The National Inventory of Woodland and Trees - England

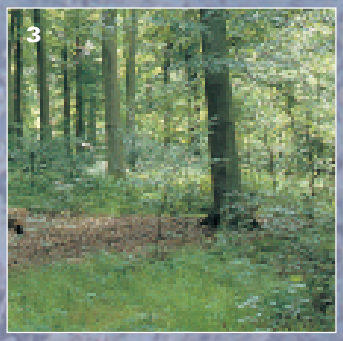
by Steve Smith

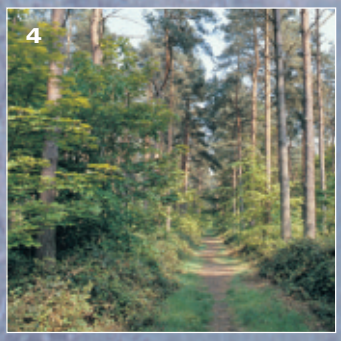
1 Mature conifer plantation

2 GIS Officer creating woodland map

3 Shrub, field and ground layers included in woodland assessment

4 Track through mixed woodland





Introduction

In prehistoric times England was largely covered with woodland. By the end of the first millenium much had already been cleared to satisfy the needs of an increasing population, with the Domesday records showing approximately 15% woodland cover across England. This trend continued, and by the end of the 19th century woodland had dropped to below 5%. Since then England's forest and woodland area has been expanding, and by the beginning of the 21st century there were over 1.1 million hectares, equivalent to 8.4% woodland cover. This, however, remains relatively low in international terms.

In the last 10 years UK forestry policy has had two main aims:

- the protection and sustainable management of existing woods and forests;
- the continued steady expansion of woodland area to provide more benefits for society and our environment.

Within this framework, the new forestry strategy for England (Anon., 1998) sets out priorities and programmes tailored to English circumstances. A key requirement for the formulation and monitoring of these priorities and programmes is to know the extent and condition of woodland and trees. The development and monitoring of policies for increasing the woodland area and for developing wood-using industries, for example, require data on aspects such as the extent, distribution, condition and ownership of woodland.

The British Boards of Agriculture carried out woodland surveys between 1871 and 1913. The Forestry Commission was then handed responsibility in 1919 and has been carrying out national woodland inventories for Britain on a regular basis since 1924. The penultimate survey has a base date of 1980. Despite updates, the information from the 1980 survey has become increasingly less reliable. For some while there has been a real need for accurate information for current issues such as the increase in harvesting volumes, monitoring the effects of recent woodland grant schemes, assessing woodland environmental habitats, and evaluation of the new focus on rural development and the social dimensions of sustainable forestry. The current National Inventory of Woodland and Trees (NIWT) was started with a pilot survey in Scotland in 1994. The survey progressively covered the rest of Britain, and the last field work was completed in England by May 2000. In contrast to the previous practice of periodic surveys, the inventory will be continually updated on a rolling basis thereafter with a cycle of approximately 10 years.

The new inventory consists of two sections:

- the survey of woodlands of 2 hectares (ha) or more.
- the survey of small woodland and trees covering woodlands less than 2 ha, groups of trees, belts of trees and individual trees.

Aims

The overall aim of the NIWT is to provide up to date information on the extent, size and composition of our woodlands. In particular the objective is to provide an accurate assessment of woodland area, and to estimate other characteristics such as forest type, species, age class, stocking, timber potential and woodland structure. The survey data will provide information for:

- decisions on land use and woodland expansion
- forecasting timber production
- targeting advice and grant aid
- assessing woodlands as a wildlife and conservation resource
- studies on biomass production and carbon storage
- monitoring the sustainability of forest management
- other more specialised woodland surveys.

A specific aim is the production of a digital map of all woodland over 2 ha, which is incorporated into a Geographic Information System (GIS) together with the sample data. This allows the sample data to be analysed by any geographically defined area. It also allows the data to be combined with other geographical datasets, e.g. the Woodland Grant Scheme (WGS) or the Ancient Woodland Inventory.

A series of County and Regional Inventory Reports will be published for England both in printed and digital format, with the latter available on the Forestry Commission internet site. Forest Research can also respond to requests for further analysis of the sample data.

Methodology

The 'Census of Woodland' in 1980 took information from the Forestry Commission's (FC) sub-compartment database and from Plans of Operation relating to Dedicated or Approved Woodland Schemes, and only surveyed the remaining private woodland. The NIWT, however, surveyed all woodland. There were several reasons for doing so: firstly, growing stock data is no longer available for grant schemes; secondly, much of the environmental data collected in the current inventory does not appear in other databases; and finally to be able to create a complete woodland map.

Between them the two surveys within the NIWT assess all woodlands, groups of trees, linear tree features and individual trees in the rural landscape (Plate 1), plus woodland of 2 ha and over in urban areas. The NIWT does not include an evaluation of hedgerows where there is no tree component, nor does it include smaller woodlands and trees in an urban setting.

PLATE 1

Landscape in Yorkshire showing the variety of forest and woodland types. (Forest Life Picture Library 1019041020)

Survey of woodland 2 ha and over

The digital map showing all woodland over 2 hectares (Figure 1) was created from 1:25 000 aerial photographs. Woodland is classified into broad forest types: Conifer, Broadleaved, Mixed, Coppice, Coppice with Standards, Shrub, Young trees, Ground prepared for new planting and Felled (Wright, 1998). New areas planted subsequent to the date of aerial photography were added by reference to WGS information and to Forest Enterprise (FE) sources. The finalised map therefore provided an up to date record of the extent of woodland. In the future this map will be updated annually, using the WGS and FE data, and revised periodically, roughly every 10 years.

Mapping was followed by a ground survey of roughly 1% of the woodland area. The digital map formed the basis for sampling woods for ground survey. Woodlands were stratified into three size categories with 1 ha plots then being used for ground sampling. A 1% sample of each size category was selected according to the following design:

Woods 2.0 ha – 100 ha:
every fifth woodland selected with plots at 5% intensity.

Woods 100 ha – 500 ha:
two woods in five selected with plots at 2.5% intensity.
Woods 500 ha and larger:
all woods selected with plots at 1% intensity.

A cluster sampling scheme was used as it was more cost effective: travelling time was reduced while ensuring that the sample plot selection remained unbiased. With the permission of owners, surveyors assessed the 1 ha plots. Data were entered onto hand-held computers which were programmed to hold data at six levels. The data structure was as follows:

Wood: locational information
Owner: address and management context
Cluster: first level of field data, e.g. management practice
Sample square: second level of field data, and vegetation/canopy structure assessment
Section: forest type, thinning history, underwood species
Element: species, area, planting year, timber potential, damage and health

Locational information, such as grid reference and local authority, is held at the wood level. Each sample woodland was given a unique number which clearly identifies the wood and enables data to be linked to the digital map. This allows the NIWT data to be used within a GIS. Details on ownership type and management context (i.e. farm, woodland estate, etc.) were entered. The surveyor made an assessment of the general management practice found within the cluster of plots, and then went on to assess each sample square.

The 1 ha sample square was divided into sections by forest type, species or age along similar lines to subcompartments within a stock map. Open areas within the square were identified as a separate section. The woodland sections were then divided into elements or components which generally identify different species or age classes. Locational information and links to the digital map were also created at this level. In England more than 12 000 one hectare sample plots were ground surveyed.

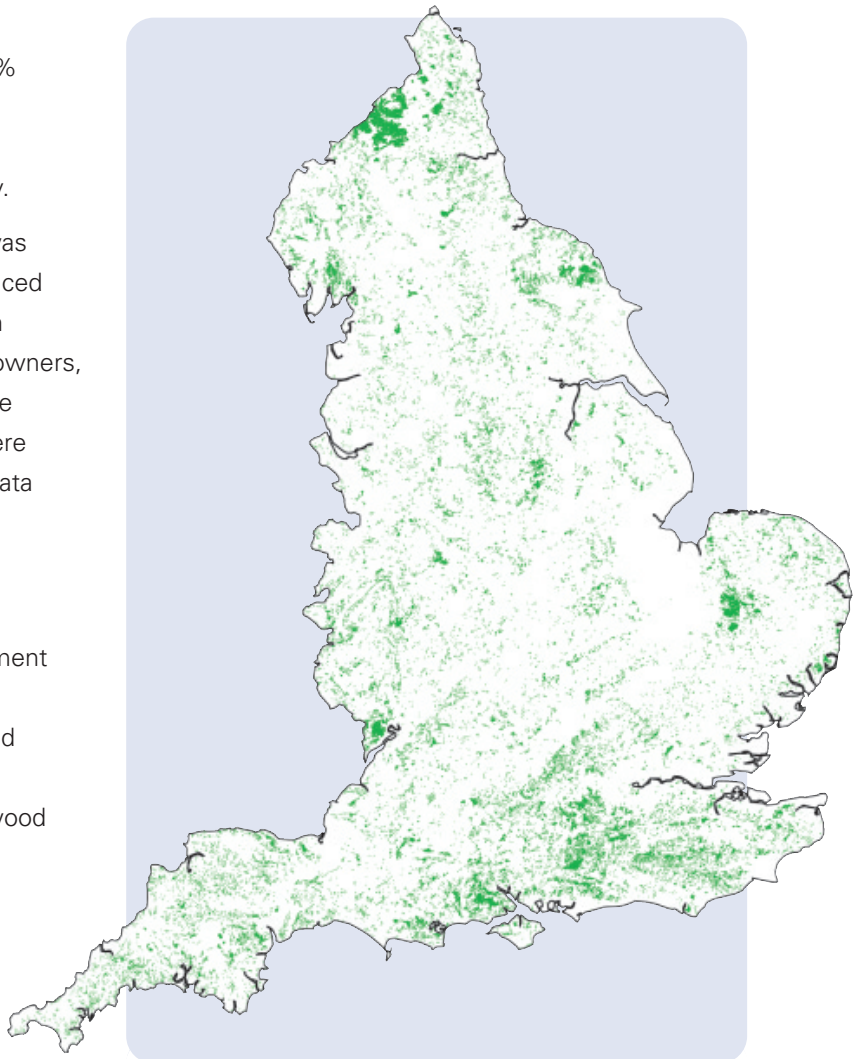


FIGURE 1

English woodland map: showing distribution of woodland of 2 ha and over.

There are a number of special features within the data collected that will help to widen our knowlege on the conservation and biodiversity aspects of our woodlands. For example, a structure assessment identifies the extent and species composition of upper, lower, shrub, field and ground layers (Plate 2), and a deadwood assessment estimates the proportion of deadwood over 15 cm diameter.

PLATE 2

The NIWT assesses woodland structure. (Forest Life Picture Library 1007378020).

Survey of small woodland and trees

For woodlands smaller than 2 ha, groups of trees and individual trees, a combination of aerial survey assessment and ground sampling was carried out. Aerial photographs were again used as the basis for this assessment.

A random sample of approximately 1% of land area was taken, with the basic sampling units being 1 km squares from the Ordnance Survey grid. The 1 km squares had to be stratified into coastal and inland types in order to ensure an adequate representation of coastal squares. Each 1 km square was then surveyed in two stages; initially aerial photographs were used to assess the whole square, which was then subdivided into 16 (250 x 250 m) squares, two of which were ground assessed. Similar types of field information to the main woodland survey were collected in this part of the survey. Over 1300 km^2 plots were assessed in England.

Results

The field survey work in England was carried out between 1996 and 2000, and an appropriate reference date is applied to each county. Results show that there were 1 097 000 ha of woodland over 0.1 ha, including an element of integral open space, in England. This represents a woodland cover of 8.4%. Table 1 gives the areas of woodland by main species/groups and woodland size.
For the most common species the precision of

Table 1 Areas of woodland in England by principal species/groups and woodland size.

Principal species/ groups	Woodland area ('000 ha)			Per cent of total area
	By woodland size		Total area	
	2.0 ha and over	0.1–<2.0 ha		
Pines	125.8	3.8	129.6	13
Spruces	79.4	1.0	80.4	8
Larches	44.4	1.7	46.1	5
Other/mixed conifers	80.2	3.8	84.1	8
Total conifers	329.8	10.4	340.2	34
Oak	147.8	10.8	158.7	16
Beech	60.6	3.5	64.0	7
Sycamore	45.0	3.8	48.8	5
Ash	96.3	8.6	104.9	11
Birch	68.5	1.1	69.6	7
Other broadleaves	89.6	21.0	110.6	11
Mixed broadleaves	77.5	13.4	90.9	9
Total broadleaves	585.3	62.2	647.6	66
Total all species	915.2	72.6	987.8	100

These are net areas of high forest, excluding coppice, felled areas and open space. Figures may not add due to rounding.

these results is very high, for example the standard error was 2% for the overall area of oak, and 2% for ash and Scots pine. However the precision of the results for the less common species was much lower.

The overall average figure of 8.4% woodland cover hides a large degree of variation within England. Humberside, for example, has less than 3% woodland cover, while Surrey has 22%. The most wooded region, the South-east, includes three more counties, Hampshire, East Sussex and West Sussex, with over 16% woodland cover.

The open space occurring within woodland, e.g. rides and clearings, has been assessed at 6.5%. The pattern was relatively consistent between FC and other woodlands at 6.0% and 7.1% respectively.

The survey of woodland of 2 ha and over included an assessment of ownership type. The Forestry Commission managed (owned or leased) 22% of woodland, with 78% being in other ownership. The 'other' ownership has been split into several categories (Figure 2).

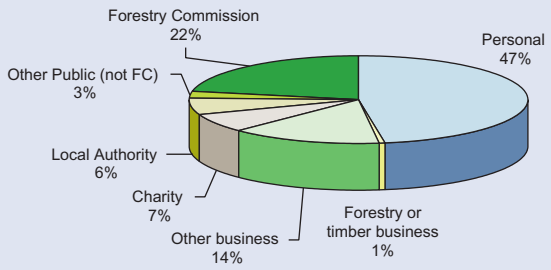


FIGURE 2

Ownership of woodland of 2 ha and over in England. 'Other Public (not FC)' includes, for example, Crown Estates, Ministry of Defence.

The results of the FC inventories are used as the basic input for the published Private Sector forecasts of softwood availability (Smith *et al.*, 2001), and produced jointly by the FC and the Timber Grower's Association (TGA). Figure 3 illustrates a recent forecast produced using the latest NIWT results.

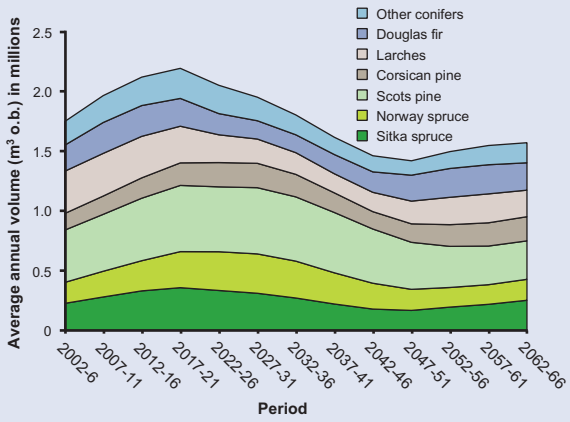


FIGURE 3

England: private sector forecast of softwood availability by species. o.b.: overbark

Comparison with previous surveys

An important role of the NIWT is to monitor changes from previous surveys. However, each survey has been designed in a slightly different way and adjustments need to be made to bring the results to a common base. Figure 4 shows how the woodland area in England has changed over the last century or so. It indicates that many of the First World War fellings were not replanted. The woodland area increased by over 17% since the last survey in 1980, which surpasses the increase of around 6% between 1965 and 1980 (Locke, 1987). While the detail should be treated with some caution, due to the methodological differences between surveys, the upward trend is clear with a near doubling of the woodland since the end of the 19th century.

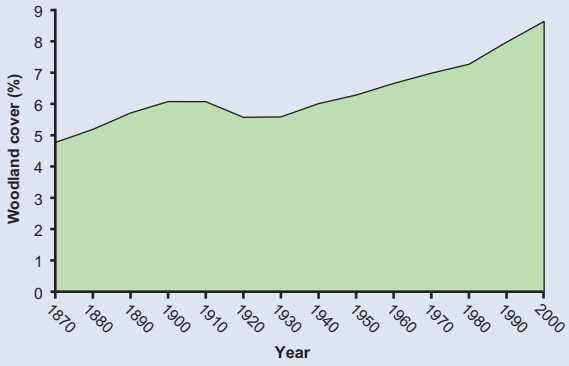


FIGURE 4

England: change in woodland cover 1870 – 2000.

Figure 5 illustrates the changes in woodland in more detail using the old county boundaries at three survey dates. The South-east has long been the most wooded region of England. The biggest differences occur in northern England. Northumberland, for example, has increased its woodland from less than 4% to over 15% since the late 1800s. At the other end of the scale the areas of woodland in Lincolnshire and Warwickshire have hardly changed.

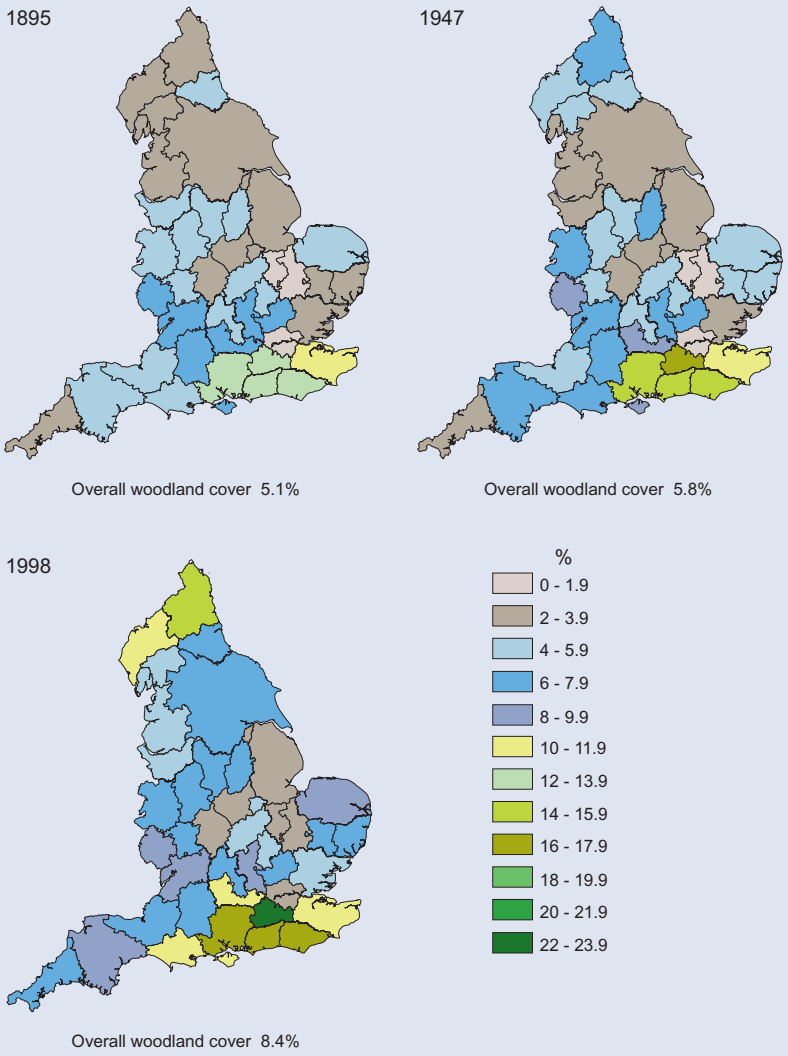


FIGURE 5

Woodland cover in England by county: 1895 / 1947 / 1998.

An analysis of woodland ownership at the last four surveys is given in Figure 6. Forestry Commission ownership as area of woodland and per cent of woodland peaked in 1980. Since 1980 the area of FC woodland has declined by 13%. Woodland in other ownerships declined slightly after 1947, but has been increasing steadily since 1965.

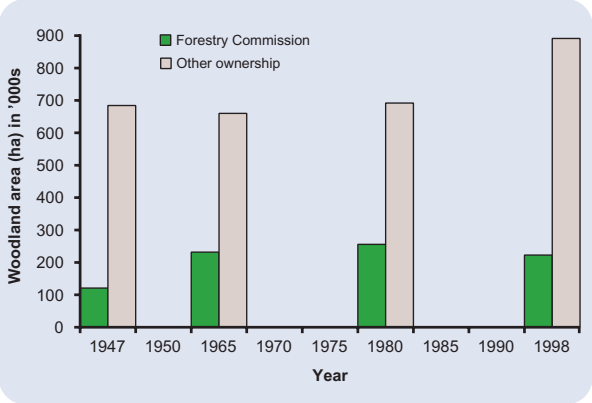


FIGURE 6

Change in woodland ownership in England since 1947.

In comparing the areas of the major species and groups between 1980 and 1998, the most notable feature is that almost across the board there are apparent increases in broadleaves and decreases in conifers (Figure 7). The only exception to the latter is the spruces, which showed a very slight increase, and the exception to the former was elm, which showed a 20% decrease. Overall conifers were down 7%, and broadleaves were up 36%. It is not possible to say how much of the increase is due to the more exacting survey techniques in the current NIWT, and how much to real woodland expansion.

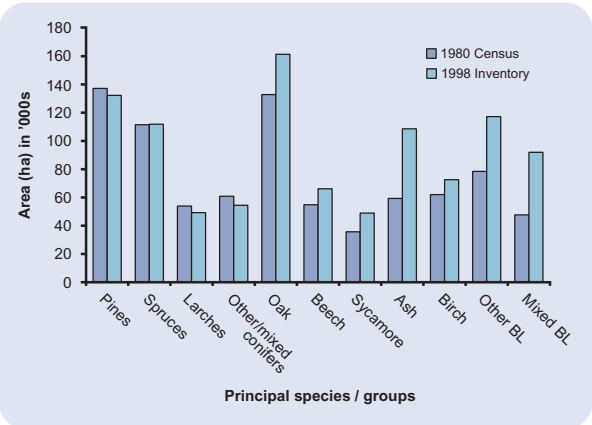


FIGURE 7

Comparison of major species/groups between 1980 Census and 1998 Inventory.

Future developments

With the digital capture of woodland areas the dataset has a key role in providing a baseline for the future, with substantial potential in monitoring the pattern of woodland change and condition within England. While the core results are being presented in the initial series of reports, there are aspects of the sample data which have not yet been fully analysed. There is also scope for further analysis of the digital map and the sample data, for example in combination with other spatial datasets. Finally, additional analyses and making the results available requires further development. The plan is to use the FC's Internet site as a convenient way of disseminating woodland inventory information.

Acknowledgements

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