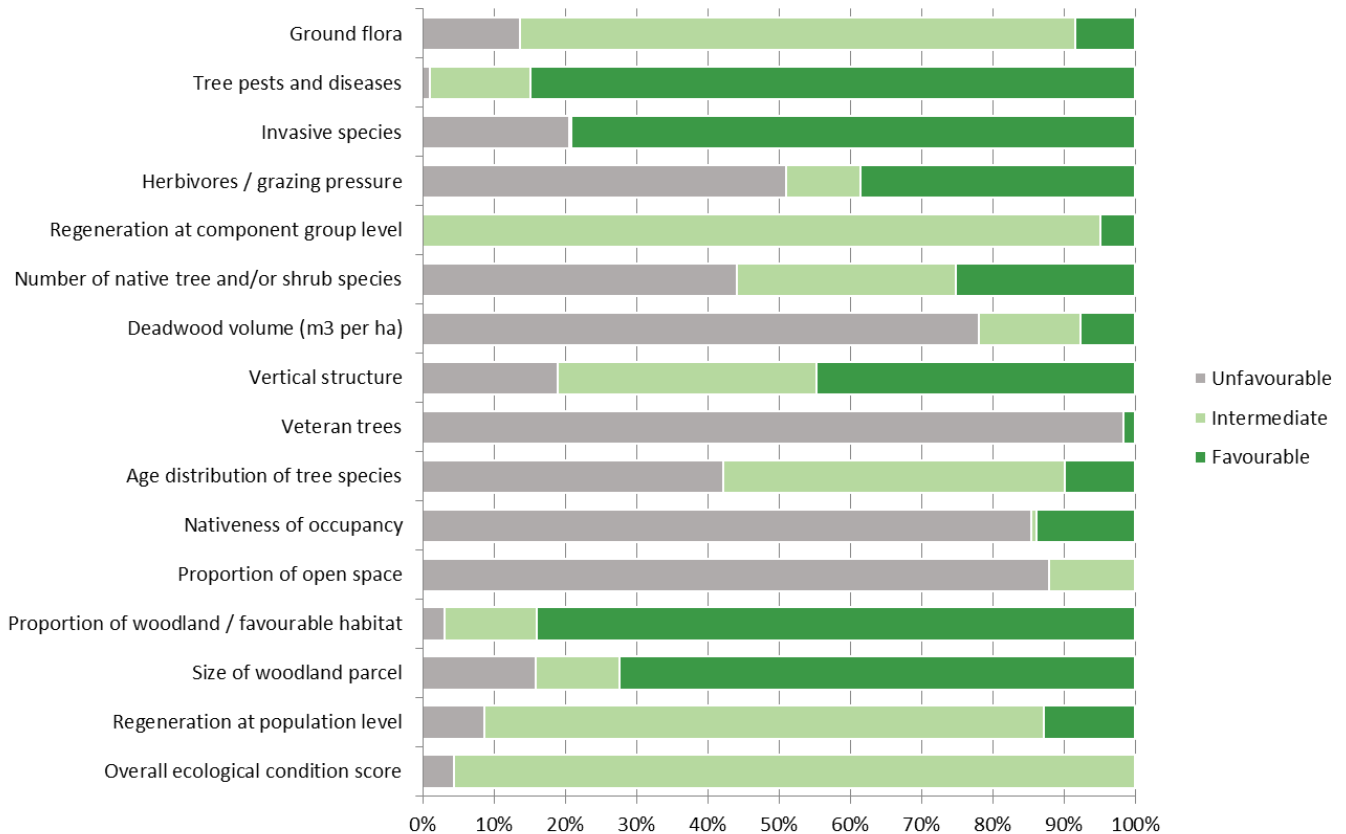
| Near native & fragments | Unfavourable | | Intermediate | | Favourable | |
|---|---------------|------|---------------|------|---------------|------|
| | Area (000 ha) | SE% | Area (000 ha) | SE% | Area (000 ha) | SE% |
| Ground flora | 2.8 | 33.3 | 15.8 | 8.1 | 1.7 | 24.0 |
| Tree pests and diseases | 0.2 | 34.8 | 2.9 | 22.2 | 17.2 | 8.7 |
| Invasive species | 4.2 | 18.9 | < 0.1 | 63.3 | 16.1 | 8.9 |
| Herbivores / grazing pressure | 10.3 | 12.2 | 2.1 | 15.6 | 7.8 | 12.5 |
| Regeneration at component group level | 0.0 | – | 19.3 | 8.2 | 1.0 | 33.0 |
| Number of native tree and/or shrub species | 9.0 | 10.2 | 6.2 | 17.3 | 5.1 | 16.0 |
| Deadwood volume (m ³ per ha) | 15.9 | 9.1 | 2.9 | 19.8 | 1.6 | 29.3 |
| Vertical structure | 3.9 | 12.3 | 7.4 | 14.8 | 9.1 | 12.3 |
| Veteran trees | 20.0 | 8.1 | 0.0 | – | 0.3 | 65.3 |
| Age distribution of tree species | 8.6 | 9.1 | 9.7 | 13.6 | 2.0 | 27.4 |
| Nativeness of occupancy | 17.4 | 8.1 | 0.1 | 38.9 | 2.8 | 28.8 |
| Proportion of open space | 19.7 | 8.8 | 2.7 | 15.1 | < 0.1 | 51.1 |
| Proportion of woodland / favourable habitat | 0.6 | 40.6 | 2.6 | 22.5 | 17.1 | 8.8 |
| Size of woodland parcel | 3.2 | 29.3 | 2.4 | 18.8 | 14.7 | 8.5 |
| Regeneration at population level | 1.8 | 26.7 | 15.9 | 9.4 | 2.6 | 16.3 |
| Overall ecological condition score | 1.0 | 30.5 | 21.4 | 8.2 | < 0.1 | 56.0 |

Notes:

1. SE = standard error. Amber text = values with SE > 25%.
2. Woodland type is defined in Section 1.3.6.
3. Woodland ecological condition classification categories and indicators are defined in methodology report.
4. For more information refer to the methodology report.
5. Size of woodland parcel: Fragments tend to occur in larger woods, therefore the results may reflect the overplanting of native woodland with large non-native plantation woods. NFI reports on woodland area (2012) evidence that non-native woods are larger on average than native woods.
6. Classification thresholds for ground flora; favourable, unfavourable and intermediate are adjusted for different woodland NVC types, with 'more' being expected of nutrient rich types than nutrient poor types.

NFI woodland condition classifications

Figure 5.1 The proportion of each woodland ecological condition class, for each WEC indicator type in near-native woodland and fragments in Scotland



Notes:

1. Woodland type is defined in Section 1.3.6.
2. Woodland ecological condition classification categories and indicators are defined in methodology report.
3. For more information refer to the methodology report.
4. Size of woodland parcel: Fragments tend to occur in larger woods, therefore the results may reflect the overplanting of native woodland with large non-native plantation woods. NFI reports on woodland area (2012) evidence that non-native woods are larger on average than native woods.
5. Classification thresholds for ground flora; favourable, unfavourable and intermediate are adjusted for different woodland NVC types, with 'more' being expected of nutrient rich types than nutrient poor types.

6 Stand-level condition classification results for non-native woodland stands in Scotland

Table 6.1 Area of non-native woodland stands in Scotland classified by woodland ecological condition classification for each of the 15 WEC indicators

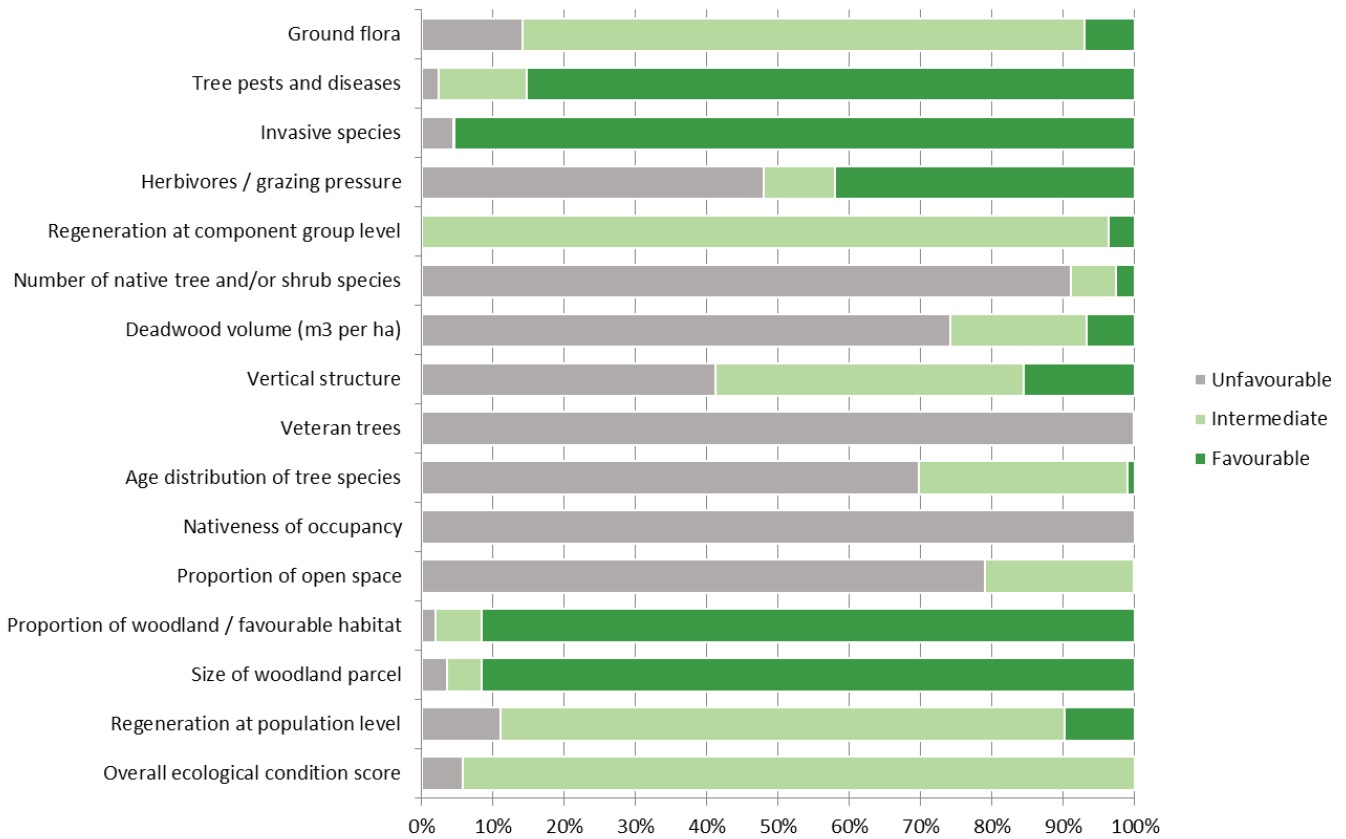
| Non native | Unfavourable | | Intermediate | | Favourable | |
|---|---------------|------|---------------|------|---------------|------|
| | Area (000 ha) | SE% | Area (000 ha) | SE% | Area (000 ha) | SE% |
| Ground flora | 128.5 | 3.2 | 716.1 | 1.0 | 63.7 | 5.0 |
| Tree pests and diseases | 21.6 | 6.5 | 112.5 | 3.8 | 774.2 | 0.9 |
| Invasive species | 40.0 | 6.3 | 1.7 | 23.6 | 866.5 | 0.7 |
| Herbivores / grazing pressure | 435.0 | 1.6 | 91.9 | 3.8 | 381.4 | 1.8 |
| Regeneration at component group level | 0.0 | – | 874.9 | 0.7 | 33.3 | 6.7 |
| Number of native tree and/or shrub species | 827.3 | 0.7 | 57.4 | 5.1 | 23.6 | 8.0 |
| Deadwood volume (m3 per ha) | 672.7 | 1.0 | 173.5 | 2.8 | 62.0 | 4.5 |
| Vertical structure | 373.6 | 1.7 | 393.2 | 1.7 | 141.5 | 3.4 |
| Veteran trees | 907.2 | 0.7 | 0.4 | 67.5 | 0.6 | 35.7 |
| Age distribution of tree species | 633.4 | 1.1 | 265.9 | 2.4 | 9.0 | 13.8 |
| Nativeness of occupancy | 908.3 | 0.7 | 0.0 | – | 0.0 | – |
| Proportion of open space | 723.0 | 1.0 | 191.9 | 2.7 | 0.6 | 20.5 |
| Proportion of woodland / favourable habitat | 18.0 | 10.9 | 58.6 | 5.7 | 831.7 | 0.7 |
| Size of woodland parcel | 31.6 | 7.8 | 45.3 | 6.2 | 831.4 | 0.7 |
| Regeneration at population level | 99.7 | 4.2 | 719.8 | 1.0 | 88.8 | 4.3 |
| Overall ecological condition score | 52.9 | 5.3 | 862.1 | 0.7 | 0.5 | 67.4 |

Notes:

1. SE = standard error. Amber text = values with SE >25%.
2. Non-native is defined in Section 1.3.6.
3. Woodland ecological condition classification categories and indicators are defined in methodology report.
4. For more information refer to the methodology report.
5. Classification thresholds for ground flora; favourable, unfavourable and intermediate are adjusted for different woodland NVC types, with 'more' being expected of nutrient rich types than nutrient poor types.

NFI woodland condition classifications

Figure 6.1 The proportion of each woodland ecological condition class, for each WEC indicator type in non-native woodland stands in Scotland

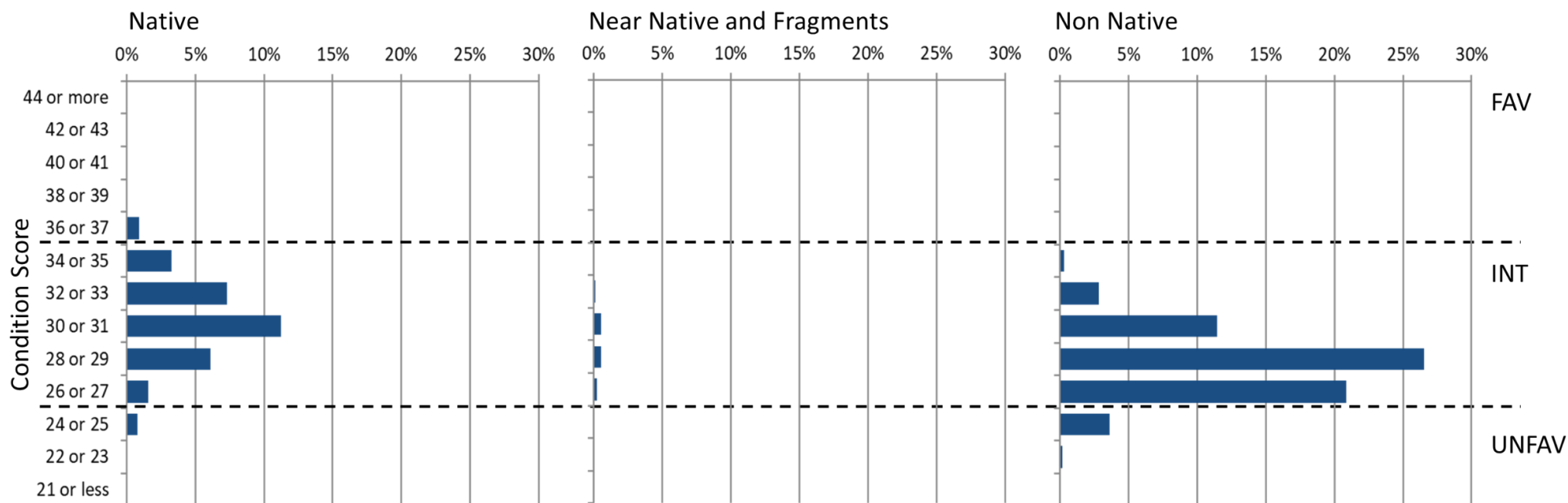


Notes:

1. 'Non-native' is defined in Section 1.3.6.
2. Woodland ecological condition classification categories and indicators are defined in methodology report.
3. For more information refer to the methodology report.
4. Classification thresholds for ground flora; favourable, unfavourable and intermediate are adjusted for different woodland NVC types, with 'more' being expected of nutrient rich types than nutrient poor types.

7 Condition scoring distribution

Figure 7.1 The overall distribution of ecological condition class by woodland type in Scotland



Notes: 1. Native = native woodland area, Near native and fragments = Near native woodland area and fragments, non-native = non-native woodland area. 2. The NFI calculator is used to score each of the 15 ecological condition indicators that can then be combined and used to give an overall score, and classification as favourable (fav) score 36-45, intermediate (int) score 26-35 or unfavourable (unfav) score 16-25 by woodland type. 3. Dashed line = threshold of each condition classification. To inform where to set the thresholds for each of the three classification categories published evidence was used. 4. Woodland types are defined in Section 1.3.6. 5. Refer to the methodology report for more information.

8 Discussion

The EC Habitats Directive requires Member States to report on the conservation status of habitats and species. This report presents the first evaluation of the condition of woodland in Scotland and represents a decade of work for the NFI team and its partners. The methodology used to assess and classify woodland area is evidence based, systematic and objective. Most of the scores presented are based on statistics derived from simple, objective measures of woodland such as tree counts, deadwood diameters and species identification, as such the statistical estimates and their classification scores have a great degree of certainty associated with them. Other indicators use more complex measures, such as the level of herbivore browsing damage or squirrel stripping high in the canopy. These can be harder to assess in the forest. For example, herbivore impacts may be seasonal, and it is difficult to evaluate bark stripping from squirrels many metres above the ground. Such factors have a greater degree of uncertainty in the estimates and may be somewhat under-reported, but overall the broad trends identified are thought to be accurate and have stood up to validation against comparable data sources (where they exist*) and expert opinion. With these caveats in mind, these results are Britain's first systematic and repeatable assessment of woodland ecological condition.

8.1 Woodland habitat area

One of the most notable results from this study was that the total area of native woodland in Great Britain is estimated to be 1.51 million hectares, about 50% more than the previous estimate (986 thousand hectares, estimated in the 2008 priority habitat assessment). The majority of the newly recorded native woodland is in the lowlands and most woods are smaller than 2 ha in extent. Similarly, the native woodland area estimate in Scotland has also risen. In Scotland circa 443 hectares is now classified as native woodland, an increase of 132 thousand hectares on the previous estimate reported in the 2012 NWSS assessment. Most of this increase in native woodland resource is in North East and West Scotland. Recent advances in earth observation technology have enabled the identification of such smaller areas of woodland than was previously possible. Furthermore, the NFI has used smaller minimum area thresholds than previous assessments (≥ 0.1 hectares within larger woods and >0.5 hectares as discrete stands), so small areas of native woodland within other woodland habitat types have been identified for the first time.

In addition to the increase in the estimate of native woodland area in Scotland, estimations of the area of other woodland habitats have also generally increased pro rata. However, increases in estimated areas are higher for some habitats compared to

* Independent surveys of deer presence, squirrel presence, invasive species and disease presence and levels of deadwood and veteran trees were available for comparison- see methodology paper.

others. For example, the area classified as lowland mixed deciduous woodland has increased to 82 thousand hectares in Scotland as compared to the 23 thousand hectares previously estimated in the 2012 NWSS NVC assessment. This is most likely a result of the fact that this habitat tends to dominate patches of smaller, lowland woods that are harder to identify and thus weren't incorporated into previous assessments.

Another factor that resulted in a disproportionate (but correct) increase in the estimated relative area of one habitat type, was the NFI reduction in the minimum area of a 'qualifying stand' of a woodland habitat within a woodland from ≥ 0.1 ha to ≥ 0.01 ha (refer to the methodology for more information). Therefore, woodland types such as wet woodland, which naturally occur in smaller localised patches (of wetter land), have been recorded and included in estimates for the first time, where previously they will have been included in the counts of other woodland types. This has resulted in an estimated wet woodland cover of around 63 thousand hectares compared with circa 45 thousand hectares that was recorded in the 2012 NWSS assessment in Scotland.

The area classified as native pine wood (124 thousand hectares) is greater than the 87.6 thousand hectares reported by the NWSS.

This study also suggests that there is a shift in the relative proportions between Upland Oakwood and Upland Birchwood when compared to previous estimates in NWSS. This study estimates 33 thousand hectares of Upland Oakwood in Scotland compared to the NWSS estimate of 20 thousand hectares and estimates 120 thousand hectares of Upland Birchwood in Scotland compared to the NWSS estimate of 91 thousand hectares. This change in estimates is likely to be as a result of methodological differences between this study and NWSS and how these two habitats are separated in situations where the two habitats overlap.

8.2 Classification of woodland condition

The WEC covers all of Scotland's woodlands, native and non-native, semi-natural and plantation alike. The results present a robust evidence base, comparing all woods to a single benchmark, and providing the first systematic measure of woodland ecological condition. Each woodland stand was scored for each of the 15 woodland ecological condition indicators, and the scores combined to give an overall score of favourable, intermediate or unfavourable. The scoring method was to take each woodland stand and compare each of the 15 indicators to the characteristics of a benchmark, namely 'semi-natural woodland in favourable condition' (refer to the Methodology report for more information). Scoring thresholds were set using published evidence where possible or, if this was unavailable, expert opinion. For example, to determine a 'favourable' number of seedlings, saplings and small trees in a woodland, a combination of published evidence and expert opinion was used.

NFI woodland condition classifications

Each indicator measures a different aspect of woodland condition and can be used to indicate the likely health of specific elements of biodiversity. For example, volume of deadwood can be used as an indicator of the potential presence of associated taxa, such as saproxylic fungi or invertebrates. Limiting the list of woodland ecological condition indicators to 15 measures is a simplification of an exceptionally complex ecosystem, however, it is a compromise between the resources necessary to carry out the survey work and the data required to describe condition comprehensively. The WEC provides a good indication of where potential issues may lie or where potential positive trends may occur, but the results are not an absolute measure of ecological condition status.

As might be expected, non-native woods do not score as highly as native woods. In particular, they scored lower on parameters such as natural regeneration (of natives and non-natives). Whilst ecological condition is not the primary objective of management for productive woodlands, the application of a consistent benchmark to all woodland types provides a transparent and consistent measure, allowing all woodland types to be compared equally, as well as highlighting where non-native woodland scores well. This consistent application of a single benchmark of condition has reflected positively on non-native plantations in Scotland, as 6% of non-native woodland were classified as 'unfavourable' overall, compared to just 2.5% of native woodlands. Non-native stands also scored equally to or higher than some native woods for some of the indicators, for example, a higher proportion of non-native stands were 'favourable' for deadwood and invasive species.

The results suggest that the indicators with the greatest area of native woodlands that score poorly (>20% of native woodland scoring unfavourable) are:

1. Age distribution of trees
2. Veteran trees and deadwood volume
3. Herbivores/grazing pressure
4. Proportion of open space

Other indicators of particular importance in native woodlands, including invasive species and pests and diseases, affect a smaller total area of stands across the country. However, they have a major impact on ecological condition where present. Future iterations of the NFI will be important to monitor trends and changes in these indicators.

The study has also highlighted some positive results for woodland ecology in Britain:

1. There is now evidence to classify more woodland in Britain as native than previously evidenced
2. Some habitats that were previously thought to be rare, such as wet woodland, are in fact more extensive than previously evidenced

3. 3% of native woods fall into favourable ecological status overall
4. Most non-native woodlands are classified favourable for size of woodland parcel and proportion of favourable habitat in the locality
5. 81% of native woods achieving favourable status for native canopy occupancy
6. 60% of native woods achieved favourable or intermediate status for the number of native trees and shrubs species in the canopy

8.3 Conclusion

This is the largest and most in-depth study of ecological condition of any habitat in Scotland to date. The results present a valuable insight into the current ecological condition of woodland habitat in Scotland and provide a foundation and reference data set for future work and added value. The reader is pointed towards the companion reports for additional information on the methodology and statistics.

8.4 Future work

NFI plan to repeat this exercise for data collected in the NFI second cycle of survey 2015 to 2020. This repeated survey using consistent techniques will provide two data points of woodland condition from which trends and changes in woodland condition can be assessed.

Further detailed analysis of each indicator will reveal areas of potential research and indicate topic areas where existing guidance may need to be reviewed or improved.

9 References

See methodology report.

10 Glossary

| Word/phrase | Definition |
|--------------------------------------|---|
| Age class | A grouping of trees into specific age ranges for classification purposes. For the purposes of the "age distribution of trees" NFI WEC indicator, trees are grouped into three age classes: 0 – 20 years (Young); 21 - 150 years (Intermediate); >150 years (Old). For birch, cherry or Sorbus species: 0 - 20 years (Young); 21 - 60 years (Intermediate) >60 years (Old). Not applicable is used for stands without trees. |
| Ancient semi-natural woodland (ASNW) | Woodland which has been in continuous existence since 1600 (1750 in Scotland). |
| Area (forest/woodland) | Forest and woodland area can be defined in net or gross terms. Net area is the land actually covered by trees (in the National Forest Inventory that is to the drip line of the canopy). Gross area includes both the area covered by trees and the open spaces (<0.5 hectare) within (e.g. rides, glades, ponds). |
| Bark stripping | The removal of bark from trees by herbivores. |
| Biodiversity | Biodiversity represents 'all heritability-based variation at all levels of organisation, from the genes within a single local population, to the species composing all or part of a local community, and finally to the communities themselves that compose the living parts of the multifarious ecosystems of the world' (Wilson, 1997, p.1) |
| Broadleaves | Trees and shrubs that belong to the angiosperms (flowering plants) (as distinct from the gymnosperms that includes conifers). Most in the UK are deciduous and have laminar leaves (they do not have needles or cones) and a few, such as alder, have cone-like structures for their seeds which are not true cones. Sometimes referred to as 'hardwoods'. |
| Browsing | Herbivores feeding on tree buds, shoots and foliage. |
| Canopy | The mass of foliage and branches formed collectively by the crowns of trees. |
| Canopy cover | The percentage cover of the canopy across a defined area (e.g. NFI survey section or square). |
| Clear-felling | Cutting down of an area of woodland (if it is within a larger area of woodland it is typically a felling greater than 0.25 hectare). Sometimes a scatter or small clumps of trees may be left standing within the felled area. |
| Common Standards Monitoring (CSM) | The CSM approach was established during the 1990s by UK conservation agencies to describe the condition of protected sites, such as Sites of Special Scientific Interest (SSSI), in order to assess the effectiveness of conservation policies and practice. |
| Component (or sub-component) | Individual elements of the NFI survey component group. For example, each tree species will be recorded under a separate component, as will each habitat type if two habitats are intimately mixed (such as upland birchwood and wet woodland). |

NFI woodland condition classifications

| Word/phrase | Definition |
|--|--|
| Component group | Homogeneous areas of the NFI survey that are too small (<0.05 ha) to practically map using Geographic Information System (GIS) software in the field, but with most of the same defining characteristics as a section. Component groups can be subdivided into components. |
| Condition | Shorthand for Woodland Ecological Condition. |
| Conifers | Trees and shrubs that belong to the gymnosperms, as distinct from the angiosperms that include broadleaves). Conifers mostly have needles or scale-like leaves and are usually evergreen. Sometimes referred to as 'softwoods'. |
| Convention on Biological Diversity (CBD) | A multilateral treaty to develop national strategies for the conservation and sustainable use of biological diversity. |
| Crown dieback | The death of branches within a tree's crown. |
| Deadwood | Non-living woody biomass not contained in the litter, either standing or lying on the ground (the NFI 'volume of deadwood' indicator does not include data on stumps). |
| Diameter at breast height (DBH) | The diameter on the stem of a tree at 'breast height', defined as 1.3 m from ground level. |
| Drip line | The drip line is the furthest tip of the widest branch in the crown; the last point from which the tree can drip if wet. If two treed sections have drip lines that cross over each other use the centre line of the cross over. |
| Earth observation | The collection of information about the physical, chemical, and biological systems of the planet via remote-sensing technologies. |
| Ecology | The relations of organisms to one another and to their physical surroundings. |
| Establishment | The formative period that ends once young trees are of sufficient size that, given adequate protection, they are likely to survive at the required stocking. This varies for species and according to environmental condition, but is typically from around five to twenty years. |
| EU Habitats Directive | The EU Habitats Directive (Directive 92/43/EEC) aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on its Annexes to a favourable conservation status (JNCC, 2018). |
| (Vegetation) field layer | Vegetation 10 cm to 2 m tall measured as part of the NFI vegetation assessment. |
| Flora | The plants of a particular region, habitat, or geological period. |
| Forest (or woodland) | See woodland |
| Forestry Commission (FC) | The government department responsible for regulating forestry, implementing forestry policy and managing state forests in England. It was formerly also responsible for Forestry in Wales and Scotland, however on 1 April 2013 the Forestry Commission's functions in Wales transferred to a new organisation, Natural Resources Wales. From 1 April 2019, forestry was fully devolved, except for common issues addressed on a GB or UK basis, such as international forestry, plant health and forestry standards. Following devolution, two new Scottish Government agencies were created, Scottish Forestry and Forest & Land Scotland. |
| Forestry and Land Scotland (FLS) | The Scottish Government agency responsible for managing Scotland's national forests and land. |

NFI woodland condition classifications

| Word/phrase | Definition |
|--|--|
| Fragments | Small areas of woodland with 50% or more native tree species occupancy in the upper canopy, but that fall in the size range 0.05 ha to 0.099 ha. |
| Geographic Information System (GIS) | A system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data. |
| Global Positioning System (GPS) | A satellite-based global navigation satellite system that provides geolocation and time information to a GPS receiver. |
| Great Britain (GB) | England, Scotland and Wales. |
| (Vegetation) ground layer | Vegetation 0 – 10 cm tall measured as part of the NFI vegetation assessment. |
| Habitat Action Plan (HAP) | For all UK BAP priority habitats classified between 1995 and 1999, a Habitat Action Plan (HAP) was created (45 in total). For the habitats added to the priority habitats list in 2007, no UK action plans have been, or will be, produced, as conservation action is now primarily carried out at a country-level, rather than a UK-level, in response to the generation of country-level biodiversity strategies and aims (JNCC, 2019a). |
| Herbivore | An animal that is adapted to eating plant material for the main component of its diet. |
| Hectare (ha) | Unit of area defined as 10,000 square metres (100 m by 100 m), approximately equivalent to 2.47 acres. |
| Indicator | A quantitative or qualitative parameter that synthesises complex information and can be periodically measured to assess trends over time. 15 stand level indicators were selected to assess the condition of woodlands as part of the NFI WEC approach. |
| Invasive species | A species that is not native to a location, where it is likely to cause ecological or economic harm. |
| Invertebrate | A cold-blooded animal that does not have a backbone. |
| Lichen | A composite organism that arises from algae or cyanobacteria living among filaments of multiple fungi species in a mutualistic relationship. |
| National Forest Inventory (NFI) | National forest inventories are carried out in GB by the FC to provide accurate, up-to-date information about the size, distribution, composition and condition of the forests and woodlands. The current NFI, which began in 2009, is a multi-purpose operation that has involved the production of a forest and woodland map for GB and a continuing programme of field surveys of the mapped forest and woodland areas. |
| National Forest Inventory map | An earth observation-based programme that monitors and maps the extent and location of woodlands across GB on an annual basis. |
| National Forest Inventory field survey | A field survey of a large, stratified-random sample (15,100 sites) of woodlands across GB on a 5-year rolling cycle using a standardised protocol. |
| Native species | Species that have arrived and inhabited an area naturally, without deliberate assistance by man. For trees and shrubs in the United Kingdom usually taken to mean those present after post-glacial re-colonisation (around 11,000 years ago) and before historic times. Some species are only native in particular regions - hence locally native. |
| Natural England (NE) | The government's adviser for the natural environment in England. Natural England is an executive non-departmental public body, sponsored by Defra. |

NFI woodland condition classifications

| Word/phrase | Definition |
|---|--|
| Naturalised species | A species that, once it is introduced outside its native distributional range, establishes self-sustaining populations. |
| Natural Resources Wales (NRW) | The organisation responsible for advising the Welsh Government on the environment, created on 1 April 2013. NRW is responsible for the functions previously carried out by the Environment Agency in Wales, the Countryside Council for Wales and Forestry Commission Wales. |
| National Vegetation Classification (NVC) | Vegetation classification system commonly used in Great Britain. |
| Native woodland | Woodland with 50% or more native tree species occupancy in the upper canopy that either: <ul style="list-style-type: none"> - Forms a discrete woodland parcel with a minimum area of 0.5 ha. - Forms a woodland stand with a minimum area of 0.1 ha that is part of a woodland that is 0.5 ha or larger. |
| Native Woodland Survey of Scotland (NWSS) | A survey of all native woodlands, nearly native woodlands and non-native plantations on ancient woodland sites in Scotland. |
| Near native woodland | 'Nearly' native woodland with 40% to 49% native species canopy cover. |
| NFI Condition Calculator | An analytical GIS tool developed to automatically produces the component group-level NFI WEC indicator results per woodland type and aggregated statistics for the reporting area. |
| NFI WEC working group | The expert committee that was established to develop the NFI WEC indicator approach. This group consists of representatives from (former) FC England and Scotland, Scottish Natural Heritage, Natural England, Natural Resources Wales and the Welsh Government. |
| Non-native woodland (Woodland) parcel | Woodland with less than 40% native species occupancy. Discrete blocks of woodland that are separated from other woodland parcels by gaps of at least 20 m in length. |
| Private sector estate | Forests and woodlands in the UK not managed by the Forestry Commission, Natural Resources Wales or Forest Service. In the context of the National Forest Inventory, 'Private sector' is used for convenience although it includes land owned or managed by bodies such as local authorities and charities. |
| (Natural) Regeneration | The regeneration of existing woodland by natural means, i.e. without sowing or planting. |
| (Ecological) resilience | The ecological resilience of woodland ecosystems refers to their ability to absorb disturbance while maintaining the major habitat-forming species that define their structure and ecosystem functioning. Resilience incorporates both the woodland ecosystem's ability to resist changes in response to disturbance or, failing this, its capacity to recover functioning via adaptation. |
| (NFI) sample square | The one-hectare (100 m by 100 m) square plots, which may be entirely within woodland or may overlap the woodland edge, used for the NFI field survey. |
| Sapling | Young tree ≥ 50 cm tall and < 4 cm in diameter. |
| Saproxyllic | Dependent on deadwood. |
| (NFI WEC) score | An ordinal score is assigned to the individual indicator classes of 'unfavourable' (1), 'intermediate' (2) and 'favourable' (3). The scores are summed for all 15 indicators to provide each stand's overall ecological condition score, which has a maximum value of 45. |

NFI woodland condition classifications

| Word/phrase | Definition |
|--|---|
| Scottish Natural Heritage (SNH) | The public body responsible for protecting and promoting Scotland's natural heritage, especially its natural, genetic and scenic diversity. To be renamed 'NatureScot' from May 2020. |
| Section | Within each NFI sample square, the forest was stratified into different woodland 'sections'. Sections are defined by individual strata at least 0.05 ha in size that are differentiated on basis of forest type, habitat, land use, silviculture system, tree and shrub composition, age and structure. |
| Seedling | Young tree <50 cm tall. |
| Shrub | Woody plants often (but not always) branching abundantly from the base that are between 2-5 m tall. |
| (Vegetation) shrub layer | Vegetation 2-5 m tall measured as part of the NFI vegetation assessment. |
| Site of Special Scientific Interest (SSSI) | A formal conservation designation that is applied to areas of particular interest to science because of the geology/geomorphology features or species it contains or supports. |
| (Woodland) Stand | A distinct area of woodland (from either planting or natural regeneration), generally composed of a uniform group of trees in terms of species composition and spatial distribution, and age and size class distribution. |
| Standard error (SE) | The measure of the margin of error associated with an estimate as a result of sampling from a population with statistical variability. Larger standard errors indicate less precision in the estimate. Standard errors in this report are quoted in relative terms (i.e. as percentages of the value of the estimate). In this report, any standard error greater than 25% is reported in amber italics and represents a lower degree of assurance in the estimates. |
| Stocking | The density of trees within a woodland. |
| Stump | The above-ground base part of a tree that would usually remain after felling. |
| Transect | A path along which a survey is carried out. |
| Transition woodland | Land classified as woodland area that is in transition between no tree cover and tree cover. Examples include clear-fell sites, restock sites, new planting sites and land with natural regeneration. |
| UK Biodiversity Action Plan (UK BAP) | The UK government's national biodiversity action plan that was developed in response to the Convention on Biological Diversity and replaced by the 'UK Post-2010 Biodiversity Framework' in 2012 following new international targets. It described the biological resources of the UK and provided detailed plans for conservation of these resources (JNCC, 2019a). The UK BAP priority habitats were identified as the most threatened habitats requiring conservation action under the UK BAP. |
| UK Forestry Standard (UKFS) | The reference standard for sustainable forest management across the UK that applies to all woodland to ensure that international agreements and conventions on areas such as sustainable forest management, climate change, biodiversity and the protection of water resources are applied in the UK. |
| United Kingdom (UK) | Great Britain and Northern Ireland. |

NFI woodland condition classifications

| Word/phrase | Definition |
|---|---|
| Woodland (or forest) | Land predominately covered in trees (defined as land under stands of trees with a canopy cover of at least 20%, or the ability to achieve this, and with a minimum area of 0.5 hectare and minimum width of 20 m), whether in large tracts (generally called forests) or smaller areas known by a variety of terms (including woods, copses, spinneys or shelterbelts). |
| (NFI) Woodland Ecological Condition (WEC) | The approach used by the NFI to assess the ecological condition of woodlands in GB in terms of their likely biodiversity value. |
| (Woodland) storey | A woodland's trees and shrubs can often be stratified into distinct layers, or storeys, according to their height. |
| Vertical (woodland) structure | The number of canopy storeys present. |
| Veteran trees | A tree that is of interest biologically, culturally or aesthetically because of its age, size or condition (Read, 2000) |

11 Annex

Table 11.1 Classification threshold summary

| Woodland Ecological Condition Indicator | Classification thresholds (abbreviated) | | |
|---|---|---|--|
| | Favourable condition | Intermediate condition | Unfavourable condition |
| Age distribution of trees | Three age classes present | Two age classes present | One age class present |
| Wild, domestic and feral herbivore damage | No herbivore or squirrel damage | Herbivore damage near to stand Squirrel damage only | Herbivore damage in stand |
| Invasive plant species | No invasive species in stand | Rhododendron and laurel not present, other invasive species < 10% cover | Rhododendron and laurel present, or other invasive species > 10% cover |
| Number of native tree species | Five or more native tree or shrub species in a stand | Three to four native tree or shrub species in a stand | None to two native tree or shrub species in a stand |
| Occupancy of native trees (in a stand) | | | |
| England and Wales | > 80% | 50-80% | < 50% |
| Scotland | >90% | 80-90% | <50% |
| Open space within woodland | | | |
| Woods greater than 10 hectares | 10-25% open & ≥ 50% of open high quality | <10% open space, yet over 50% of open high quality | ≥ 50% open space, irrespective of quality of open |
| | | >25 and <50% open space & > 50% high quality open space | <10% open space and over 50% of open space low quality |
| | | 10-25% open space and over 50% of open space low quality | |
| Woods less than 10 hectares | 0-10% & > 50% of open high quality | 10-25% open space with over 50% high quality open | >25% open space |
| | | 0-10% open space and less than 50% of open space high quality | 10-25% open space and over 50% low quality open |
| Proportion of favourable land cover around woodland | >20% | 10-20% | <10% |
| Woodland Regeneration: Stand | All three classes present in stand; Trees 4-7cm dbh, saplings and seedlings | One or two classes only present in stand | Not applicable |
| Woodland Regeneration: Square-level | All three classes present nearby; Trees 4-7cm dbh, saplings and seedlings | One or two classes only present nearby | No classes present nearby |
| Tree health | Tree mortality less than 10%, no pests or diseases and no crown dieback | 11% to 25% mortality | Greater than 25% tree mortality |
| | | 0-11% mortality and crown dieback or low risk pest or disease present | Any high risk pest or disease |
| Vegetation and ground flora | Strong plant community | Average plant community | Weak plant community |
| Woodland vertical structure | Four or more storeys in a stand or a complex stand | 2 or 3 storeys in a stand | One or less storey in a stand |
| Veteran trees | Greater than 40 veteran trees per 20 hectares | Between one and 40 veteran trees per 20 hectares | Less than 1 veteran tree per 20 hectares |
| Volume of deadwood | Greater than 80 cubic metres per hectare | Between 20 and 80 cubic metres per hectare | Less than 20 cubic metres per hectare |
| Size of woodlands | Greater than 20 hectares | between 5 and 20 hectares | less than 5 hectares |
| Score per WEC indicator | 3 | 2 | 1 |
| Total score | Greater than 35 | 26 to 35 | Less than 25 |

12 NFI national reports

This inventory report is one of a series of publications reporting the outputs of the Forestry Commission National Forest Inventory.

These and NFI data can be found on the NFI website www.forestryresearch.gov.uk/inventory.

Official Statistics

This is not an Official Statistics publication, but it does include two tables of official statistics (Tables 3.1 and 3.2). More information about Official Statistics and the UK Statistics Authority is available at www.statisticsauthority.gov.uk

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