UK 25-Year Forecast of Softwood Availability[*]

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[*] The sense in which technical and other terms are used are defined in the Glossary at the end of the report. Softwood availability, potential production and production forecast are also expanded upon as concepts in the *Interpreting NFI Timber Volume Forecasts* paper.

Summary

This publication contains statistics for the United Kingdom (UK)[*] on:

- a 25-year management plans forecast of coniferous timber production from the Forestry Commission (FC) plus Forest Service of Northern Ireland (FS) managed estates[†] as of 31 March 2011;

- a 25-year forecast of potential coniferous timber production from private sector estate forests as of 31 March 2011.

The timber forecast statistics in this release make use of the FC estate 2011 inventory and design and thinning plans, the FS 2011 management and design plans, the 2011 National Forest Inventory (NFI) map of Great Britain, 4,036 NFI field sample squares assessed in 2010 and 2011, and Forestry Commission growth and yield models.

The results of equivalent broadleaved forecasts will be published in 2013; further information on this and other National Forest Inventory outputs is available from **www.forestry.gov.uk/inventory**

The main findings are:

- The volume of coniferous timber that would be produced on the FC and FS estates in the UK for the 25 years commencing 1 April 2011, if current (as of 31 March 2011) approved FC and FS design plans and thinning plans are adhered to, is 6.0 million cubic metres per annum, which represents a modest decrease in expected production compared to the previous 2005 forecast. Under these plans average annual volume production will peak at 6.6 million cubic metres per annum in the period 2012-16, which is 5 years earlier than forecast in 2005.

- The volume of timber that could potentially be produced in the UK private sector estate for 25 years commencing 1 April 2011 is estimated to be 10.5 million cubic metres per annum. This is a significant increase in forecast volumes compared to the previous 2005 forecast. The volume is forecast to peak at 12.7 million cubic metres per annum in the period 2027-31, which is one five-year period later than the peak predicted in 2005 (2022–26).

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[*] Including breakdowns for individual countries.

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The 5-yearly breakdown of the 25 year management plans forecast for the FC estate across GB predicts that 6.0 million cubic metres per annum would be produced in the first five-year period, 5.7 million cubic metres per annum would be produced in the second five-year period, followed by 5.4, 5.2 and 4.8 million cubic metres per annum in the remaining five-year periods of the forecast. However, both Forestry Commission Scotland and Forestry Commission Wales intend to cap production below these forecast levels over the period 2012–16 and beyond.

Production forecasts from forests managed by FS, based on management plans and available yield data, would average 0.5 million cubic metres per annum over the 25 years. The average annual production over the 25 years of the forecast for the FC estate by country is 1.1, 3.4 and 0.9 million cubic metres per annum for England, Scotland and Wales respectively.

If the GB private sector estate manages its woodlands to maximise[*] long-term timber productivity over the same period, the forecast indicates that it would produce an average of 10.5 million cubic metres per annum of coniferous timber for the next 25 years. For England the average is 2.5 million cubic metres per annum; for Scotland 7.1 million cubic metres; for Wales 0.9 million cubic metres; and for Northern Ireland 0.033 million cubic metres. For GB the 5-year breakdown of this forecast indicates 7.6 million cubic metres per annum in the first five years, 9.6 million cubic metres per annum in the next five years, and 11.3, 12.7 and 11.7 million cubic metres per annum in the following five-year periods. These forecasts are derived from a sample of private sector woodland from the NFI field survey. The consequent sampling error attached to these forecasts at GB level are of the order of 5%. This does not include some other sources of error, such as those inherent in the models used to estimate and project timber volumes in this forecast, but the combined effect of these on the forecasts is expected to be substantially less than sampling error, which is therefore closely representative of the accuracy of the forecasts if all forms of error were taken into account.

However, private sector owners have a wide range of objectives and some may not manage their estates with the objective of maximising long-term timber productivity, so future realised production is expected to vary from this estimate. Future production is likely to be less than forecast, which may occur for a variety of reasons such as some stands being uneconomic or difficult to harvest, or the owner chooses not to fell for other reasons. If the felling assumptions used in the 2005 production forecast are used instead (which were based on the industry's opinion of the most probable harvesting decisions), the cumulative forecast production is around 6% less than that for the biological

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[*] The concept of maximising long-term timber productivity is explored further in the text of this report and in the paper *Interpreting NFI Timber Volume Forecasts*.
[*] The FC/FS estate is often referred to as the 'national forest estate' or 'public sector estate', but as these terms are also used in other senses they are avoided here. All remaining forests are referred to as 'private sector estate', but will include land owned by charities and local authorities, for example.

potential forecast. This difference reflects the inherent difficulty in predicting future levels of harvesting and the impact of that upon the forecast. If historical production trends are continued, realised production will be less than forecast.

Similarly it must be noted that Forestry Commission Scotland, Forestry Commission Wales and Forest Service NI intend to cap production below management plan forecast levels in 2012–16 in order to secure a more sustainable level of production over the medium term. FS intends to continue production at 0.4 million cubic metres per annum in 2012–16 while more information is gathered to inform future timber production levels.

The combined volume of the FC/FS estate management plans forecast and the Private sector estate production potential is 16.5 million cubic metres of coniferous production per annum, averaged over the 25-year forecast. For England this average is 3.7 million cubic metres per annum; for Scotland 10.5 million cubic metres; for Wales 1.8 million cubic metres; and for Northern Ireland 0.6 million cubic metres. For GB the combined production forecast over the forecast period rises from an average of 13.6 million cubic metres per annum in 2012-16 to 17.8 million cubic metres per annum in 2027-31.

This combined forecast is more than predicted in the 2005 forecast. Most of this difference arises from the private sector estate component of the forecast. In this sector there is a 52% increase in cumulative potential production over the 25 years. This increase arises mainly as a consequence of a more accurate measure of the growing stock compared to that used for the 2005 forecast. The present assessment found more forest, of a higher yield and higher stocking than was assumed in 2005 and this alone accounts for an increase of43% in potentially available volume. Additionally, predicting private sector estate cutting practice through assuming the sector will cut to biological potential (as opposed to using private sector predictions of market behaviour) accounts for approximately another 6% of volume and compounds with the 43%.

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Introduction

The Forestry Commission,[*] in conjunction with the Forest Service of Northern Ireland (FS), has produced a UK production forecast of UK timber approximately every five years since 1964. The production forecast estimates the amount of coniferous stem wood timber (softwood) that is expected to be produced from UK forests over a 20 or 25-year period. The aim of this is to provide robust information to help both the growers and processors of timber to plan and invest appropriately in the sector.

Methodology

Approaches to forecasting coniferous timber production

A production forecast is derived through assessing what the forests are composed of today, how quickly they are growing and when this growth will be harvested. This is achieved firstly by estimating three key elements of the forests as they stand: the area of woodland, the type of woodland and its rate of growth Forestry Commission growth and yield models are then applied to this data to predict how fast that forest will grow. This forecast of growth is used in conjunction with assumptions about which stands of trees will be cut and when.

The UK 25-Year Forecast of Softwood Availability is built from four separate forecasts, one for each of the Forestry Commission estate (FC estate) in Great Britain (GB); the private sector estate in GB; the FS managed estate in Northern Ireland and the private sector estate in Northern Ireland. All remaining forests are referred to as 'Private sector estate', but will include land owned by charities and local authorities, for example. All previous forecasts followed the same overall approach but each component forecast was derived in different ways, dependent upon ownership (FC, FS or private).

The Forestry Commission and Forest Service forecasts

In both 2011 and 2005, the FC estate forecast was derived from the Commission's sub-compartment database (SCDB), an inventory with full coverage of the FC estate, giving woodland area, woodland type and growth rates (held on a stand-by–stand basis). This was used in combination with Forestry Commission felling and thinning plans (held as individual felling and thinning coupes across the entire estate) and these were processed through the Forestry Commission's Forecast system, which uses Forestry Commission

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growth and yield models. This process generates a prediction based on approved plans which is used to inform a commitment of production over the first five years of the forecast, and a broad prediction of intent for the following 20 years. The Northern Ireland public forest forecast produced by the Forest Service was derived by following a similar approach and used the same growth and yield models. The main difference between the approaches used between 2005 and 2011 was the use of an updated and more highly developed version of the forecast system, which included improved Sitka spruce models and a wider range of thinning prescription options. A full account of the FC estate methodology for the 2011 forecasts and a comparison with the 2005 approach can be found in the *NFI Forecasts Methodology Overview* paper and the *Felling and Removals Forecasts* document.

Forestry Commission marketing plans

The volumes and assortments published in this forecast of timber production reflect the cumulative impact of managing the FC estate (as of 31 March 2011) in accordance with approved forest design and thinning plans as of 31 March 2011. These plans evolve over time to reflect emergent policies and events. For the first period of the forecast (2012-2016) the individual countries make a series of commitments to producing a proportion of what is forecast through their marketing strategies.

- In the period 2012–16 Forestry Commission England is committed to bring to market the forecast volume to ±5%, through a combination of new and existing contracts.
- Forestry Commission Scotland is committed to bring 3.2 million cubic metres per annum (+/-5%) to market in the period 2012–16 through a combination of new and existing contracts. Forestry Commission Scotland's aim is to smooth production in the medium to long term, although management of diseases such as Dothistroma needle blight may result in production increases in the short term.
- Forestry Commission Wales is committed to bring to market at least 80% of forecast volume in the period 2012–16 through a combination of new and existing contracts.

FS intends to continue production at current levels in the period 2012–16.

For the Forestry Commission beyond 2016 the forecast is a signal of intent only, but is based upon existing plans, which will as noted evolve over time.

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Private Sector forecast 2005

The 2005 GB private sector estate forecast was based upon a woodland area derived from the National Inventory of Woodland and Trees (NIWT) (which had a base year of 1995), woodland type taken from the 1995 NIWT field survey and growth data estimated with inputs from industry expertise. It also used generic assumptions provided by industry experts about trends in felling and thinning, rather than actual plans. In 2005 the private sector estate forecast in Northern Ireland was based upon records of woodland and forests established in line with the requirements of the UK Forestry Standard.

Private Sector forecast 2011

The method used to derive the 2011 forecast has been through a significant upgrade and overhaul, than that was used to derive the 2005 forecast, the following section explains that process.

The new statistical approach to predicting production potential from the private sector estate

A driver behind establishing the National Forest Inventory (NFI) in 2009 was the lack of data on GB forests, especially so in the private sector. One of the NFI's main aims is to provide an accurate picture of the forest growing stock by assessing extent and type of woodland through mapping and direct measurement. The NFI also captures data on the biodiversity and social aspects of forests to provide a more holistic picture of GB forests. More detail on the approaches used in the NFI can be found in the papers *NFI Forecasts Methodology Overview* and *NFI Survey Manual.*

For the inventory of the private sector estate, the NFI produced a new GB 2011 woodland map (available on the NFI website), covering all woodland over 0.5 hectare and 20% canopy cover, including new planting, clearfell sites and restocked sites. The NFI map was based upon 25-cm resolution colour aerial photography for England and Scotland and 40-cm resolution aerial photography for Wales. The map was also validated and updated using satellite imagery, which gave an independent cross-check of woodland areas. Satellite imagery was also used to identify areas of woodland recently felled This will have included any clearfelling due to the establishment of wind farms or habitat restoration up until 2009. This map-based estimate was refined and updated by the field survey work, which generally includes clearfelling through to 2011. This mapping represents the best estimate of woodland area in GB to date. It was found that there were 2.95 million hectares of woodland in GB, 8% more than previously estimated. This accounted for a 5.6% increase in stocked coniferous woodland area. The stocked area of coniferous species by age class can be found in Appendix D. A full account of the NFI mapping exercise can be found in the *NFI Forecasts Methodology Overview* paper. The mapped woodland area results can be found in the *NFI Woodland Area Statistics* for

Great Britain, England, Scotland and Wales, which are available on the NFI website - http://www.forestry.gov.uk/forestry/inventory.

Field surveys of 4,036 one-hectare sample squares were located at random within these mapped areas of private sector forests and were used to compile these forecasts. These squares represent a sub-sample of 15,000 statistically representative sample squares covering all GB woodland that are planned to be surveyed during the first cycle of the NFI survey (due for completion in 2015). An example of the distribution of these squares within woodland can be seen in Appendix H, figure H1. At each sample square, the forest was stratified into different woodland types or stands, where information on species, management, ages and a range of other parameters were measured. An average of around two stands were found per square, resulting in data from 8,052 stands being used for the private sector estate production forecast. An example of a square with its respective sectioning can be found in Appendix H, figure H2. Within each stand, field-based computer systems were used to locate two or three 100 square metre (0.01 ha) circular plots, within which all trees over 4 centimetres dbh were mapped, species identified, diameters measured and stocking levels calculated. This resulted in 228,311 trees being measured for exact location, species, diameter and age and nearly 30,000 for stem straightness. The diameter distributions arising from these measures can be found in appendix C for all conifers, Sitka spruce, Norway spruce and Scots pine and are a core element in producing the forecast. For 59,334 of these trees, additional measures were taken of tree height and crown dimensions. Figure C5, appendix C gives the distribution of heights found. An example of a survey plot and its individual tree measurements such as height and crown dimensions can be found in Appendix H, figure H3. All squares and plot locations were marked on the ground with metal pegs and their GPS data were recorded. At least 8% of squares were completely remeasured by an independent quality assurance team in the field for checking purposes and all squares went through a series of quality assurance processes by office based teams. Appendix G gives more detail on the number of sample squares taken within each NFI region. The *NFI Forecasts Methodology Overview* and *NFI Survey Methodology* papers cover this methodology in detail and Appendix H gives examples of outputs of the surveying exercise and the data collected in a square. This is the largest mensurational exercise ever undertaken on private sector woods in GB.

Additionally for the 2011 forecast a new approach to gauging the effects of future harvesting regimes in the private sector estate was established through evaluating the outcomes of various scenarios of future harvesting strategies.

The approach used in the main forecast outputs is that all the private sector forests are managed under a biological potential regime, within which it is assumed that timber will be harvested at age of maximum mean annual increment (maximum MAI) to maximise biological potential. This maximises timber yield in a formulaic but widely understood

manner. For thinning a similar approach was taken by applying a series of prescriptions set out in Forestry Commission Management Tables, (known as thinning to Management Table Intensity (MTI)) to areas not generally at significant risk from windthrow if thinned. In areas considered to be at high exposure to wind risk, as determined by a detailed aspect methodology score (DAMS) of 16 or more, a strategy of no thinning, and felling conditional upon attainment of an assumed terminal height, reached when the stands reach a top height of 25 metres and higher. 25 metres was chosen in preference to 21 metres because a significant amount of stands of over 21 m in height were found while surveying areas with a DAMS score of 16 and above. The distribution of these heights are shown in Appendix C, figure c 6. Other assumptions of what top height to use as a proxy for terminal height in wind risk areas could also be used. An alternative forecast using 21metres terminal height is reported in the *Interpreting NFI Timber Volume Forecasts* report

More information on this approach and the alternative scenarios can be found in the paper *Interpreting NFI Timber Volume Forecasts* and the technical documentation *Forecast Types*.

From the mensuration data gathered, a standing volume was calculated per square, broken down by species, age class etc. An example of this is given in appendix H, figure H4. The forecast results for the individual surveyed squares were aggregated and scaled up to the areas identified by the woodland map, using standard statistical survey methodology, to produce the forecasts in this report. Along with these forecasts, associated sampling standard errors have also been calculated and reported. This gives a measure of the forecast's 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, but not from any systematic biases in the field measurements. However, because of the quality assurance process it is thought unlikely that any substantial biases of this nature are present in the survey data. The sources of error that are not accounted for in the reported standard errors will be modelling errors and biases deriving from use of empirical models to estimate standing volumes from the recorded survey data and the use of Forestry Commission growth and yield models to project future volumes. Modelling errors are diluted in the aggregation process and their overall effects on precision tend to be small compared to sampling error, but model biases, where they exist, would have a greater impact on the precision of the forecasts.

Yield class estimation

Yield class estimation is based upon identifying tree species, tree age and tree heights and these are then applied to Forestry Commission Yield curves to calculate yield class. Doing this on the Forestry Commission estate is a relatively straightforward process, as the ages of the trees are known from the sub compartment database and the other measures can be assessed directly in the field with a high degree of reliability.

Achieving this in the private sector is not as straightforward as there is no single source of tree age data that covers all of the private sector. To mitigate this the National Forest Inventory devised a process whereby estimates of tree age were taken in the field against all stands. These estimates were statistically calibrated against known tree ages, which were obtained on a sample of stands from reliable administrative sources, such as owner records. These administrative records were in turn calibrated against the results of increment or tree boring and ring counts, and the adjustments suggested by these calibrations were applied to tree age estimates for which no corresponding reliable record was available. Through this statistical process more accurate and unbiased tree age estimates could be achieved for all stands. Figure 1 illustrates this process, which is described fully in the NFI Methodology paper: *NFI Forecasts Methodology Overview*.

Figure 1 Process for establishing tree age in Private sector stands
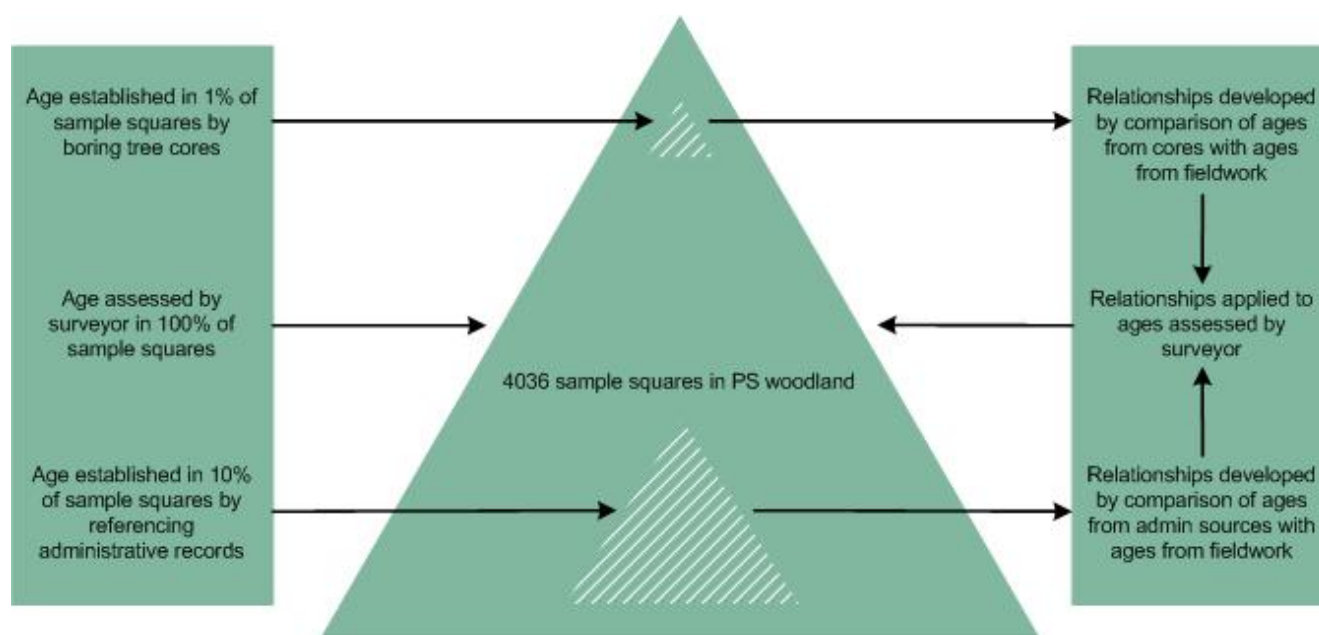
In existing crops that are too young to reliably estimate yield class, the mean yield class for that species for more mature crops (of 15 to 50 years of age) within that region was assigned to these younger stands. This may under- or over-represent differences in yield

class between older and younger crops. These may arise due to the use of improved stock, pest infestation and diseases, fertiliser use etc.

Timber not included in the forecasts

There is timber that is currently standing within the forests, which due to its specific properties does not fit within the standard approaches for public and private sector forecasts. There are also areas of land that could produce timber that fall into this category. Examples of these would be:

- Overdue timber*
- Currently clearfelled area
- Forestry Commission land flagged for sale

*Timber defined as overdue is timber that is situated within stands that are currently over the age for felling prescribed by the harvesting scenario (in this case management plans for the Forestry Commission estate or age of maximum MAI, or an assumed terminal height in wind risk areas for the private sector estate). In applying the harvesting scenarios consistently across all stands, this implies that these stands are 'overdue' for felling and that they would be clearfelled in the first year of the forecast.

Due to their particular characteristics the potential volumes associated with overdue timber, currently clearfelled area and land scheduled for sale on the Forestry Commission estate are not included in the main forecast and are reported upon separately. Further explanation of how such areas and volumes are treated are in the results and discussion sections.

Results

Overall coniferous timber production volumes

The overall forecasts of UK coniferous timber availability from each of the sectors and the total across both sectors, presented in five-year periods, are shown in Figures 2 and 3. Timber that is currently past the prescribed fell age of the harvesting scenario used is termed 'overdue' and is represented separately to the main volumes

Figure 2: UK 25-year forecast of softwood availability
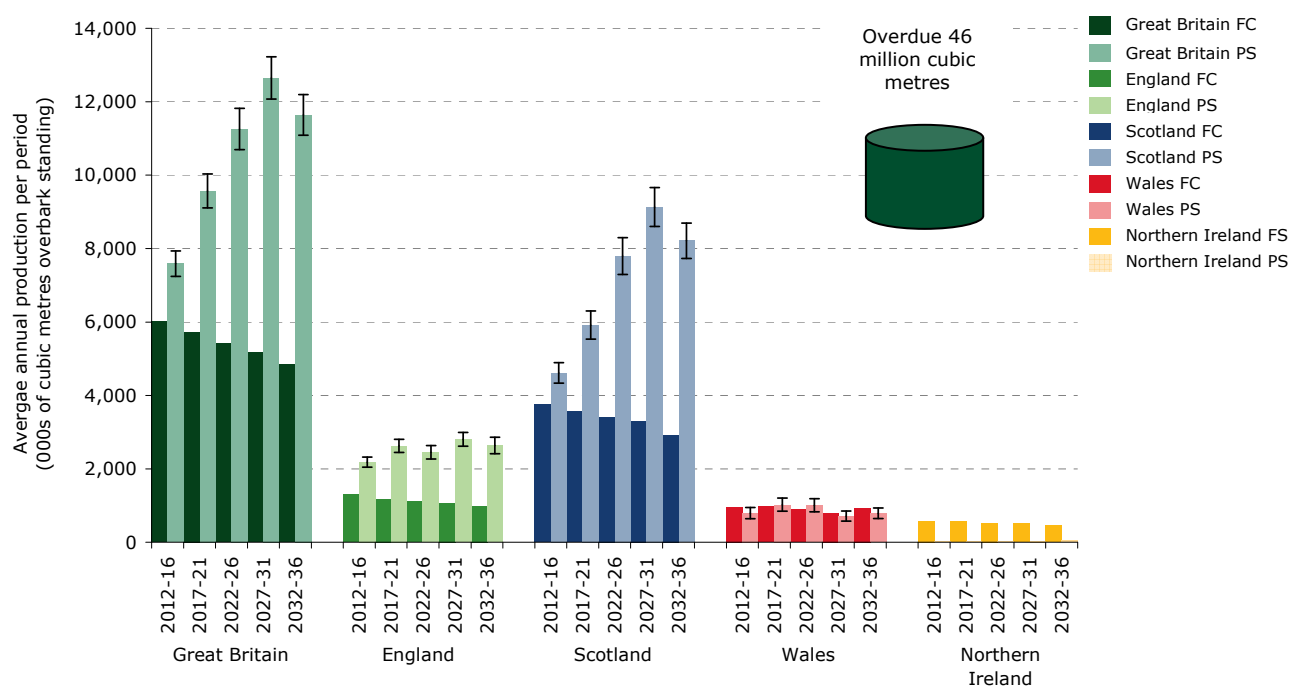
Notes:
1. The overdue volume graphic is sized in relation to the volumes represented by the columns height and width
2. Volumes are presented as average annual amounts for the 5 year period

Figure 3. UK 25-year softwood availability by sector

Notes:

1. Volumes are presented as average annual amounts for the 5 year period
2. The use of a single line to represent the profiles involves an element of smoothing between the periods, making differences appear less evident. Figure 2 provides the same information in a bar chart which makes the difference between periods more evident

The GB figures in table 1 and represented in figure 4 are based upon the application of Forestry Commission felling and thinning plans (as of 31 March 2011). There are a series of commitments to meet these plans to within a given tolerance and to bring most of the resulting harvested volume to market within the first five-year period of the forecast. The details of these commitments are set out in the methodology section - Forestry Commission Marketing Plans. This section notes that in Scotland and Wales in the period 2012-16 the commitment to bring timber to market is less than the forecast level whilst in England there is a commitment to bring close to forecast levels to market in the first period. Beyond 2016 the forecast for all countries indicates intent only, but is based upon existing plans. Actual production will ultimately arise from the individual country marketing plans and strategies, which although based on the production forecast, take other operational factors into account. When considering these volumes it is worth

noting that historically the Forestry Commission's actual production has been reasonably close to forecast production. However, this relationship may alter in the future.

Figure 4. UK 25-year timber production forecast for Forestry Commission / Forest Service estate
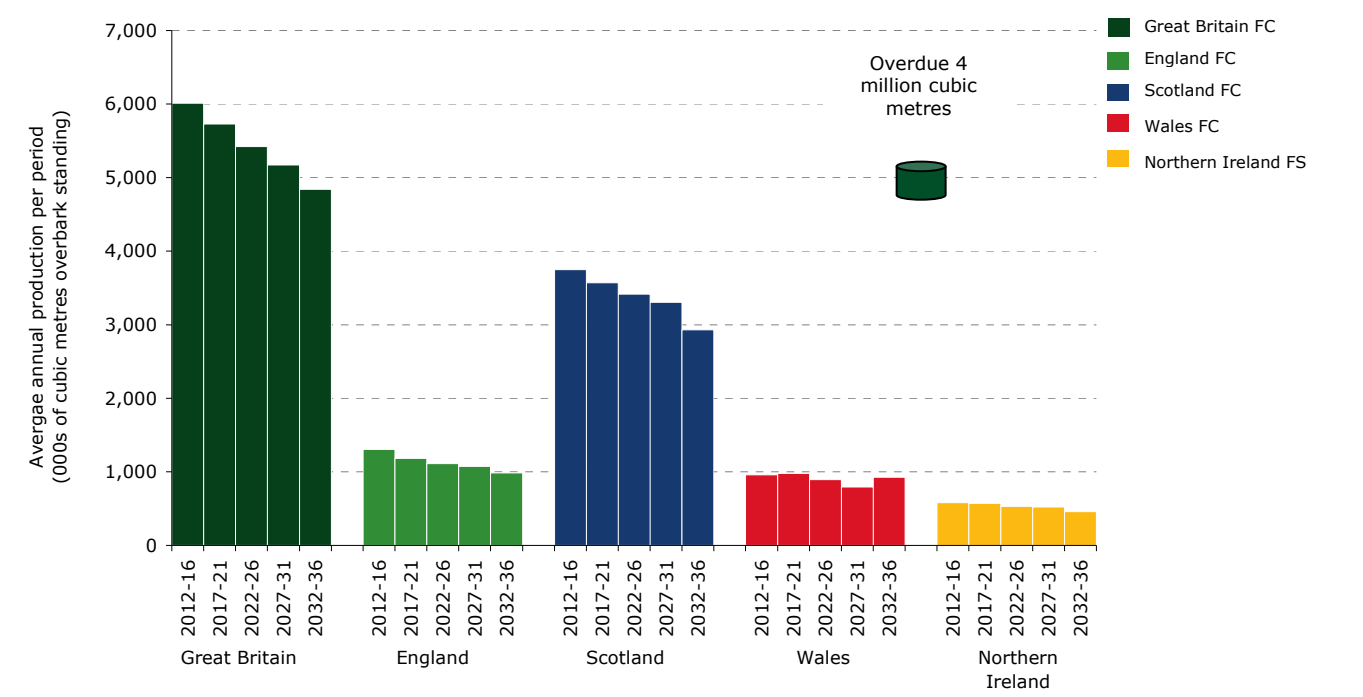
Notes:
1. The overdue volume graphic is sized in relation to the volumes represented by the columns height and width.

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Table 1. UK 25-year timber production forecast for Forestry Commission / Forest Service estate

	2012-16 FC/FS volume (000 m^3 obs)	2017-21 FC/FS volume (000 m^3 obs)	2022-26 FC/FS volume (000 m^3 obs)	2027-31 FC/FS volume (000 m^3 obs)	2032-36 FC/FS volume (000 m^3 obs)
England	1,305	1,183	1,110	1,072	985
Scotland	3,749	3,568	3,417	3,305	2,930
Wales	958	979	893	795	927
Great Britain	**6,013**	**5,730**	**5,420**	**5,172**	**4,841**
Northern Ireland	579	572	529	519	458
United Kingdom	**6,592**	**6,302**	**5,949**	**5,691**	**5,299**

The GB forecast in figures 2, 3 and 5 and table 2 represent the volume of timber that would be produced if felling to MMAI and thinning to MTT was followed in the private sector estate (except in high wind risk areas, as noted in the methodology). The forecasts are based upon the statistical survey of the National Forest Inventory and have associated sampling standard errors ranging from 6% to 9% at country level for England and Scotland to around 5% at GB level, contingent upon the harvesting assumptions being realised. Wales, which possesses a smaller area of conifer forest, has standard errors ranging between 17% and 19%. As the survey gathers more data, these standard errors will reduce. However, it is unlikely that the private sector will manage the majority of stands to this prescription and actual volumes harvested will vary, dependent on private sector practice. Figure 6 illustrates the forecast volumes that arise from applying alternative potential scenarios of private sector harvesting practice.

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Figure 5. UK 25-year timber production forecast for the Private sector estate
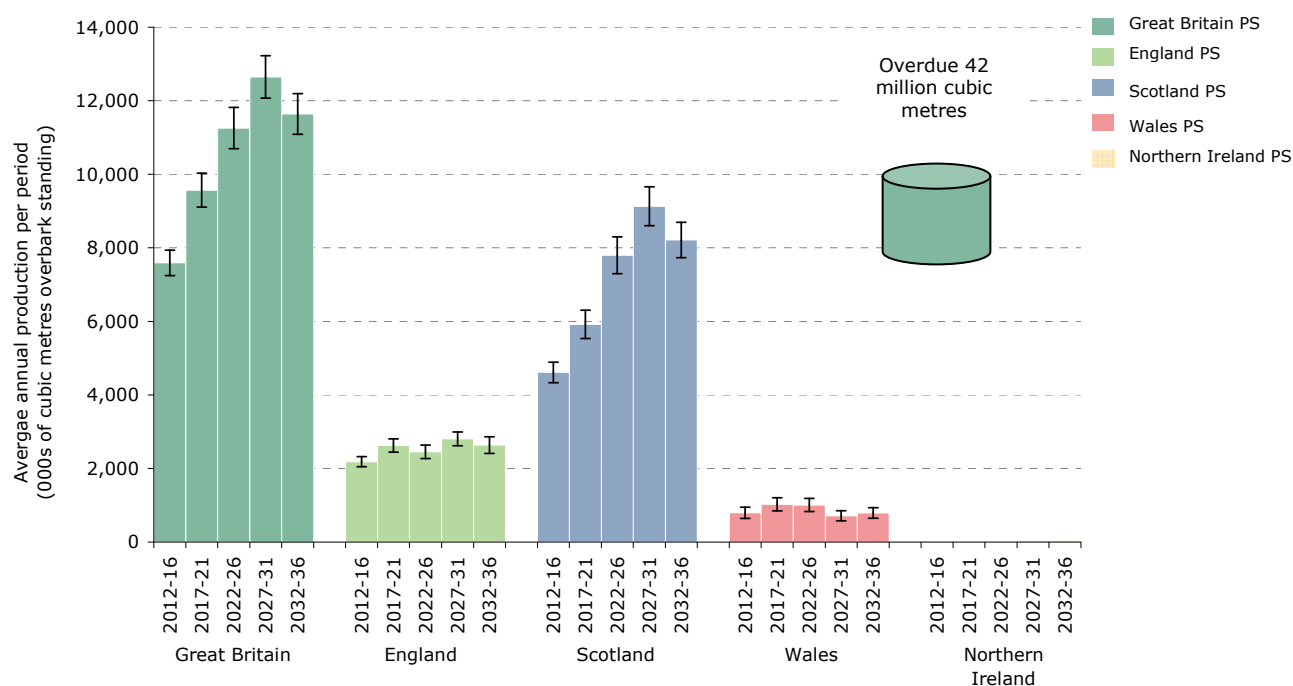
Table 2. UK 25-year timber production forecast for the Private sector estate

	2012-16		2017-21		2022-26		2027-31		2032-36	
	Private sector		Private sector		Private sector		Private sector		Private sector	
	volume (000 m³ obs)	SE %	volume (000 m³ obs)	SE %	volume (000 m³ obs)	SE %	volume (000 m³ obs)	SE %	volume (000 m³ obs)	SE %
England	2,184	6	2,626	7	2,450	7	2,804	7	2,637	9
Scotland	4,614	6	5,917	6	7,796	6	9,131	6	8,213	6
Wales	793	19	1,025	17	1,008	18	713	19	791	18
Great Britain	**7,591**	**5**	**9,569**	**5**	**11,255**	**5**	**12,648**	**5**	**11,641**	**5**
Northern Ireland	26	-	22	-	25	-	44	-	44	-
United Kingdom	**7,617**	**-**	**9,591**	**-**	**11,280**	**-**	**12,692**	**-**	**11,685**	**-**

Just as there is variation in the volumes of potential production between the countries, there are also large differences between individual NFI regions. For example, cumulative private sector potential conifer production is highest in the South Scotland NFI region. Appendix A, table A1 gives a breakdown of the forecasts by individual NFI region.

Harvesting assumptions used

As discussed in the methodology, for the Forestry Commission Estate current FC felling and thinning plans were used to set rates of harvest within the forecast. For the private sector a harvesting scenario was chosen. The biological potential harvesting scenario which was used in deriving the GB forecast volumes in figures 1 to 4 and tables 2 and 3 (private sector only) is highlighted in figure 6. It can be seen that the harvesting scenario chosen is one of many potential scenarios. This scenario illustrates an 'upper ceiling' of potential production, with most other scenarios forecasting less volume. This should be borne in mind when appraising the forecast and it should be understood that actual production may take the path of any of these or other possible scenarios. A full explanation of each scenario and the impacts of such assumptions on the forecast are explored in the National Forest Inventory Interpretation Paper: *Interpreting National Forest Inventory Timber Volume Forecasts.*

Figure 6. The impact of different harvesting scenarios upon 25-year timber potential for the Private sector (GB)
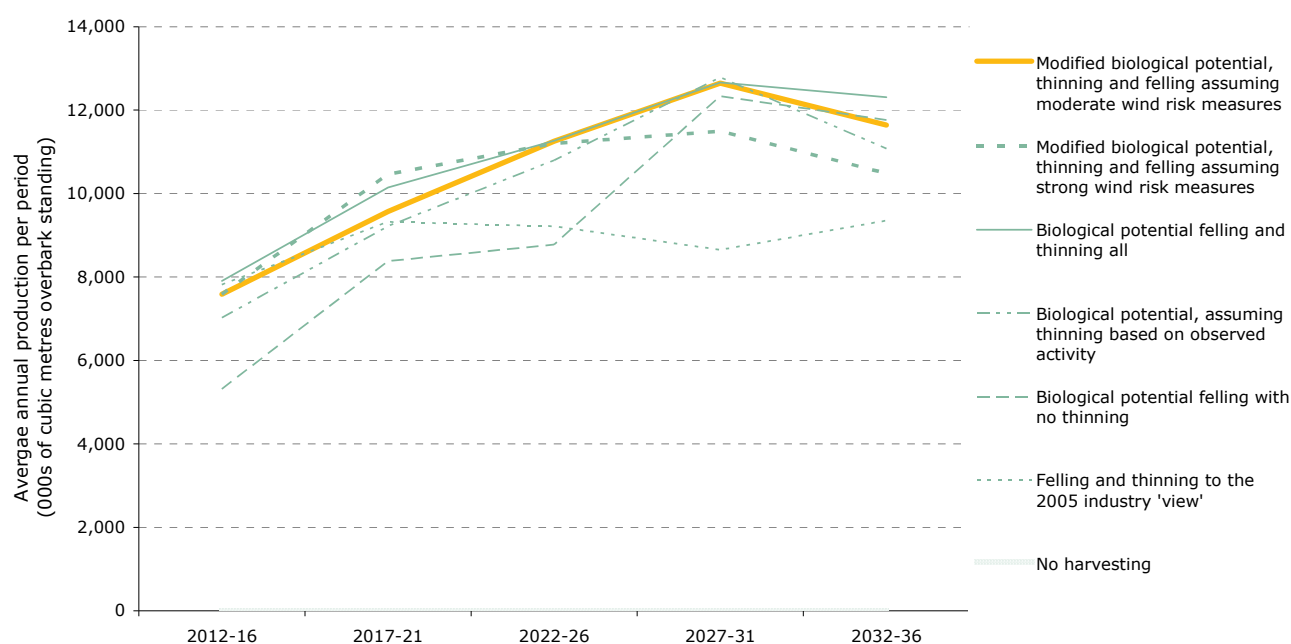
Notes:

1. The scenario used in the main forecasts is the 'Modified biological potential, thinning and felling assuming moderate wind risk measures'. It assumes felling at age of Maximum mean annual increment (MAI) in all stands below DAMS 16, plus thinning to Management Table Intensity (MTI) in these stands. It also assumes no thinning in those stands at or above DAMS 16 and felling of these at age of Maximum MAI or at a top height of 25m, if attained first. This is assumed to equate to terminal height.

2. The 'zero intervention' scenario assumes no harvesting within the forecast period and illustrates the impact of setting this scenario for all crops.

3. The 'Biological potential felling and thinning all' scenario assumes felling at age of Maximum mean annual increment and thinning to Management Table Intensity (MTI) in all stands

4. The 'Biological potential felling with no thinning' scenario assumes felling at age of Maximum mean annual increment in all stands and no thinning of any stands

5. The 'Biological potential, assuming thinning based on observed activity' scenario assumes felling at age of Maximum mean annual increment in all stands and applying thinning to only those stands that have been measured as thinned in the NFI field survey.

6. The 'Felling and thinning to the 2005 industry view' scenario applies the same harvesting prescriptions to the NFI inventory data that were used to produce the 2005/6 production forecast.

7. The 'Modified biological potential, thinning and felling assuming strong wind risk measures', assumes felling at age of Maximum mean annual increment (MAI) in all stands below DAMS 16, plus thinning to Management Table Intensity (MTI) in these stands. It also assumes no thinning in those stands above DAMS 16 and felling of these at Maximum MAI or, if attained first, at a top height of 21m, which is assumed to equate to terminal height.

Table 3 provides a detailed summary of these results for the UK as a whole, for GB and for each individual country, with total volumes broken down into individual top diameter timber size classes. The percentage of Private sector production attributable to spruce species (primarily Sitka spruce) is also shown. Table 4 gives the volumes broken down by principal species. Table A1 and A2 in Appendix A provides a further disaggregation of these results into individual regions of England and Scotland.

Table 3. UK 25-year forecast of softwood availability for FC/FS estate and Private sector estate broken down by forecast period, country and top diameter classes

Top diameter class	2012-16 FC/FS volume (000 m³ obs)	% spruce	2012-16 Private volume (000 m³ obs)	SE %	% spruce	2017-21 FC/FS volume (000 m³ obs)	% spruce	2017-21 Private volume (000 m³ obs)	SE %	% spruce	2022-26 FC/FS volume (000 m³ obs)	% spruce	2022-26 Private volume (000 m³ obs)	SE %	% spruce	2027-31 FC/FS volume (000 m³ obs)	% spruce	2027-31 Private volume (000 m³ obs)	SE %	% spruce	2032-36 FC/FS volume (000 m³ obs)	% spruce	2032-36 Private volume (000 m³ obs)	SE %	% spruce
England																									
7-14cm	301	56	308	5	42	215	59	263	7	39	179	62	222	8	41	152	68	324	7	33	145	67	356	7	31
14-16cm	111	66	120	5	38	91	63	113	7	40	78	66	98	8	47	70	72	103	9	51	62	73	113	12	44
16-18cm	111	66	137	6	36	96	61	137	7	41	83	63	125	8	47	76	69	122	9	54	66	70	126	13	49
18-24cm	304	61	496	7	34	281	55	543	7	40	256	54	541	8	45	239	59	528	8	52	207	58	501	13	52
24-34cm	273	40	638	9	32	281	37	824	8	40	278	32	817	8	40	278	36	868	8	44	252	32	798	10	43
34-44cm	110	25	260	10	26	119	25	379	9	37	123	22	352	10	36	130	25	436	9	37	124	21	382	10	33
44-54cm	53	21	112	11	22	56	21	169	11	34	59	20	156	13	34	62	23	213	10	33	61	20	181	11	28
54+cm	41	17	112	20	19	44	19	198	22	48	54	17	139	18	37	66	19	211	14	31	66	19	179	14	23
Total	**1,305**	**50**	**2,184**	**6**	**32**	**1,183**	**46**	**2,626**	**7**	**40**	**1,110**	**44**	**2,450**	**7**	**41**	**1,072**	**47**	**2,804**	**7**	**42**	**985**	**45**	**2,637**	**9**	**40**
Scotland																									
7-14cm	909	67	1,046	4	72	749	73	944	5	76	649	72	1,061	5	77	601	71	1,182	5	67	505	71	1,058	5	56
14-16cm	392	73	388	5	72	345	77	424	5	78	309	76	496	6	81	285	75	529	6	79	241	76	464	6	67
16-18cm	402	76	403	5	71	365	79	495	6	79	336	78	614	6	83	313	77	661	6	81	268	78	573	6	71
18-24cm	1,066	80	1,225	8	70	1,029	82	1,633	7	80	982	81	2,328	7	84	957	81	2,626	6	83	837	81	2,277	6	76
24-34cm	707	81	1,076	10	67	767	82	1,598	10	75	779	82	2,361	8	82	788	82	2,881	7	83	730	83	2,660	7	76
34-44cm	178	77	299	12	55	205	77	509	12	67	230	79	619	11	75	229	78	832	9	77	218	79	784	9	67
44-54cm	63	72	108	16	45	69	71	189	15	62	84	75	186	18	69	81	72	259	12	68	78	74	244	13	54
54+cm	32	64	69	22	28	38	65	123	22	54	49	69	130	35	68	51	65	162	18	52	53	70	154	22	44
Total	**3,749**	**76**	**4,614**	**6**	**68**	**3,568**	**79**	**5,917**	**6**	**76**	**3,417**	**78**	**7,796**	**6**	**81**	**3,305**	**78**	**9,131**	**6**	**79**	**2,930**	**79**	**8,213**	**6**	**70**
Wales																									
7-14cm	195	71	99	15	58	196	71	92	16	62	169	71	89	16	72	130	68	88	16	55	153	72	117	17	60
14-16cm	84	72	43	18	58	81	72	41	18	71	74	74	42	18	74	61	71	34	20	70	72	75	51	21	69
16-18cm	89	72	49	18	58	84	73	56	19	73	79	75	52	19	75	70	74	40	22	73	84	76	61	22	73
18-24cm	258	74	180	18	56	249	74	241	19	77	233	75	231	20	75	219	78	146	23	72	281	80	224	22	77
24-34cm	218	76	218	20	48	230	77	372	21	72	207	74	329	19	67	190	80	209	26	65	217	82	217	22	81
34-44cm	71	78	94	31	43	80	79	143	23	61	73	75	134	25	48	67	79	100	27	51	61	77	67	25	81
44-54cm	28	77	44	42	44	34	79	53	31	46	32	75	62	35	36	30	78	47	30	38	28	75	25	34	75
54+cm	15	71	68	75	70	24	74	28	36	57	26	65	68	42	17	27	65	49	34	40	30	65	29	38	70
Total	**958**	**74**	**793**	**19**	**53**	**979**	**75**	**1,025**	**17**	**69**	**893**	**74**	**1,008**	**18**	**62**	**795**	**75**	**713**	**19**	**60**	**927**	**77**	**791**	**18**	**75**
Great Britain																									
7-14cm	1,405	65	1,453	3	64	1,161	70	1,298	4	68	998	70	1,372	4	71	882	70	1,594	4	60	803	71	1,532	4	51
14-16cm	587	72	550	4	63	517	74	579	4	70	461	74	636	5	76	416	74	666	5	74	374	75	628	5	63
16-18cm	603	74	588	4	62	546	75	688	5	71	498	75	791	5	76	458	76	822	5	76	419	76	760	6	67
18-24cm	1,629	76	1,902	6	60	1,559	76	2,416	5	71	1,470	75	3,100	6	76	1,415	77	3,300	5	78	1,325	77	3,001	6	72
24-34cm	1,198	71	1,932	7	53	1,278	71	2,794	7	65	1,263	70	3,508	6	70	1,256	72	3,957	6	74	1,200	72	3,675	6	69
34-44cm	359	61	653	8	42	404	62	1,031	8	55	426	62	1,105	8	59	427	62	1,367	7	62	403	61	1,233	7	57
44-54cm	143	54	264	11	35	159	55	412	9	48	175	56	404	11	50	173	55	520	8	51	167	54	450	8	45
54+cm	89	43	248	23	36	107	48	349	15	51	129	47	338	18	45	144	44	422	10	40	150	46	362	12	36
Total	**6,013**	**70**	**7,591**	**5**	**56**	**5,730**	**71**	**9,569**	**5**	**65**	**5,420**	**71**	**11,255**	**5**	**70**	**5,172**	**71**	**12,648**	**5**	**70**	**4,841**	**71**	**11,641**	**5**	**64**
Northern Ireland																									
7-14cm	80	90	4	-	90	69	90	3	-	90	57	90	3	-	90	58	87	6	-	87	50	87	6	-	87
14-16cm	48	90	2	-	90	40	90	2	-	90	35	90	2	-	90	36	87	3	-	87	30	87	3	-	87
16-18cm	65	90	3	-	90	56	90	2	-	90	50	90	2	-	90	50	87	4	-	87	42	87	4	-	87
18-24cm	247	90	11	-	90	240	90	9	-	90	220	90	10	-	90	214	87	18	-	87	174	87	16	-	87
24-34cm	121	90	5	-	90	147	90	6	-	90	151	90	7	-	90	143	87	12	-	87	142	87	13	-	87
34-44cm	11	90	1	-	90	11	90	0	-	90	10	90	1	-	90	13	87	1	-	87	13	87	1	-	87
44-54cm	3	90	0	-	90	3	90	0	-	90	4	90	0	-	90	3	87	0	-	87	4	87	0	-	87
54+cm	4	90	0	-	90	5	90	0	-	90	3	90	0	-	90	3	87	0	-	87	3	87	0	-	87
Total	**579**	**90**	**26**	**-**	**90**	**572**	**90**	**22**	**-**	**90**	**529**	**90**	**25**	**-**	**90**	**519**	**87**	**44**	**-**	**87**	**458**	**87**	**44**	**-**	**87**
United Kingdom																									
7-14cm	1,485	67	1,458	-	64	1,229	64	1,302	-	68	1,055	71	1,375	-	71	940	71	1,600	-	60	853	71	1,537	-	51
14-16cm	635	73	553	-	63	557	63	580	-	70	496	75	638	-	76	452	75	669	-	74	404	75	631	-	63
16-18cm	667	76	591	-	62	602	62	690	-	71	548	77	793	-	76	508	77	826	-	77	460	77	764	-	67
18-24cm	1,875	77	1,913	-	60	1,799	60	2,425	-	71	1,690	78	3,111	-	76	1,629	77	3,318	-	78	1,499	78	3,018	-	72
24-34cm	1,319	73	1,937	-	53	1,426	53	2,800	-	65	1,414	73	3,515	-	70	1,399	72	3,969	-	74	1,342	73	3,689	-	69
34-44cm	370	62	654	-	42	415	42	1,031	-	55	436	63	1,106	-	59	439	63	1,368	-	62	416	63	1,234	-	57
44-54cm	146	55	264	-	35	162	35	412	-	48	179	56	404	-	50	177	57	520	-	51	170	56	451	-	45
54+cm	93	45	248	-	36	112	36	349	-	51	132	50	338	-	45	147	48	422	-	40	153	45	362	-	36
Total	**6,592**	**72**	**7,617**	**-**	**56**	**6,302**	**56**	**9,591**	**-**	**65**	**5,949**	**73**	**11,280**	**-**	**70**	**5,691**	**72**	**12,692**	**-**	**70**	**5,299**	**73**	**11,685**	**-**	**64**

NFI Statistical Analysis Report

Source: Forestry Commission

Notes:

1. Volumes for FC/FS estate based upon Forestry Commission and FS inventory and management plans.
2. Volumes for private sector based upon NFI data and the biological potential, thinning and felling with moderate wind risk measures scenario Individual values may not sum to totals due to rounding
3. As in previous forecasts, all annual volumes include 'thinning plus felling'.
4. The baseline date of the forecasts is 31 March 2011.
5. The forecast starts in 2012, with 2012 defined as starting on 1 April 2011 and ending on 31 March 2012. This convention applies to all forecast years or periods quoted.
6. Forecasts are presented as average annual volumes for each five-year period.
7. Timber refers to the coniferous standing volume of stem wood to 7 centimetres top diameter in cubic metres overbark standing (m3 obs), including stump (above ground) and utilisable branchwood (of minimum 3 metres in length and 7 centimetres top diameter).
8. Private sector data is provided with associated sampling standard errors (SE).
9. Harvesting regimes used are based upon Forestry Commission design and thinning plans for the FC estate and biological potential constrained by wind risk in the private sector estate.
10. The Forestry Commission Scotland aim is to smooth production at 3.2 million cubic metres per annum. To achieve this will require a significant overhaul of forest design plans over the next five years, as this is compared to a forecast of 3.7 million cubic metres per annum in the first 5-year period. This equates to a reduction of 2.7 million cubic metres of production over the next 5 years compared to that forecast.
11. FS intends to continue production at current levels in 2012–16.

NFI Statistical Analysis Report

Table 4. GB 25-year forecast of softwood availability for FC estate and Private sector estate broken down by forecast period, country and principal species

Principal species	2012-16 FC volume 000m³ obs	2012-16 Private sector volume 000m³ obs	2012-16 SE%	2017-21 FC volume 000m³ obs	2017-21 Private sector volume 000m³ obs	2017-21 SE%	2022-26 FC volume 000m³ obs	2022-26 Private sector volume 000m³ obs	2022-26 SE%	2027-31 FC volume 000m³ obs	2027-31 Private sector volume 000m³ obs	2027-31 SE%	2032-36 FC volume 000m³ obs	2032-36 Private sector volume 000m³ obs	2032-36 SE%
England															
All conifers	1,305	2,184	6	1,183	2,626	7	1,110	2,450	7	1,072	2,804	7	985	2,637	9
Sitka spruce	552	436	21	483	644	20	445	589	19	457	634	18	401	647	27
Scots pine	141	495	12	127	534	10	126	654	11	109	933	12	92	826	12
Corsican pine	273	224	18	285	288	18	276	232	26	253	151	28	253	112	42
Norway spruce	103	272	10	66	406	19	44	404	23	49	540	15	38	395	18
Larches	63	251	14	64	190	17	68	117	19	53	182	10	56	241	10
Douglas fir	80	245	21	72	267	19	78	138	25	82	126	24	89	86	16
Lodgepole pine	43	39	44	41	26	51	34	38	51	21	31	59	16	60	56
Other conifers	50	244	22	45	290	18	40	281	16	48	203	19	39	276	23
Scotland															
All conifers	3,749	4,614	6	3,568	5,917	6	3,417	7,796	6	3,305	9,131	6	2,930	8,213	6
Sitka spruce	2,697	2,954	8	2,694	4,329	8	2,592	6,041	8	2,494	6,989	7	2,250	5,495	8
Scots pine	216	656	11	215	805	10	226	858	12	220	982	11	202	1,235	11
Corsican pine	12	5	145	7	5	138	10	4	149	5	39	23	11	58	67
Norway spruce	142	179	31	114	148	17	89	242	24	85	243	22	53	284	28
Larches	182	506	16	191	329	29	154	334	21	162	315	17	138	344	12
Douglas fir	49	49	60	45	143	17	37	82	53	43	47	150	46	64	146
Lodgepole pine	423	199	10	280	181	18	284	174	21	276	417	14	214	627	12
Other conifers	28	56	63	22	67	77	24	31	45	21	67	45	16	80	39
Wales															
All conifers	958	793	19	979	1,025	17	893	1,008	18	795	713	19	927	791	18
Sitka spruce	636	396	33	660	684	24	601	602	23	560	380	31	674	557	24
Scots pine	15	20	49	23	17	53	15	18	61	10	21	54	13	9	55
Corsican pine	18	9	41	24	24	66	29	39	51	22	1	60	12	4	98
Norway spruce	70	26	41	70	26	41	59	25	42	40	49	59	43	34	40
Larches	82	191	33	90	83	39	84	44	59	67	109	45	79	68	30
Douglas fir	44	104	51	48	111	55	53	99	46	47	81	61	72	30	35
Lodgepole pine	29	10	34	28	11	33	20	10	34	19	11	35	9	53	52
Other conifers	64	30	37	36	59	60	31	159	67	29	56	52	24	31	51
Great Britain															
All conifers	6,013	7,591	5	5,730	9,569	5	5,420	11,255	5	5,172	12,648	5	4,841	11,641	5
Sitka spruce	3,885	3,786	8	3,837	5,657	7	3,638	7,231	7	3,511	8,003	7	3,324	6,699	7
Scots pine	372	1,171	8	366	1,356	7	367	1,530	8	339	1,936	8	307	2,070	8
Corsican pine	303	237	18	316	317	18	316	276	23	280	191	23	276	174	35
Norway spruce	315	477	13	250	580	14	192	671	16	174	832	12	135	714	15
Larches	327	948	12	345	603	18	306	495	16	282	606	12	273	653	8
Douglas fir	173	399	20	165	521	16	168	319	23	172	255	36	206	180	53
Lodgepole pine	496	249	11	348	218	16	338	222	18	316	460	14	239	739	12
Other conifers	142	330	20	104	416	20	95	471	25	98	325	18	80	386	19

The results in Tables 3 and 4 are presented separately for the two sectors since the volumes forecast within the FC/FS estate and private sector estate differ in the nature of their derivation.

The FC estate forecasts are based on a forest inventory with full coverage of all stands that includes details of felling and thinning plans for each stand, which form a sound basis for a reliable forecast. The Forestry Commission, at a country level, commits to produce a proportion of this forecast volume in the period 2012–16 and will make these volumes available to the market through a combination of existing contracts and new opportunities for purchase. Beyond this first period, the forecast is a signal of intent only. If large, unplanned volumes (e.g. from windblow or disease outbreaks) necessitate rescheduling of harvesting from the established plans, these are likely to substitute for other planned harvesting rather than add to forecast volumes. In such circumstances species and assortments will change.

The private sector component of the forecasts are based upon the statistical survey of the NFI and are presented with associated sampling standard errors. These forecast volumes are contingent upon a harvesting scenario of biological potential constrained by wind risk. Other harvesting strategies and scenarios are possible and this forecast should be seen as an 'upper ceiling' of potential production.

Further regional breakdowns of these figures for both the public and private sector can be found in Appendix A, tables A1 and A2.

Volume not in the forecast

The following stands, volumes and areas have not been included in the main forecast results. Due to their specific nature they are treated as 'special cases' and are assessed separately. Dependent on the perspective taken on their nature, the likelihood of these stands being harvested or not can be assessed and a view can be taken as to whether or not these volumes should be added to the figures already quoted in the main forecasts in terms of a total assessment of standing volume, increment and production.

Overdue timber

Timber that is defined as overdue is standing timber that is situated within stands that are currently over the age for felling prescribed by the harvesting scenario (in this case management plans for the Forestry Commission or age of maximum MAI, or an assumed terminal height in wind risk areas for the private sector). If we are to apply the harvesting scenarios consistently across all stands, this implies that these stands are 'overdue' for felling and that they should be clearfelled in the first year of the forecast. With this being the case, this prescription is followed in the implementation of the forecast, but the volumes immediately felled by reason of being 'overdue' are reported separately from other harvested volumes – in recognition that this is an artificial and unlikely occurrence.

In most harvesting scenarios overdue represents a significant amount of standing volume (around 14%) and whether this timber is harvested is an important factor that needs to be addressed in the forecast. Whether this volume will be harvested will depend upon a number of factors; owner choices, physical and biological constraints and the characteristics of the stands involved.

The fact that, in the Private sector especially, the volume of overdue timber represents a significant amount of total standing volume at the start of the forecast indicates that a portion of the estate is not currently being managed according to the assumed scenario. For 'biological potential' scenarios, this in turn implies that the current practice on at least a portion of the Private sector estate is to leave some stands beyond the age of maximum MAI.

Since such stands are currently being managed in a way contrary to the assumed prescription, these, and some other stands that are currently below the age of maximum MAI, are also not likely to be managed in the assumed way in the future. Reasons for the observed 'delayed felling' leading to the presence of overdue timber at the start of the forecast for any particular stand is not known.

Additionally, as a result of applying scenarios consistently, all areas felled as overdue will be restocked on a like–for-like basis, as for any other felled stand in the forecast period. In most scenarios, this approach will not significantly impact on the forecast standing volumes in the first periods of the forecast, but as the replacement crops mature later in the forecast period they will start to contribute to standing volume. Table 5 shows that there is estimated to be 46 million cubic metres of overdue coniferous timber under the specific scenarios reported here. This volume may or may not be harvested during the forecast period and therefore may or may not contribute to future standing volumes and increment profiles. Felling overdue timber results in an immediate drop in standing volume that will persist for the forecast period. Tthe restocking associated with this assumed felling will begin to offset this removal by the end of the 25-year period.

Table 5 shows that there are around 46 million cubic metres of overdue timber, mostly on the private sector estate. Tables 6 and 7, and figures 7 and 8, break the overdue timber within the Private sector into age classes and principal species. This volume may or may not be harvested during the forecast period.

Table 5. GB Overdue timber by sector as at March 2011

Country	FC volume (000 m^3 obs)	Private sector volume (000 m^3 obs)	SE %		FC area (000 ha)	Private sector area (000 ha)	SE %
England	912	18,866	7		3.4	38.5	6
Scotland	794	19,443	10		2.9	39.8	8
Wales	2,194	3,501	25		5.0	6.0	22
Great Britain	**3,900**	**41,810**	**6**		**11.2**	**84.3**	**5**

Notes:
1. Overdue is defined as the area or volume of timber that currently exceeds the felling age or height prescribed by the harvesting scenario used in deriving the forecast.
2. The harvesting regimes used for the FC estate are the Forestry Commission design and thinning plans.
3. The harvesting regimes assumed for the private sector estate are maximum MAI and MTT, or no thin and felling at terminal height in wind risk areas.

Table 6. Overdue timber as at 31 March 2011 by age class for the Private sector.

Age Class	Private sector volume (000 m³ obs)	SE %	Private sector area (000 ha)	SE %
England				
0-10	0	0	0.0	0
11-20	0	0	0.0	0
21-30	0	0	0.0	0
31-40	334	41	0.9	42
41-50	2,872	16	7.0	15
51-60	4,858	13	10.7	12
61-80	7,257	13	13.4	12
81-100	1,794	29	2.3	26
101-140	1,309	31	2.8	26
141-180	115	49	0.6	44
181+	323	52	0.9	48
Total	**18,862**	**7**	**38.5**	**6**
Scotland				
0-10	0	0	0.0	0
11-20	0	0	0.0	0
21-30	0	0	0.0	0
31-40	538	69	1.0	64
41-50	2,709	23	5.8	21
51-60	5,951	17	11.8	16
61-80	3,952	20	7.0	18
81-100	2,179	27	4.4	27
101-140	3,227	31	6.1	21
141-180	528	61	2.2	39
181+	353	67	1.5	52
Total	**19,436**	**10**	**39.8**	**8**
Wales				
0-10	0	0	0.0	0
11-20	0	0	0.0	0
21-30	0	0	0.0	0
31-40	319	66	0.4	62
41-50	1,637	42	2.0	40
51-60	0	0	0.0	0
61-80	0	0	0.0	0
81-100	1,196	40	2.3	37
101-140	305	62	0.7	62
141-180	0	0	0.0	0
181+	43	71	0.6	74
Total	**3,501**	**25**	**6.0**	**22**
Great Britain				
0-10	0	0	0.0	0
11-20	0	0	0.0	0
21-30	0	0	0.0	0
31-40	1,191	38	2.3	34
41-50	7,218	14	14.8	12
51-60	10,809	11	22.5	10
61-80	11,209	11	20.4	10
81-100	5,169	18	9.1	18
101-140	4,841	23	9.6	16
141-180	643	51	2.8	33
181+	718	41	2.9	33
Total	**41,798**	**6**	**84.3**	**5**

Table 7. Overdue timber as at 31 March 2011 by principal species for the Private sector.

Principal species	Private sector volume (000 m³ obs)	SE %	Private sector area (000 ha)	SE %
England				
All conifers	**18,866**	**7**	**38.5**	**6**
Sitka spruce	1,715	26	2.7	26
Scots pine	2,547	26	3.6	24
Corsican pine	1,556	24	3.0	28
Norway spruce	20	76	0.1	88
Larches	8,928	8	21.9	8
Douglas fir	2,776	22	4.4	19
Lodgepole pine	56	102	0.1	102
Other conifers	1,310	21	3.1	22
Scotland				
All conifers	**19,443**	**10**	**39.8**	**8**
Sitka spruce	4,949	21	7.4	20
Scots pine	3,813	19	11.9	16
Corsican pine	0	0	0.0	0
Norway spruce	144	59	0.4	63
Larches	7,263	13	17.1	12
Douglas fir	1,019	35	1.5	37
Lodgepole pine	155	76	0.3	75
Other conifers	2,133	47	1.4	41
Wales				
All conifers	**3,501**	**25**	**6.0**	**22**
Sitka spruce	1,408	46	2.1	41
Scots pine	36	104	0.1	104
Corsican pine	0	0	0.0	0
Norway spruce	0	0	0.0	0
Larches	1,484	36	2.3	36
Douglas fir	382	56	0.8	64
Lodgepole pine	0	0	0.0	0
Other conifers	279	48	1.0	53
Great Britain				
All conifers	**41,810**	**6**	**84.3**	**5**
Sitka spruce	8,072	16	12.2	15
Scots pine	6,397	15	15.7	13
Corsican pine	1,556	24	3.0	28
Norway spruce	164	53	0.4	55
Larches	17,674	7	41.3	7
Douglas fir	4,176	18	6.7	17
Lodgepole pine	211	62	0.3	61
Other conifers	3,721	28	5.5	19

Figure 7. Overdue timber as at 31 March 2011 by age class for the Private sector.
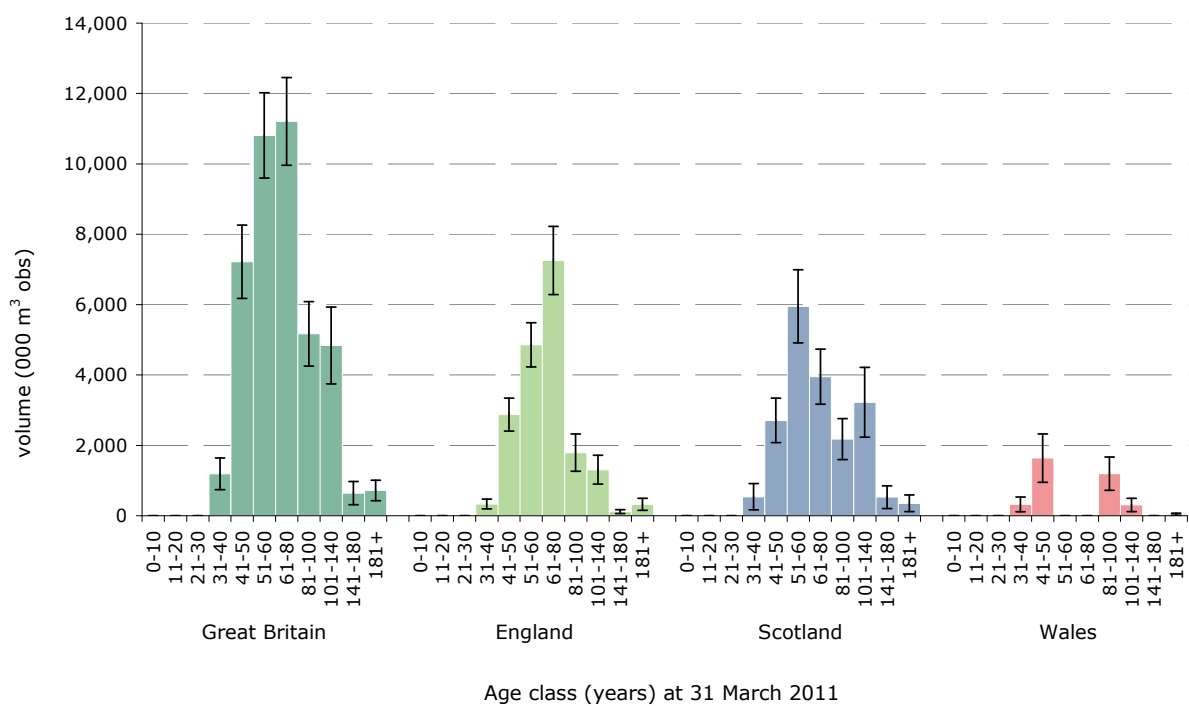
Figure 8. Overdue timber as at 31 March 2011 by principal species for the Private sector.
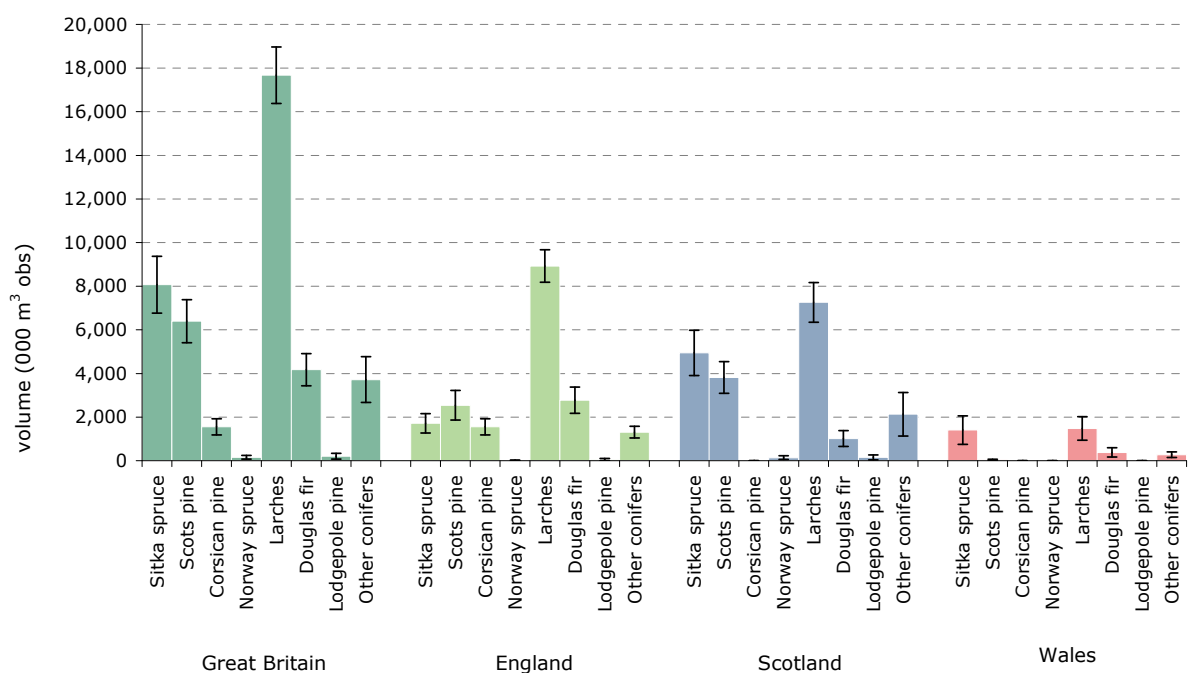
Currently clearfelled area

Mapped forest areas were identified as clearfelled[*] by aerial photography and subsequently updated by satellite imagery. Areas of clearfell that were observed in the NFI field survey (2010 to 2011) are not included in these forecasts. The assumption is made that these areas are not replanted in the future. This assumption is conservative and is used because the NFI has no information on what was planted on these sites before felling and therefore the replanted crop on the 'like-for-like' replanting assumption that is applied for the rest of the forecast period cannot be determined. It is probable that a high proportion of this area will be replanted and will contribute to standing volume, increment, production, carbon sequestered and biomass. Assuming no replanting on these areas will create a small underestimate in most forecasts, especially in later years. There will be much less impact on the production forecast than on standing volume, biomass and carbon forecasts, as such stands, if replanted, would come to full maturity after the forecast period. However, with the increased harvesting without replanting associated with wind farms, open habitat restoration and the current low proportion of coniferous species that are being replanted in some areas, this conservative approach may be appropriate, and is consistent with the approach taken by all previous forecasts. Future forecasts will provide more options on how this land may be utilised in future.

Changes in land use and land management

Although there is a general presumption that forested land stays forested within the UK Forest Standard, land use can change from forest to non-forest, and this impacts upon timber potential. Additionally, at any point in time there are active sales and purchases of land and such transactions often involve a change in approach to harvesting, especially if moving from public to private ownership. The following situations are considered to be those that have most impact on potential volume:

1. Forested land transferring from one ownership to another, whilst remaining as forest
2. Forested land transferring from one ownership to another and undergoing conversion to another land use
3. Forest land being converted to another land use
4. Open land being purchased for afforestation
5. Existing open land being afforested

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[*] On the NFI map, area of clearfell was initially identified by aerial photography and updated by satellite imagery. For the private sector estate, these areas are included in the NFI field sample, and the area of clearfell across the whole private sector estate as at 2011 was estimated from the field sample. Such areas observed in the field sample will sometimes be in non-clearfelled areas on the map, and not all areas of clearfell on the map covered by the field survey will be confirmed as current clearfell areas in the field sample.

For situations 2, 3, 4 and 5 the NFI field work will take account of any apparent land use changes that have happened up until 31 March 2011. This will apply to all areas of woodland within the NFI woodland map and bordering areas of non-woodland that may occur in NFI sample squares. Thus the NFI sample may capture some areas of transition of woodland to non-woodland, and also areas of transition from non-woodland to woodland, especially, in the latter case, instances of expansion of pre-existing woodland area. Other areas of new woodland will be identified through grant scheme information or remote sensing. The NFI forecasts then assume that no further land use changes will occur during the period of the forecast. This assumption may either over- or under-estimate the amount of available growing stock in the future. Since there is no quantifiable evidence to take account of future land use changes, no provision is made for such changes in the NFI forecasts.

With regard to the first situation described above, some information is known about the particular instances where land presently under FC ownership is transferred to other ownership and a description of how this is handled is described in the next section.

Forestry Commission sales of land

The Forestry Commission has previously sold or disposed of significant amounts of forest land. This has been a key driver in the reduction of volume predicted to arise from the Forestry Commission estate when compared to previous forecasts. Sales policy is the responsibility of the respective Ministers of each country and as policy evolves over time planned sales may be increased, decreased or ceased altogether. For example the current Scottish Policy is one of repositioning the estate, involving both purchase of new land and sales of 30,000 hectares of Forestry Commission land over the next few years. In England land sales policy has been reviewed as part of the review undertaken by the Independent Panel on Forestry. However, the forecast must make assumptions about how forest will be managed over the forecast period and thus needs to make assumptions about past, current and potential sales. This is covered within the forecast by:

1. Removing any areas already sold from the FC sub-compartment database and transferring this area to the private sector estate forecast, where stands are assumed to be managed to biological potential constrained by wind risk.
2. Accounting for planned future sales. Forestry Commission flag the year of any planned disposals within the sub-compartment database and these areas will continue to contribute to the Forestry Commission forecast until the date of disposal. After that point these areas and volumes are treated separately and are assumed from the time of disposal to be managed to biological potential constrained by wind risk.
3. All FC land not currently flagged for disposal in the sub-compartment database is assumed to continue to be owned and managed by the Forestry Commission throughout the period of the forecast.

As of 31 March 2011, the Forestry Commission sub-compartment database had around 30,000 hectares flagged for disposal. This disposal programme is an indication of intent and may change over time. These areas and the volume forecast arising from them after the point of sale are accounted for separately from the main forecast tables and are represented in Table 8:

Table 8: production from Forestry Commission land flagged for sale

Country	2012-16 volume (000 m³ obs)	2017-21 volume (000 m³ obs)	2022-26 volume (000 m³ obs)	2027-31 volume (000 m³ obs)	2032-36 volume (000 m³ obs)
England	57	51	47	42	41
Scotland	144	223	273	279	286
Wales	-	-	-	-	-
Great Britain	**201**	**273**	**320**	**321**	**328**

Notes:
1. The harvesting scenario used for these is one of biological potential constrained by wind risk.
2. Whether this land is sold or not and if this harvesting scenario is applied is unknown.

Standing coniferous timber volume

This section gives an estimate of the standing volume (as of 31 March 2011) in living coniferous trees within Great Britain's (GB) woodlands and forests while the following section gives a forecast of standing volume and increment during the next 25 years. Standing coniferous volume is defined as live coniferous stem wood to 7 cm top diameter and excludes roots, below-ground stumps, small branches, foliage and deadwood. It also excludes standing volume in trees in woodlands of less than 0.5 hectares. Increment is a measure of growth in timber volume over time. Net increment is defined as volume growth, inclusive of any harvested volumes, less loss due to natural mortality, including endemic windthrow.

Current standing volume

The NFI has estimated that the total standing coniferous timber volume in GB forests as at 31 March 2011 is 336 million cubic metres. This figure was first published in the NFI Report: *Standing timber volume for coniferous trees in Britain*. The species composition of this total estimate (by percentage of total volume) is: Sitka spruce 50%, Scots pine 15%, larches 11%, Norway spruce 6%, lodgepole pine 5%, Corsican pine 4 % and Douglas fir 4%. This standing volume includes all measurable trees (to 7cm dbh), covering young, pole stage and mature stands. It should also be noted that standing volume estimates do not take account of the conversion loss involved in cutting trees to specific lengths, extraction loss from timber left in the forest and the timber volume held in stumps. Table 9 gives a breakout of standing volume per species.

Table 9. Standing volume by principal species, GB and country

Prinicipal species	FC volume (000 m³ obs)	Private sector volume (000 m³ obs)	SE %	Total volume (000 m³ obs)
England				
All conifers	**26,148**	**60,621**	**3**	**86,769**
Sitka spruce	8,481	9,840	10	18,322
Scots pine	3,896	15,012	7	18,908
Corsican pine	5,359	5,047	11	10,406
Norway spruce	1,759	7,127	10	8,886
Larches	1,710	11,112	7	12,823
Douglas fir	2,595	5,631	12	8,225
Lodgepole pine	800	1,107	25	1,908
Other conifers	1,547	5,963	10	7,510

Prinicipal species	FC volume (000 m³ obs)	Private sector volume (000 m³ obs)	SE %	Total volume (000 m³ obs)
Scotland				
All conifers	**79,558**	**132,827**	**2**	**212,385**
Sitka spruce	51,641	79,930	3	131,571
Scots pine	8,540	22,419	6	30,959
Corsican pine	349	349	50	697
Norway spruce	3,482	5,032	14	8,514
Larches	4,764	12,656	8	17,420
Douglas fir	1,386	2,308	23	3,694
Lodgepole pine	8,391	6,955	10	15,346
Other conifers	1,006	3,244	32	4,251

Prinicipal species	FC volume (000 m³ obs)	Private sector volume (000 m³ obs)	SE %	Total volume (000 m³ obs)
Wales				
All conifers	**18,868**	**17,720**	**7**	**36,588**
Sitka spruce	10,643	9,477	12	20,120
Scots pine	494	301	45	795
Corsican pine	602	252	42	854
Norway spruce	1,437	907	42	2,345
Larches	2,760	3,119	20	5,879
Douglas fir	1,251	1,885	26	3,135
Lodgepole pine	607	424	36	1,031
Other conifers	1,073	1,340	39	2,413

Prinicipal species	FC volume (000 m³ obs)	Private sector volume (000 m³ obs)	SE %	Total volume (000 m³ obs)
Great Britain				
All conifers	**124,575**	**211,167**	**2**	**335,742**
Sitka spruce	70,766	99,247	3	170,012
Scots pine	12,930	37,732	4	50,662
Corsican pine	6,309	5,648	11	11,958
Norway spruce	6,678	13,067	8	19,745
Larches	9,235	26,887	5	36,122
Douglas fir	5,232	9,823	10	15,055
Lodgepole pine	9,798	8,486	9	18,285
Other conifers	3,627	10,547	12	14,174

Source: Forestry Commission
Note: Sampling standard errors (SE) attached to private sector estimates are expressed in relative terms (%) to the right of the relevant estimate. obs = overbark standing.

Figure 9 shows how this standing volume is distributed between age classes of stands.

Figure 9. Standing volume by age class by country and GB as at 31 March 2011
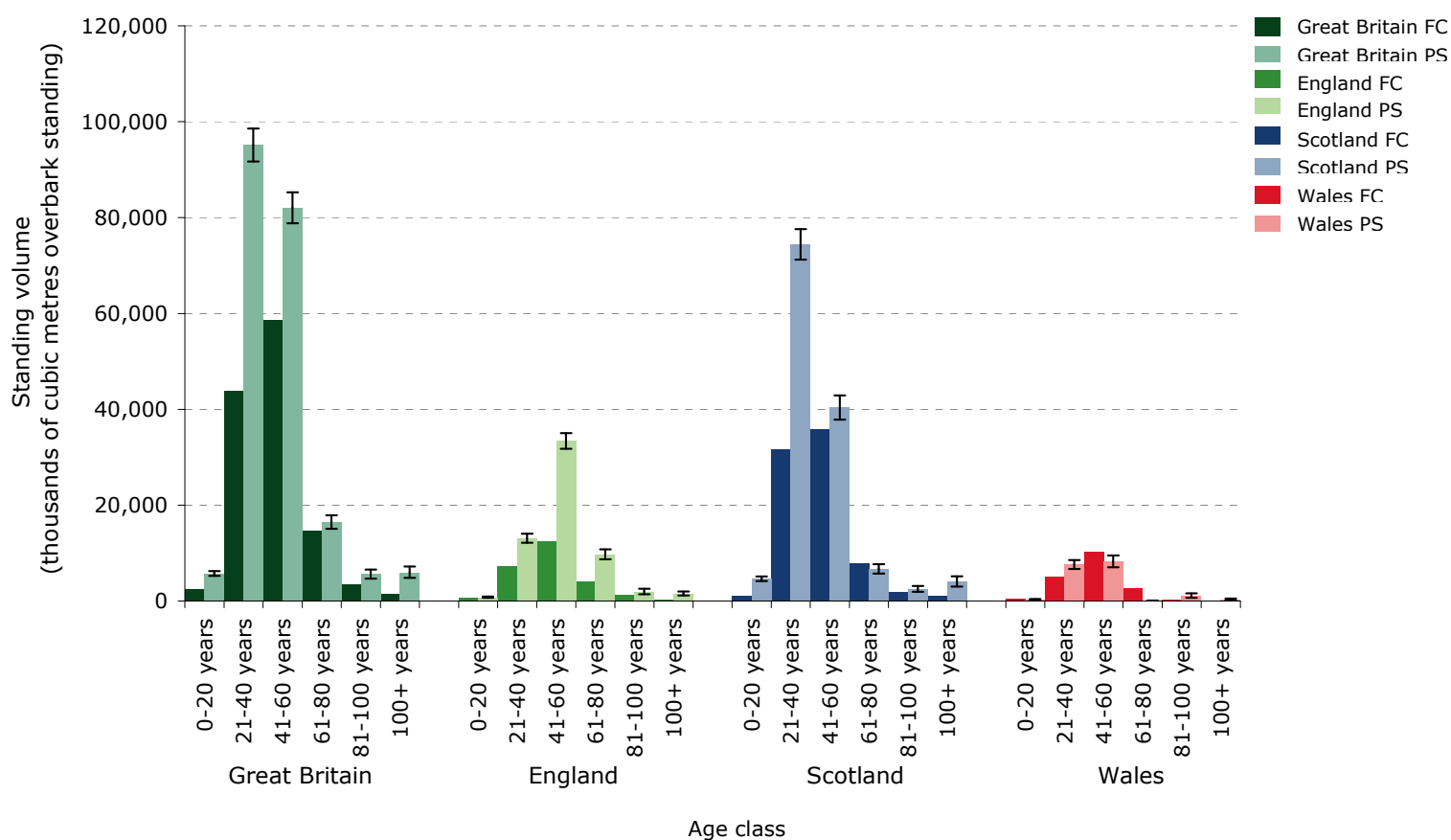
Forecasts of standing volume and increment

Forecasts of standing volume and increment are dependent upon two main factors:

- The inherent characteristics of the forest such as species, age and most importantly the rate of timber growth
- The predicted levels of removal of standing volume of timber from the forest through harvesting

These forecasts of standing volume and increment are conditional upon forests being harvested as currently planned on the Forestry Commission estate (FC estate) and as assumed in the private sector estate. The following figures and tables show how current standing volume will evolve over the next 25 years if the same harvesting scenarios used to derive the forecast of availability are applied to standing volume and increment. Other harvesting scenarios are possible and what is presented is a single option out of many. Market conditions, owner choices and physical and biological factors will determine when timber is actually harvested and in turn will affect the impact of that harvesting on the level of standing volume remaining. Some standing volume could also be lost to pests or wind and these variables have not been factored into these forecasts. The paper on *Interpreting NFI Timber Volume Forecasts* discusses how such factors influence the amount of timber that will be harvested in any period.

Figure 10 shows the overall evolution of standing volume over the forecast period in GB and in each country resulting from application of the harvesting scenarios.

Figure 10. 25-year forecast of average annual standing coniferous volume
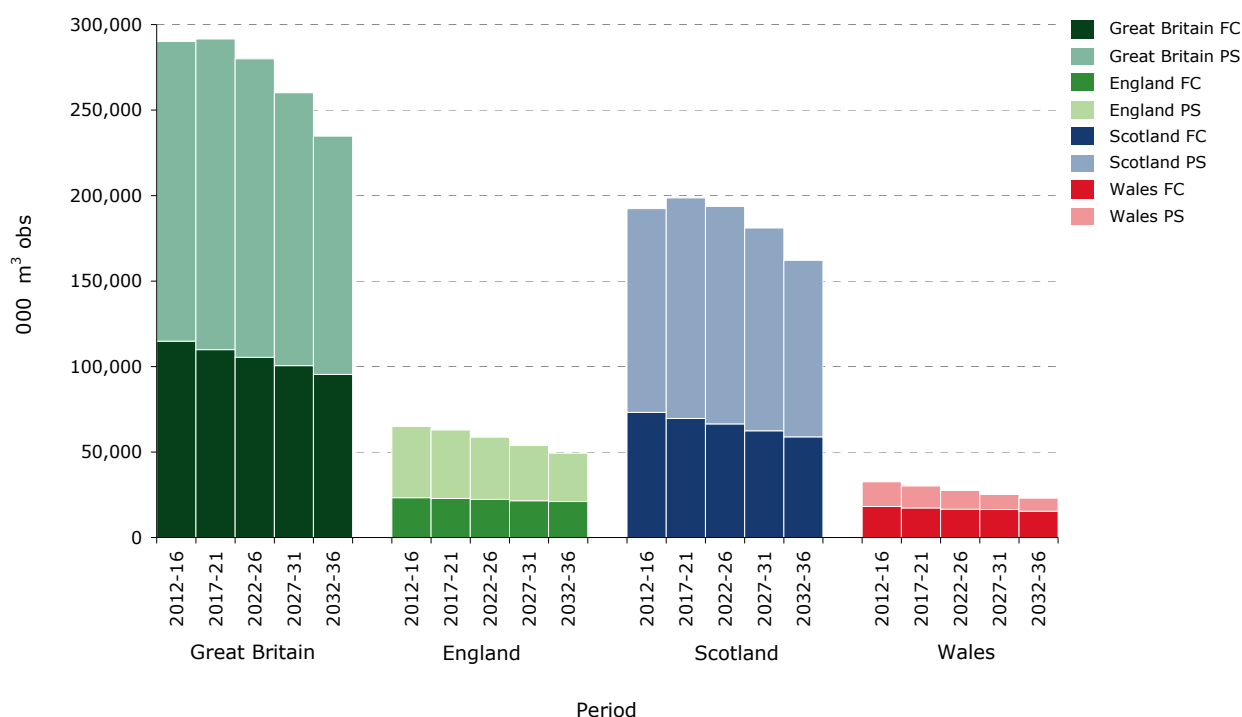
Source: NFI and Forestry Commission

The overall decline in standing volume over the forecast period, as seen in the results displayed in Figure 16, reflects in the main the underlying age class structure of forests. The post war boom in planting is coming to maturity and is now being harvested, which results in the reduction in standing volume. The rate of harvesting predicted is the same as that used within the forecast and shows that this rate of harvest exceeds the rate of increment. This rate of harvesting also impacts upon the annual increment. Annual increment can be thought of as the total amount of growth that all forests undergo within a year. Figure 11 shows that average annual increment for the 5 year period's declines over the 25 years.

Figure 11. 25 year forecast of average annual coniferous increment
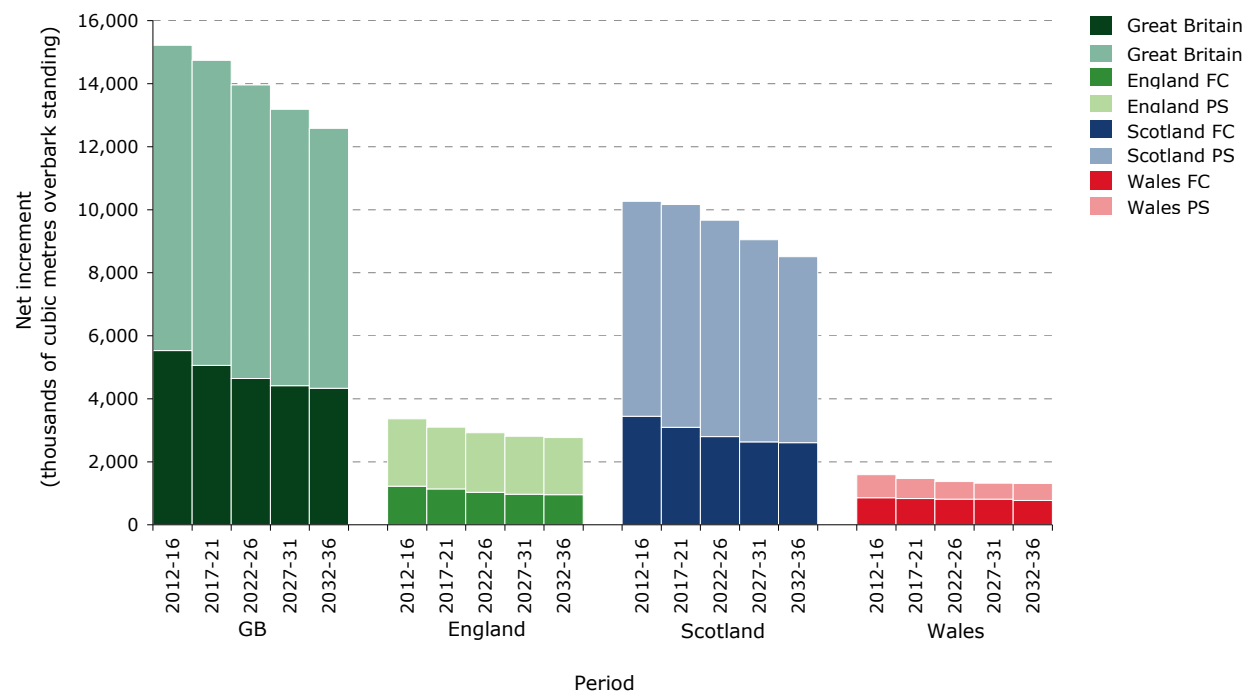
Source: NFI and Forestry Commission

This decline comes as a result of expected future harvesting levels, which are largely driven by the age structure of the resource, exceeding levels of natural growth. This occurs because harvesting removes older stands with higher increment and these are replaced with stands of younger trees, which have a lower annual increment. Thus total annual increment reduces over time. The NFI Statistical Analysis Report: *GB 25-Year Forecast of Standing Coniferous Volume and Increment* explores these findings in more depth.

Figure 12. 25-year forecast of standing volume, net increment and production – FC estate
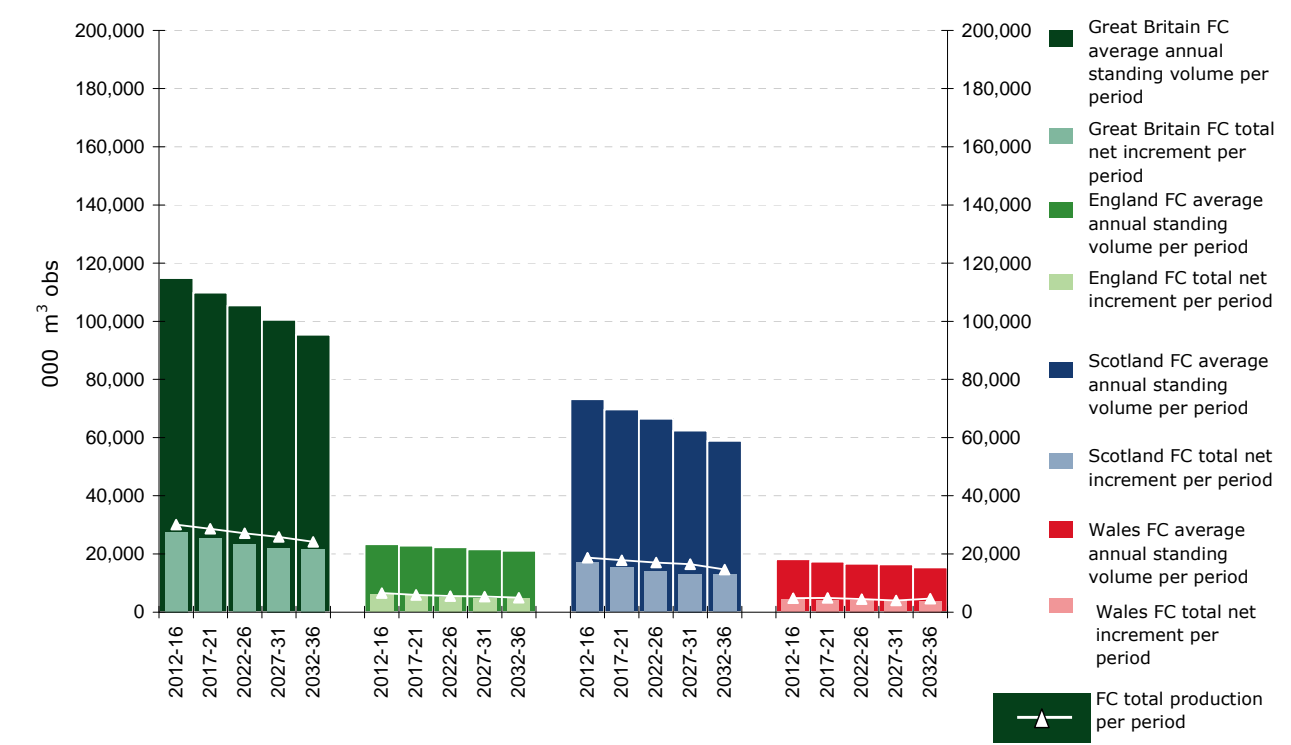
Figure 13. 25-year forecast of standing volume, net increment and production – Private sector estate
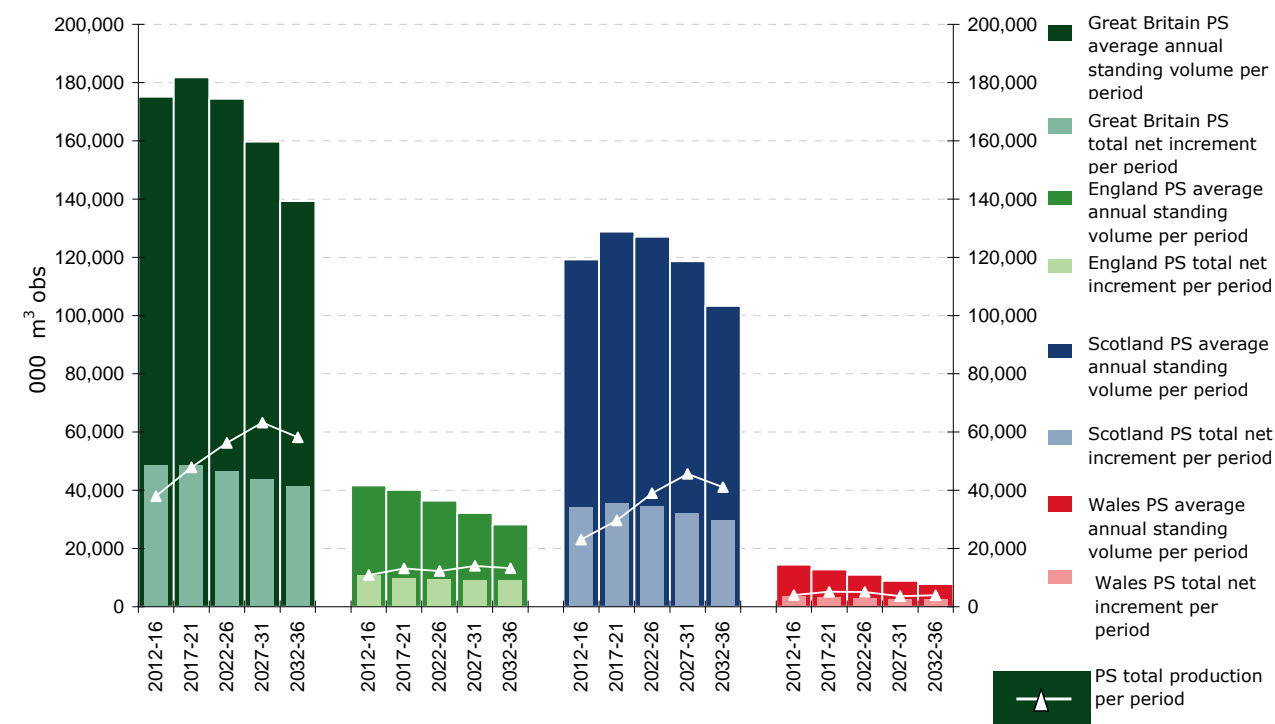
Discussion

Comparison between overall volume in the 2005 and 2011 forecasts

The general trend in the combined public and private sector estate volume is comparable to that of previous forecasts so far as harvested volumes rise to a peak within the forecast period and reduce for the remainder of the period. The peak in the 2011 forecast is in the 2027-31 period and fell in the 2017-21 period, while in the 2005 forecast it occurred in the 2017-21 period. The 2011 forecast profile of production is determined by the current age structure of forests in GB and also by the management assumptions used in the forecast scenario, both of which reflect the boost in planting in the post-war period which lasted until the late 1980s. However, even though the shape of the overall profile is similar between the two forecasts the timing is different and the total amount of available timber forecast is significantly higher in the 2011 forecast. Whilst Forestry Commission and Forest Service production is reasonably similar to previous forecasts, private sector potential production is significantly higher compared to previous forecasts, especially so in Scotland. Tables 10 and 11 give direct comparisons between the 2011 and earlier forecasts.

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Forestry Commission estate

Figure 14. Comparison of 2000, 2005 and 2011 FC estate softwood availability forecasts for GB and countries

	2000	2005	2011	% change 2000 to 2011	% change 2005 to 2011
England					
2007-11	1,497	1,368	-	-	-
2012-16	1,482	1,430	1,305	-12	-9
2017-21	1,414	1,403	1,183	-16	-16
2022-26	1,218	1,199	1,110	-9	-7
2027-31	1,211	-	1,072	-11	-
2032-36	1,125	-	985	-12	-
Scotland					
2007-11	3,477	3,232	-	-	-
2012-16	3,756	3,769	3,749	0	-1
2017-21	4,432	4,102	3,568	-19	-13
2022-26	3,833	3,697	3,417	-11	-8
2027-31	3,389	-	3,305	-2	-
2032-36	3,214	-	2,930	-9	-
Wales					
2007-11	1,006	789	-	-	-
2012-16	1,006	881	958	-5	9
2017-21	1,006	793	979	-3	23
2022-26	981	746	893	-9	20
2027-31	636	-	795	25	-
2032-36	508	-	927	82	-
Great Britain					
2007-11	5,980	5,389	-	-	-
2012-16	6,244	6,080	6,013	-4	-1
2017-21	6,852	6,298	5,730	-16	-9
2022-26	6,032	5,642	5,420	-10	-4
2027-31	5,236	-	5,172	-1	-
2032-36	4,847	-	4,841	0	-

(Average annual volume in thousands of cubic metres overbark standing)

Figure 15. Comparison of FC estate forecasts for 1995, 2000, 2005 and 2011
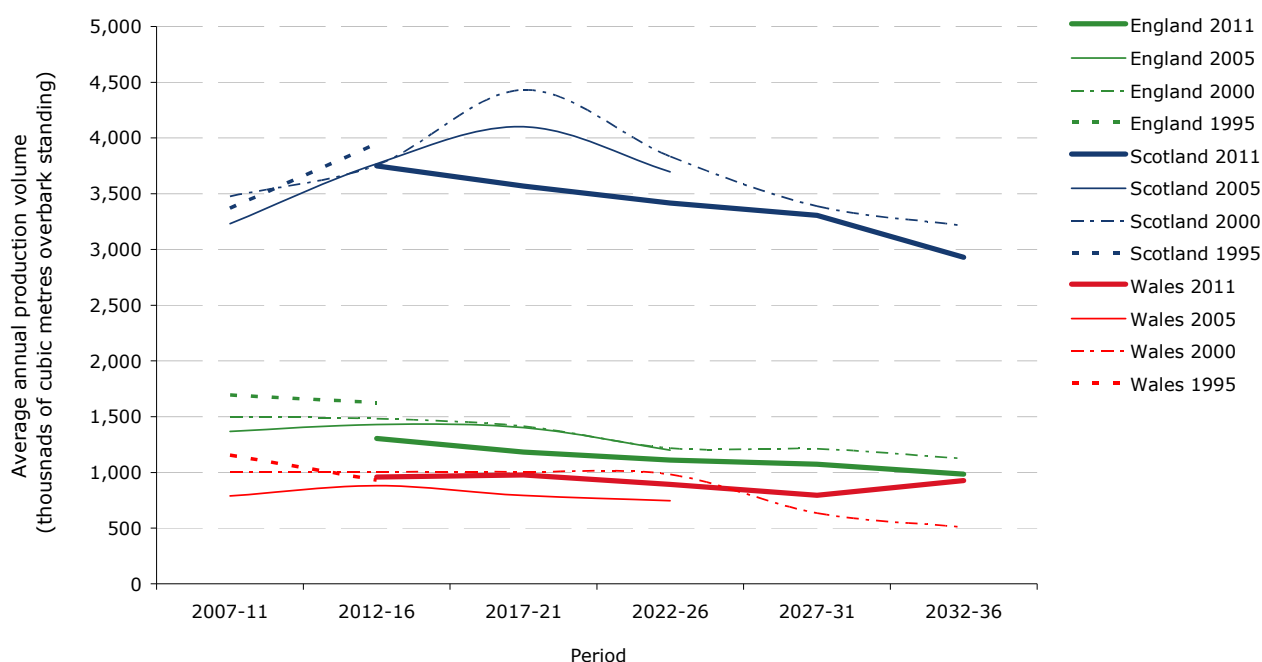
The FC/FS estate forecast volume is broadly comparable with the forecast in 2005. The methodology for the assessment of the area and the composition of the FC estate has not changed substantially since 2005 and consequently, in broad terms, the FC estate forecast has not altered substantially between 2005 and 2011. The FC approach to felling and thinning has also not significantly changed in that period. There has, however, been some improvement to the Forestry Commission growth and yield models which the forecast uses and which now better reflect levels of mortality, and also production from non-standard crops. The main difference this has made is in stocking levels and assortments, resulting in higher stocking and slightly higher levels of larger diameter products. However, it should also be noted that Forestry Commission Scotland is in the process of implementing a realignment of production, which will move some volume from the short to medium term overall. FS are also engaged in a similar process of production realignment during which production will not be increased beyond the current level.

Within this broad similarity there is however a slight downward shift of 5% in total volume over the first three periods in the 2011 forecast compared to the 2005 forecast. This has resulted in maximum production occurring in 2012-2016 as opposed to 2017-21 in the 2005 forecast. A significant element of this reduction is the result of Forestry

Commission land sales. All the areas sold between April 2005 and March 2011 have been removed from the Forestry Commission area (around 20,000 hectares of land - net) and have been transferred into the Private Sector area in the 2011 forecast, which has reduced Forestry Commission volumes and increased Private Sector volumes. Another 40,000 hectares of Forestry Commission land is marked for sale between 2011 and 2014 and these areas have been forecast separately, reducing the overall Forestry Commission figures. Whether these future sales actually occur is a matter of country policy. Another element that contributes to the reduction is Forestry Commission forest management policy, which currently involves retaining more volume for longer periods for sustainable forest management purposes. However, this picture of decline in Forestry Commission forecast production at a GB level varies between the countries; while production in both England and Scotland is projected to decline over the forecast period, production in Wales is projected to increase.

Private sector

Production volumes forecast for the private sector estate have noticeably changed from those projected by the previous forecast. They are now substantially higher, largely due to the significant revision of the base inventory data arising from the NFI.

NFI Statistical Analysis Report

Table 11. Comparison of 2000, 2005 and 2011 softwood availability forecasts for the Private sector

(Average annual volume in thousands of cubic metres overbark standing)

	2000	2005	2011	% change 2000 to 2011	% change 2005 to 2011
England					
Allocated overdue	4,109	3,537	0		
Unallocated overdue	6,782	7,854	18,866		
2007-11	1,966	1,858	-	-	-
2012-16	2,122	2,002	2,184	3	9
2017-21	2,202	2,155	2,626	19	22
2022-26	2,057	2,201	2,450	19	11
2027-31	1,960	2,025	2,804	43	38
2032-36	1,806	1,825	2,637	46	44
Cumulative production	57,515	58,896	82,375	43	40
Scotland					
Allocated overdue	6,521	8,677	0		
Unallocated overdue	9,047	3,661	19,443		
2007-11	4,443	3,661	-	-	-
2012-16	5,351	4,380	4,614	-14	5
2017-21	5,713	4,840	5,917	4	22
2022-26	6,108	5,006	7,796	28	56
2027-31	6,164	5,042	9,131	48	81
2032-36	5,650	4,877	8,213	45	68
Cumulative production	153,976	124,388	197,798	28	59
Wales					
Allocated overdue	1,071	1,262	0		
Unallocated overdue	1,311	455	3,501		
2007-11	669	669	-	-	-
2012-16	731	746	793	8	6
2017-21	714	761	1,025	44	35
2022-26	652	746	1,008	55	35
2027-31	609	661	713	17	8
2032-36	553	544	791	43	45
Cumulative production	17,611	17,743	25,153	43	42
Great Britain					
Allocated overdue	11,701	13,475	0		
Unallocated overdue	17,140	11,970	41,810		
2007-11	7,077	6,188	-	-	-
2012-16	8,204	7,128	7,591	-7	6
2017-21	8,630	7,756	9,569	11	23
2022-26	8,817	7,954	11,255	28	42
2027-31	8,733	7,728	12,648	45	64
2032-36	8,008	7,245	11,641	45	61
Cumulative production	229,102	201,027	305,325	33	52

Source: Forestry Commission

Note:
1. In the 2000 and 2005 forecasts, part of the total overdue volume was allocated to future production and is contained within the quoted periodic forecasts of production.
2. Cumulative production is summed over the period 2012-2036 and also includes unallocated overdue volumes.
3. Table includes previously unpublished figures from the 2005 private sector forecast

Figure 16. Comparison of Private sector forecasts for 1995, 2000, 2005 and 2011
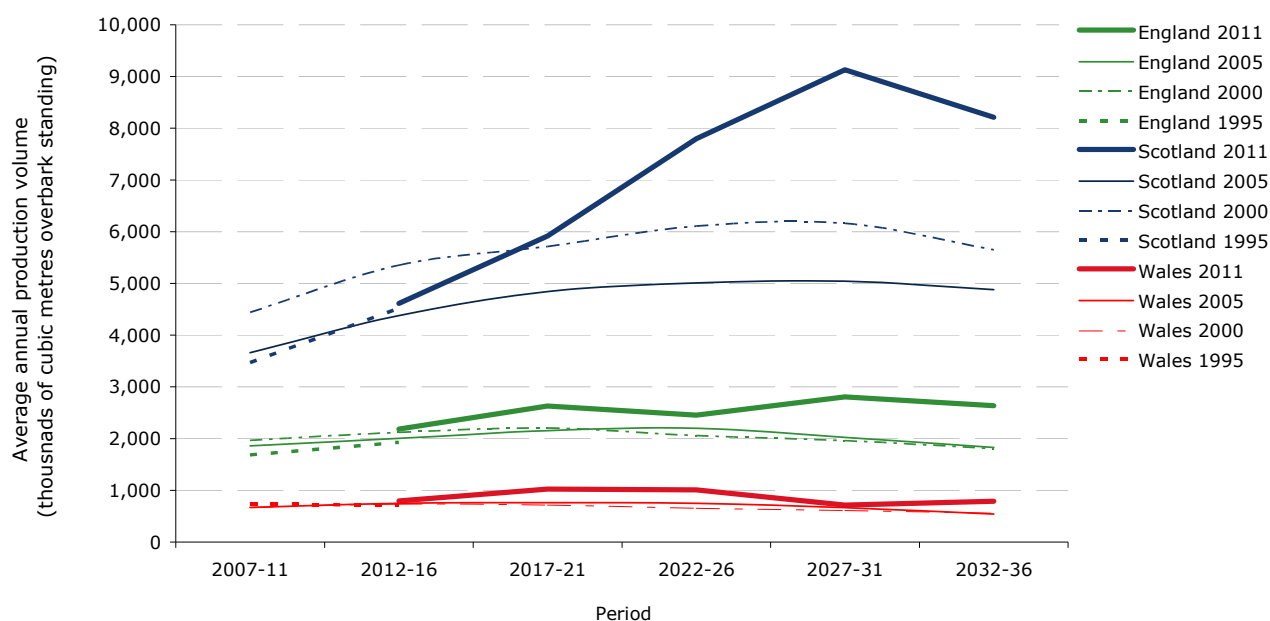
In making these direct comparisons between the private sector forecasts it should be noted that;

- The 2000 and 2005 volumes have a proportion of overdue timber allocated within the overall forecast totals. The 2011 forecast reports these separately. If all or part of the overdue volume in the 2011 forecast was allocated in a similar fashion to that in the 2005 forecast it would further increase the rise in potential availability. That would enhance the increase in volume between the previous and current forecasts in figure 16

- The 2000 and 2005 volumes are based upon an industry view of likely felling patterns, whilst the 2011 forecast assumes felling to biological potential which elevates volumes by around 7% within the 25 year period.

The table and figure in appendix B separates out the issue of using different harvesting assumptions by running the 2005 harvesting assumptions on the 2011 forecast data . This provides a like for like comparison between the forecasts.

This rise in potential production from the private sector alters the proportion of total timber production potentially arising from the private sector estate relative to the public

sector estate. It rises from 56% in 2012–16 to 71% in 2032–36. This is higher than the 58% in 2032-36 predicted by the 2005 forecast.

Over both sectors, 67% of the timber forecasted is from spruce – rising from 62% in 2012-16 to 70% in 2022-31, and moving to 66% by the end of the forecast.

The proportion of volume forecast to fall into categories of larger diameter timber products for the FC estate and the private sector estate has increased from the 2005 forecast. This reflects a number of factors, including the first direct measurement of crops for dbh and stocking density. Improvements in the growth and yield models also add to this picture and now better reflect lower levels of mortality in unthinned Sitka spruce crops, leaving more trees alive, with a smaller average dbh. (Appendix C shows the distribution of dbh found in the plots in the private sector estate.) It can be seen that the mean dbh for Sitka spruce is relatively small, showing that, overall, crops are relatively young compared to their size at year of maximum MAI.

Main factors behind the differences between the 2005 and 2011 private sector forecasts

Analysis of the input data has shown that the differences between the forecasts are due to five main factors:

1. Area: There is estimated to be 8% more woodland and 5.6% more stocked conifer area in GB than was used in the previous forecast.
2. Yield classes: Estimated private sector estate yield class for all conifers is about 13% higher than previously estimated.
3. Felling ages used: The 2011 private sector estate production forecast uses year of Maximum MAI, whereas the previous estimate used assumptions about when the private sector is likely to fell creating a 6% difference in cumulative volume.
4. Standing volumes at time of clearfell: The standing volumes per hectare at time of clearfell are higher in the 2011 forecast (based on modelled growth applied to directly measured stands) than in the 2005 forecast (based entirely on modelled stands). This makes the most significant difference between the forecasts.
5. Treatment of overdue woodland: There have been changes in the definitions of overdue and how it is treated within the forecast, with overdue being partially allocated to felling in 2005 and reported separately in 2011.

The sections below discuss the differences in the forecasts, including how these five main factors have contributed to the differences.

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Area

It is important to be aware of the distinction between gross area and net area when interpreting the forecasts. All area figures quoted for the private sector are quoted in net stocked area, which means that all the area occupied by mapped open space and deciduous trees is excluded.

The identified area of conifer in the private sector estate has increased from 735 thousand hectares used in the 2005 forecast to 775 thousand hectares in this forecast. For the individual countries the areas are:

- England 192.6 thousand hectares in 2011 compared to 189 thousand hectares in 2005.
- Scotland 532.1 thousand hectares in 2011 compared to 487 thousand hectares in 2005.
- Wales: 49.7 thousand hectares in 2011 compared to 59.1 thousand hectares in 2005.

Most of these differences are attributable to the improved assessment of private sector estate area. In 2005 it was assumed that there were 717,069 hectares of coniferous woodland capable of producing sawn timber and 18,251 hectares of woodland suitable for roundwood only production. This split was based upon a visual assessment by the surveyor, where stands were classified into those capable of providing sawn timber, small roundwood or firewood only. In the 2011 inventory this was assessed as 775 thousand hectares in total, which is higher in spite of the high rates of harvesting in the intervening five years. The area of Sitka spruce assessed in the NFI and used in the 2011 production forecast is 356 thousand hectares. This is more than that used in the 2005 production forecast, increasing from 333 thousand hectares of timber potential woodland and 7 thousand hectares of roundwood potential, totalling 340 thousand hectares across both grades. The differences in area are mostly due to increased accuracy in measuring the gross woodland area via the NFI map (compared to NIWT). This gross area assessment is further improved upon by assessing the net coniferous area within that gross area. This is achieved through using the detailed assessment of forest/non-forest, species composition, stocking, basal area and crown dimension data recorded within the NFI field sample. This gave a more detailed analysis of the composition of woodland area compared to NIWT, which probably contained more open space and broadleaves in the conifer area than was reported.

There has also been a significant advance in the identification and measurement of areas of clearfell in recent years through the use of remote sensing technologies. The total amount of clearfelled sites (up to around 10 years of age, including restocked areas not yet apparent in aerial photography) in GB woodland is approximately 183,000 hectares. This represents around around 8 to 12% of conifer area, a portion of which will be

restocked with new conifer crops.. This indicates an active programme of recent felling and this will have reduced the standing mature conifer area over the last 10 years. This further suggests that the conifer area was under-estimated at the time of the 2005 forecast.

Finding of higher rates of clearfelling over the last 10 years indicates that there has probably been a reduction in the area of stocked coniferous forest available for production in 2011 compared to the area available in 2005. However, the 2005 assessment underestimated total coniferous forest area at the time and it is evident that this underestimate exceeded the subsequent losses of mature conifers from clearfelling in the intervening period. This results in the present forecast being based on a larger estimated coniferous area.

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Forestry Commission yield classes

For the FC estate average yields (yield classes) are assessed on a stand-by-stand basis, with every stand being allocated a yield class. Some of these yield classes (especially when applied to young crops) are estimates, while others are based on direct measurement. Figure 17 shows the FC estate Sitka spruce yield class distribution, and Table E. 1 in Appendix E gives a breakdown of the yield class distributions of the main species by country.

Figure 17. FC estate Sitka spruce mean yield classes
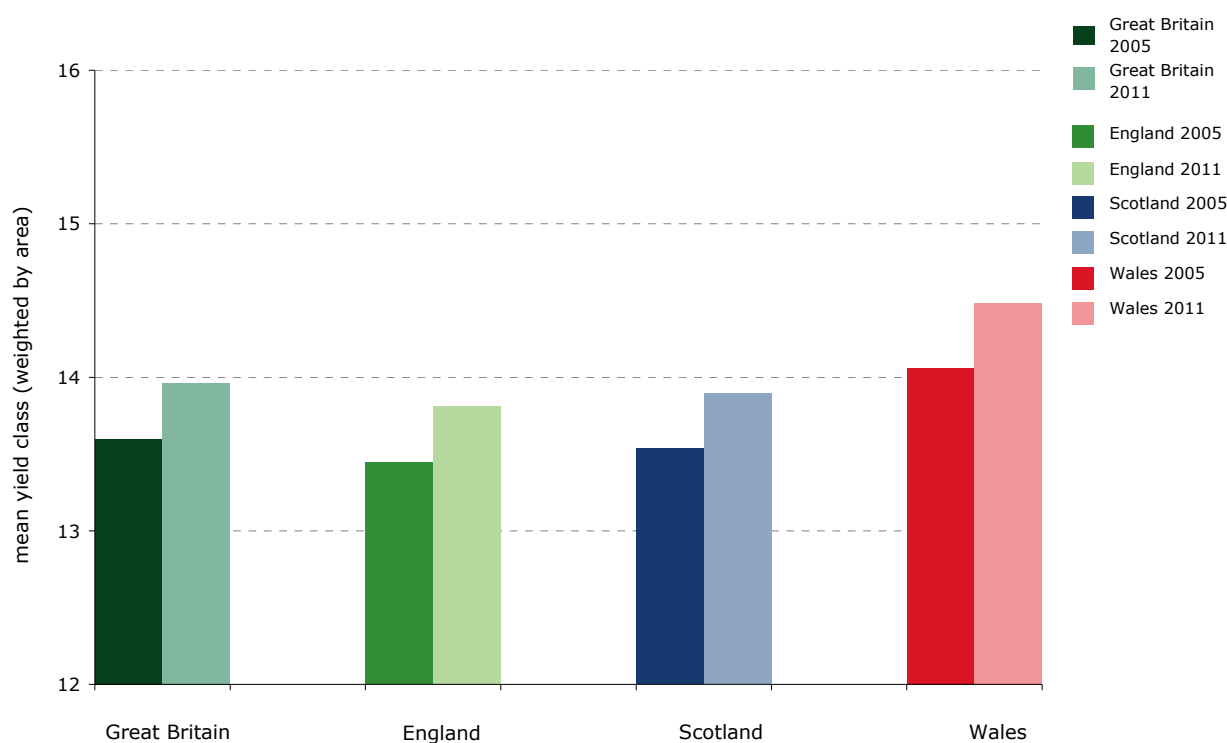
Source: Forestry Commission

Notes:
1. Yield classes are based on sub-compartment database (SCDB) records.
2. The mean yield classes shown are calculated from stands in the age range of 15 to 50 years.
3. Ages are taken from administrative data as at 31 March 2011.

The increase in yield class observed in the Forestry Commission estate, will have arisen as part of ongoing improvements in the inventory of the forests managed by FC. It may also reflect the removal of some strata of yield classes through the felling that has occurred between 2005 and 2011.

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Private Sector yield classes

For the private sector estate in GB average yield class across the main species is higher than used in the 2005 and 2000 forecasts, with Sitka spruce and all other species yield classes being higher than previously estimated (Figure 18). This is a significant finding and has a notable impact upon volume, increasing productivity and yield across most stands. The yield classes used in previous private sector estate forecasts were either estimates based upon industry expertise, equated to the mean yield classes recorded in the FC estate or were a hybrid of these two. Those used in this forecast are determined from direct assessment of stands found in the NFI sample squares. Table E.2 in Appendix E gives a breakdown of the yield class distributions of the principal species by country.

Figure 18. Private sector estate Sitka spruce mean yield classes
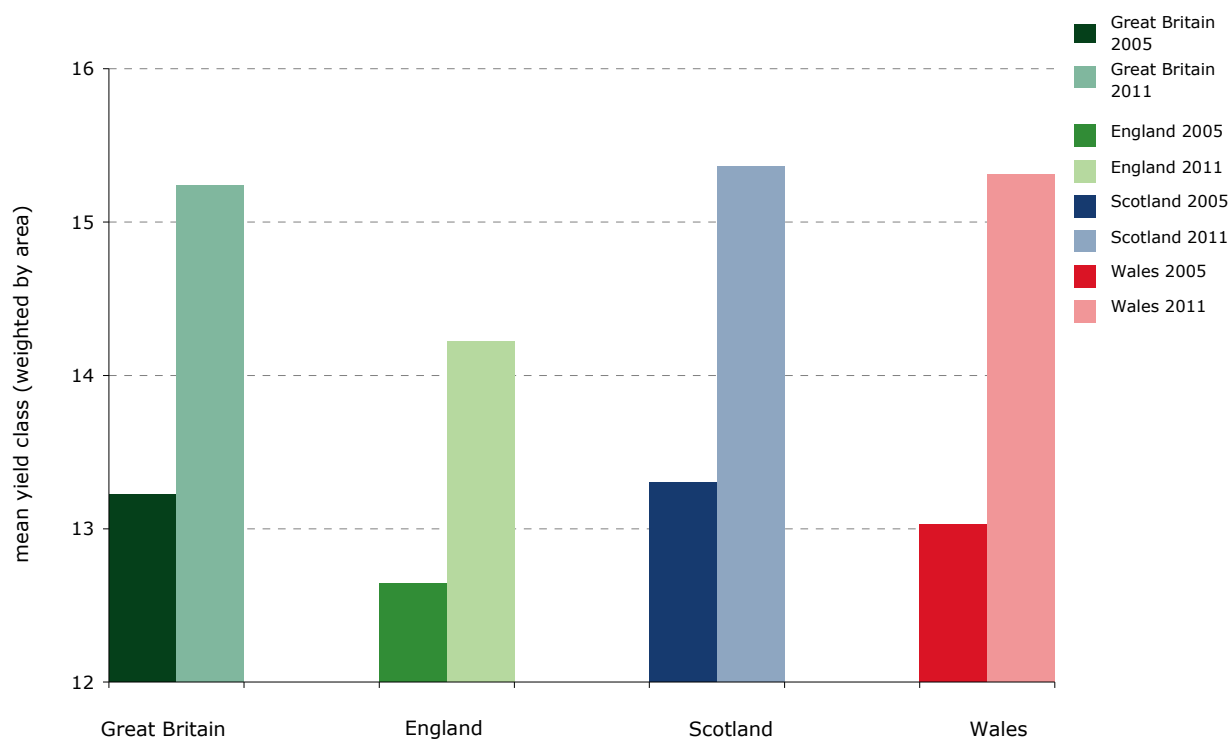
Source: Forestry Commission

Notes:
1. Yield classes are based on NFI field measures of height, species and age.
2. Ages assessed in the field survey have been checked and calibrated against administrative and tree boring data.

It will be noted that there are some differences in yield class between the FC estate and private sector estate. At the GB level, mean yield classes for both Sitka spruce and All conifers are higher in the private sector estate. This is thought to be as a result of:

- A proportion of FC estate yield classes are estimates, which studies in some regions show to be slightly conservative.
- Based upon an analysis of DAMS score and forest ownership it was observed that the private sector estate holds a higher proportion of less exposed land.

Felling ages used

In the private sector estate there is neither a comprehensive record of felling and thinning plans, nor a commitment to harvest a given amount. Consequently, without specific information on plans for felling or thinning in the private sector estate, a prescriptive and formulaic future management scenario has been used to determine potential future production from this sector. This scenario has been chosen after extensive consultation with private sector woodland owners and timber processors. This is a change from using expert opinion on fell ages in the 2005 forecast.

The basic assumption used is that most private sector forests are managed under a biological potential regime, within which it is assumed that felling takes place at the age of maximum mean annual increment (maximum MAI). This maximises long-term timber productivity in a formulaic and widely understood manner. For thinning operations, a similar approach was taken by applying a series of prescriptions set out in Forestry Commission Management Tables or Management Table Intensity (MTI) to areas not generally at significant risk from windthrow if thinned. In areas considered to be at high exposure to wind risk, as determined by the detailed aspect methodology score (DAMS), a strategy of no thinning, and felling conditional upon attainment of an assumed terminal height, was prescribed.

This forecast therefore defines an upper limit to long-term potential taking account of adjusted management strategies in areas considered to be exposed to wind risk. However, it is unlikely that the private sector estate will manage all stands to this prescription and actual volumes harvested will vary, dependent on private sector practice. This approach differs from the approach used in the previous three forecasts of private sector production, where industry opinion of future harvesting approaches were used to set rates and timings of harvesting. However, given the uncertainties surrounding future rates of harvest, this was thought to be an unreliable approach. In its place, felling at maximum MAI is used in combination with the use of alternative harvesting scenarios for comparison and sensitivity analysis.

For the purposes of understanding the impact of this choice, the 2005 private sector felling assumptions were applied to the 2011 private sector estate inventory data. This harvesting scenario shows that 6% less timber would be produced in terms of cumulative timber production for the same forecast period if the 2005 industry derived assumptions were used. However, these differences in harvesting approach do not

account for the bulk of the increase in potentially available volume. This shift is primarily due to the improved inventory data arising from NFI, with an increase in woodland area and increased stocking and yield classes in private sector woodland (points 1 and 2).

Table 12 presents two forecasts, based on either the 2005 or 2011 datasets, but both using the same management assumptions (those used in 2005). This comparison mainly illustrates the impact of the new inventory data arising from the NFI, but also includes the effects of other updates in the intervening period, such as improvements to yield models.

Table 12. Comparison of 2005 and 2011 PS forecasts using the same management data

	Allocated overdue	Unallocated overdue	2012-16	2017-21	2022-26	2027-31	2032-36	Cumulative production
	volume (000 m³ obs)	volume (000 m³ obs)	volume (000 m³ obs)	volume (000 m³ obs)	volume (000 m³ obs)	volume (000 m³ obs)	volume (000 m³ obs)	volume (000 m³ obs)
England								
2005 Data	3,537	7,854	2,002	2,155	2,201	2,025	1,825	58,896
2011 Data	0	21,632	2,468	2,522	2,087	2,285	2,244	79,659
Difference			23%	17%	-5%	13%	23%	35%
Scotland								
2005 Data	8,677	3,661	4,380	4,840	5,006	5,042	4,877	124,388
2011 Data	0	40,188	4,530	5,899	6,286	5,810	6,602	185,819
Difference			3%	22%	26%	15%	35%	49%
Wales								
2005 Data	1,262	455	746	761	746	661	544	17,743
2011 Data	0	4,337	821	903	843	559	509	22,515
Difference			10%	19%	13%	-15%	-6%	27%
Great Britain								
2005 Data	13,475	11,970	7,128	7,756	7,954	7,728	7,245	201,027
2011 Data	0	66,158	7,818	9,324	9,216	8,654	9,355	287,993
Difference			10%	20%	16%	12%	29%	43%

Source: Forestry Commission

Notes:
1. The two forecasts are run with the same management assumption for thinning and felling that were used to run the 2005 forecast (industry prescription). The 2011 forecast has not allocated overdue timber for felling during the forecast period, unlike the 2005 forecast.
2. The 2005 forecast above includes an allocated additional 13.5 million cubic metres of timber from overdue within the average annual totals (which has been subtracted from the total overdue, the remainder being unallocated)
3. The 2005 forecast used a combination of the 1997 NIWT data and industry expertise for inventory data.
4. The 2011 forecast used the NFI for inventory data.
5. The differences highlighted in the table are primarily ascribed to the use of improved inventory data in 2011.
6. Cumulative production is calculated over the period 2012-2036, and includes unallocated overdue timber.

The application of the same management assumptions to the 2005 and 2011 inventory datasets, produces a significantly different level of cumulative volume, with the 2011 inventory being much higher. This shows that the difference between the forecasts is primarily due to the improved inventory data, not the felling ages used.

These are significant increases in available private sector volume and the question that will be raised is as to whether or not this volume will be harvested. Current actual timber production at around 6 million cubic metres per annum for GB in the private sector is

less than forecast (an average of 7.6 million cubic metres per annum over the next five year period). This apparent difference may disappear if production were to rise strongly over the next five years. However, various factors may constrain this from happening, such as that some stands are uneconomic to harvest, owners' preferences, customs and practices, and general macro-economic factors. Figure 6 illustrates the impact upon production of applying a range of different harvesting scenarios to the private sector and shows how even small changes to assumptions about felling and thinning practice can have a significant impact upon the scale and timing of production. The *Interpreting NFI Forecasts* paper explores this aspect further.

Standing volumes at time of clearfell

Previous forecasts for the private sector estate assumed a standing volume at time of fell, based upon Forestry Commission growth and yield models. This modelled standing volume assumed a certain level of thinning (to MTT) and mortality. The 2011 forecast however, is based upon a measured assessment of stocking at time of survey, which gives a more direct and accurate estimate of current standing volume and a more accurate starting point for modelling future stocking and standing volume. The current assessments from the NFI field survey show higher levels of stocking than would be predicted by the growth models incorporating thinning to MTT, which have evidently resulted from previous under-thinning and a lower level of mortality than the models previously predicted. It should be noted that NFI stocking rates are based on net area occupied by conifers, with mapped open space and area occupied by broadleaves removed.

Treatment of overdue stands

Overdue woodland is defined as woodland that is still standing at an age later than that determined by the harvesting scenario's prescriptions for felling. In the 2005 production forecast, a large proportion of overdue timber was allocated for harvest in the subsequent 20 years. This was achieved by setting a series of felling prescriptions, dependent upon geographic region and the species, age and yield class of the crops. This overdue volume in the 2005 forecast accounted for about 25.4 million cubic metres of potential timber production. Since the base data of the 2005 forecast was collected in the mid 1990's, it had a baseline date of 1995. This required updating to a 2005 baseline to reflect the harvesting and planting that had occurred between 1995 and 2005. Through this a 2005 baseline, which formed the starting point for the 2005 forecast, was created. To achieve this it was assumed that some overdue timber would be felled between 1995 and 2005. It was further assumed that some would also be felled within the 2005-2025 forecast period. Through this process 13.5 million cubic metres of overdue timber were assumed to be felled by the forecast between 1995 and 2015. As a consequence, the 2000 and 2005 forecast volumes included volume allocated from overdue timber.

The private sector estate 2011 production forecast uses the biological potential forecast scenario to set fell years, where the average age of felling is greater than that used in the 2005 forecast, which was based on industry opinion. The overdue volume for the 2011 forecast is shown in figures 2, 4 and 5 and Table 6 and accounts for 42 million cubic metres of timber. In the 2011 production forecast, overdue volume has not been allocated to be produced in a specific year, as was implemented in the 1995, 2000 and 2005 forecasts. It has instead been reported separately to the main forecast and no assumption has been made about when this will be harvested (see the paper *Felling and Removal Forecasts* for further details on overdue allocation). These two changes between the 2005 and 2011 forecasts lessen the difference in the average annual forecasts of total volume produced and the timing of volume produced. It does not affect cumulative production for the period, as this includes all overdue. If overdue was allocated to the 2011 forecast as it was in 2005, the forecast of timber availability would be greater within each 5-year period and would thereby show greater increases in periodic production compared to previous forecasts.

Other factors behind the differences between the 2005 and 2011 private sector forecasts

Levels of management activity

Levels of past management can give an indication of how stands will be managed and harvested in the future. This uses the assumption that if stands have been in the hands of owners who were, or are, currently active in managing and thinning their stands, then they are more likely to continue to do so. Such information can be used to assess what proportion of stands may be thinned and harvested in future and is presented in the following figures.

Many private sector woodlands are managed (Figure 19) and a significant proportion are thinned (Figure 20).

Figure 19. Evidence of management
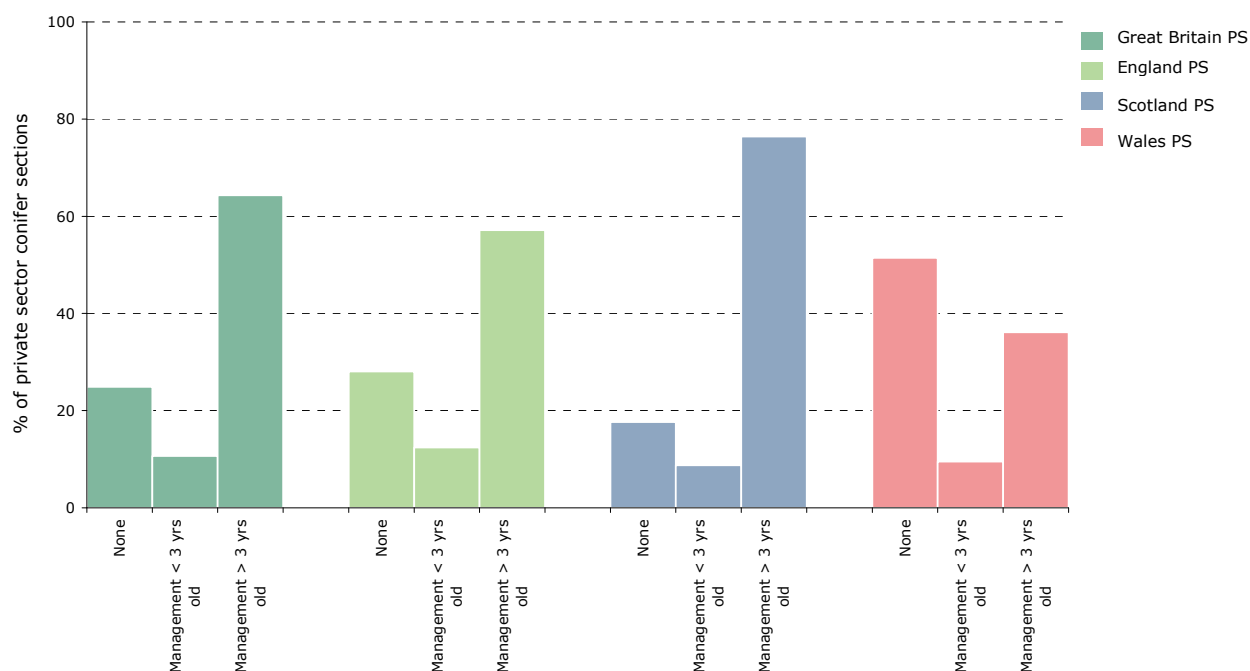
The criteria used for assessing management covers most forest management activities, such as establishment, thinning and clearfelling, and as active management for recreation. For a stand to register an activity that activity must have occurred within the NFI sample square, not the woodland as a whole. The activities assessed in the survey are listed in the *Interpreting NFI Forecasts* paper. Figures 19 and 20 distinguish between recent activity (less than 3 years ago) and older activity (greater than 3 years ago).

Figure 20. Evidence of thinning
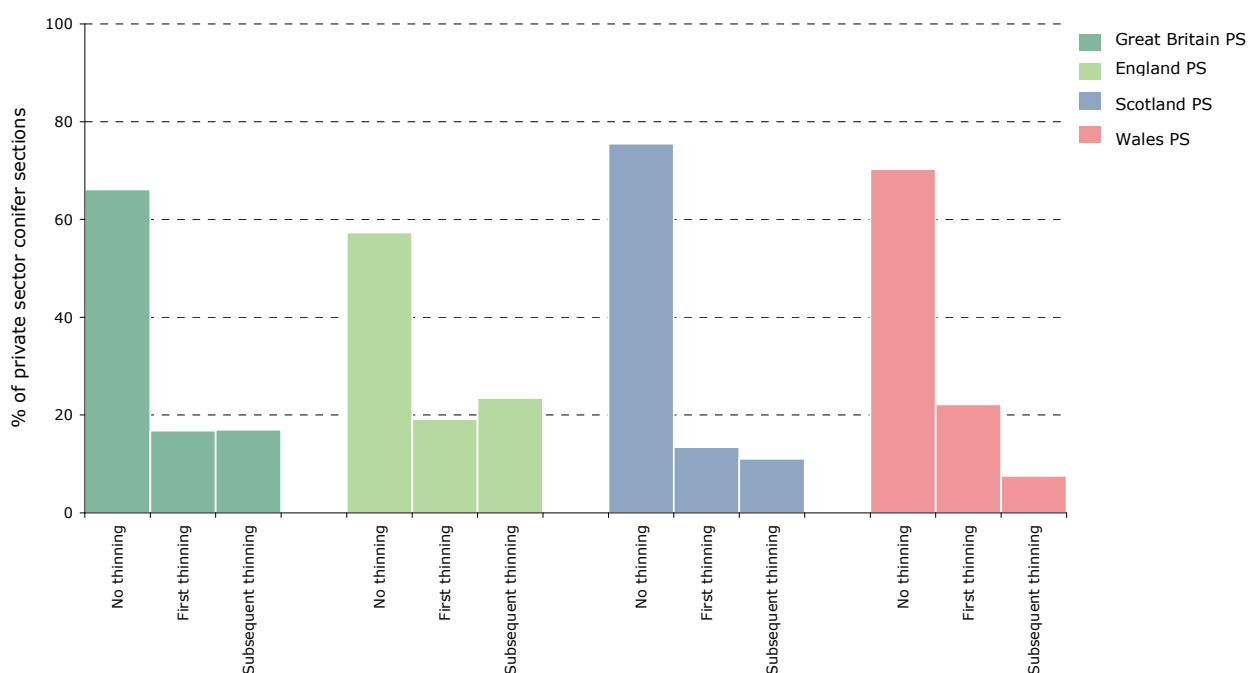
Harvesting constraints

Owner choices may be constrained by physical site factors, which make management or harvesting problematic. The 2011 forecast and past forecasts have taken this factor into account in different ways. The 2005 forecast used NIWT data that showed that 1-2% of forest area would not be harvested due to stands being either difficult or impossible to harvest and this 1-2% was netted off the total forecast volumes. The 2011 forecast has been slightly less prescriptive and has not netted off any area of woodland due to these factors, on the assumption that few areas are impossible to harvest. However, some areas are more difficult to harvest and are as a result potentially less likely to be harvested. On this basis such stands are not excluded outright from the forecast and have therefore been left in the area used in the 2011 forecast. The information is provided to assess the effect of excluding these areas from the forecast. It accounts for a small difference between the forecasts, but the proportions of area involved are relatively small.

The National Forest Inventory has measured some of the factors that will help to determine if some stands can be harvested or not, or if they are less likely to be harvested. The proportion of area found where such constraints may apply is similar to

those predicted in the 2005 forecast. Many factors affect whether a stand can be physically harvested including slope, access and roading and these areas are reported in the following figures. However it cannot be fully determined on this information whether owners will choose to harvest these 'difficult' stands or not.

Most sites assessed are capable of being harvested (Figure 21) and most sites are less than 200 metres from a forest or public road that can take a commercial timber lorry (Figures 26, 27 and 28). The survey does not assess if there are restrictions on such roads for timber haulage, which will be the case for a proportion of these roads.

Figure 21. Suitability for harvesting

Legend:
- Wheeled vehicle on site possible
- Wheeled vehicle on site impossible
- Sky line site
- Mechanised harvesting impossible
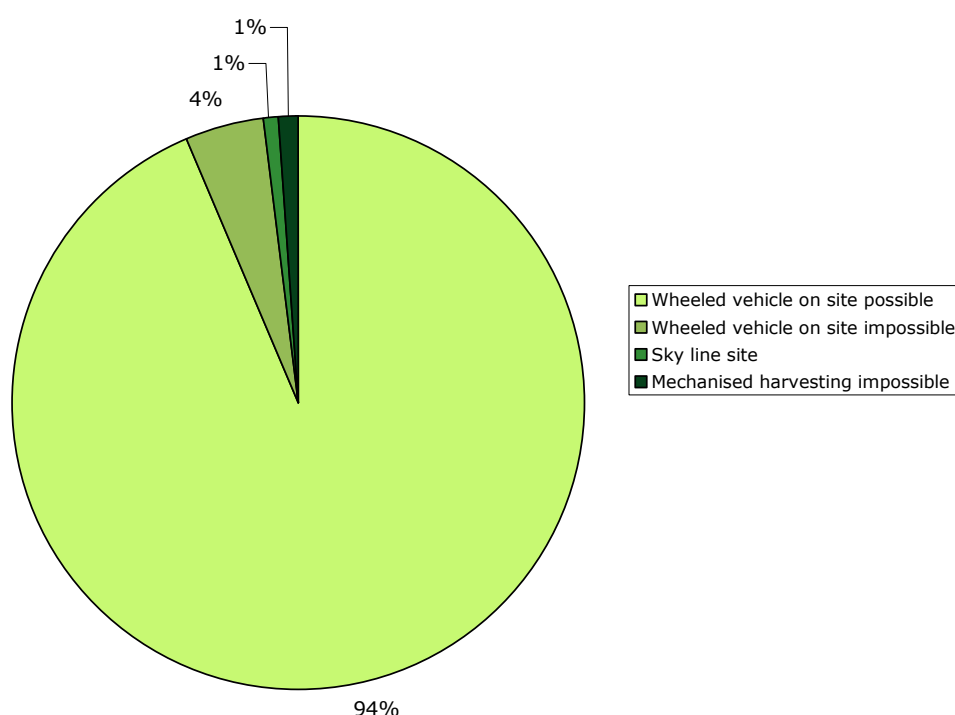
The assessment criteria set for surveyors when gathering this information is:
- 'can a harvesting vehicle get on site?'
- If not, 'can a skyline be used or is it not possible to get any sort of mechanised harvesting on site?'

This is assessment considers *site* conditions regardless of the tree cover. Sites are categorised as:

- Wheeled vehicle on site possible – this category includes *any* mechanical harvesting: wheeled harvesting vehicles, tracked harvesting vehicles and skylines
- Wheeled vehicle on site impossible - tracked vehicles or skylines only can be used

- Sky line site – the site is such that only skylines can be used to harvest the site (e.g. for steep slopes where it would be dangerous or impossible for tracked or wheeled vehicles to operate)
- Mech. Harvesting Impossible
- Not Possible to Assess (this option is allowed when a surveyor cannot access the site)

Figure 22. Distance to roads physically capable of timber haulage
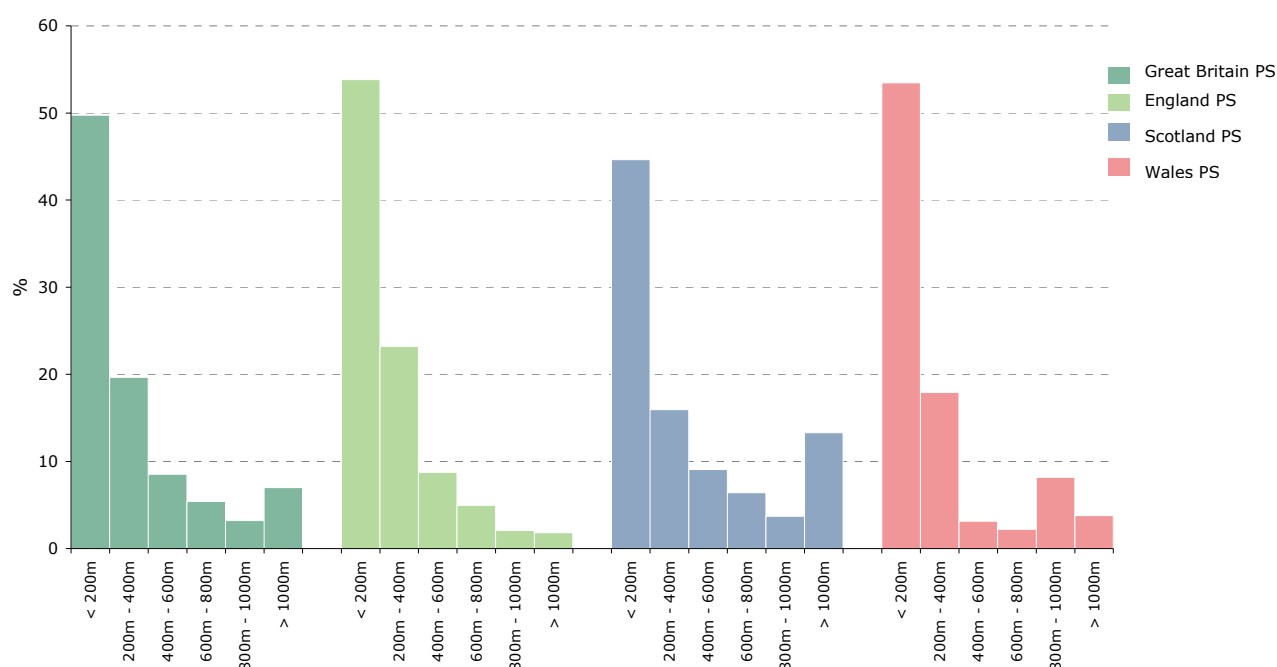
Distance from square to road

This is the distance, as the crow flies, to the nearest category 1A road (able to take a 32 ton timber lorry) or better. The Surveys Handbook notes that 'CAT 1A' roads within the forest are defined as:

- principal timber haulage route on a long-term basis;
- constructed to high specification;
- maintained to a high standard;
- all year but not all weather;

These can be assessed either as a map exercise or by field assessments. Distances are recorded as:

- <200m
- 200 – 400m
- 400 – 600m
- 600 – 800m
- 800 – 1000m
- > 1000m
- Not Possible to Assess

As noted, the survey does not assess if the roads identified are restricted from timber haulage, or if the road accessed by the stand only leads to roads that could not support timber haulage.

Figure 23 shows the proportion of squares which have either roads or rides present, and Figure 24 shows the type of road or ride.

Figure 23. Road or ride in survey square
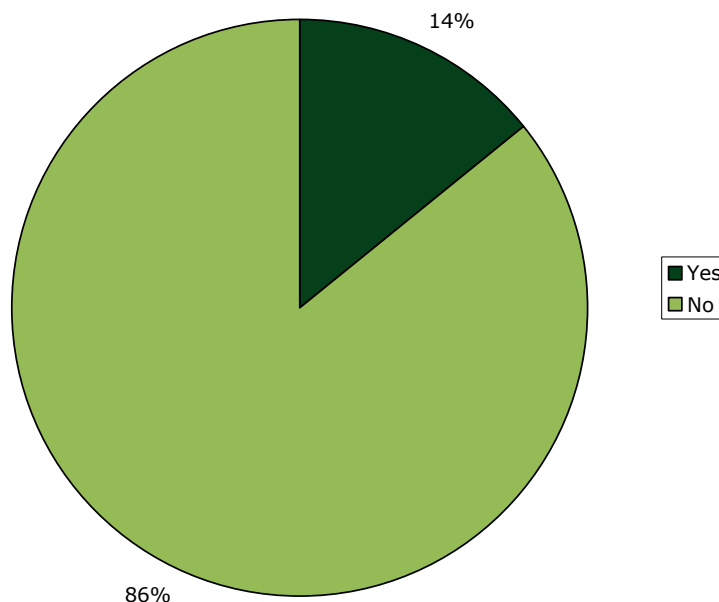
Figure 24. Type of access in survey square
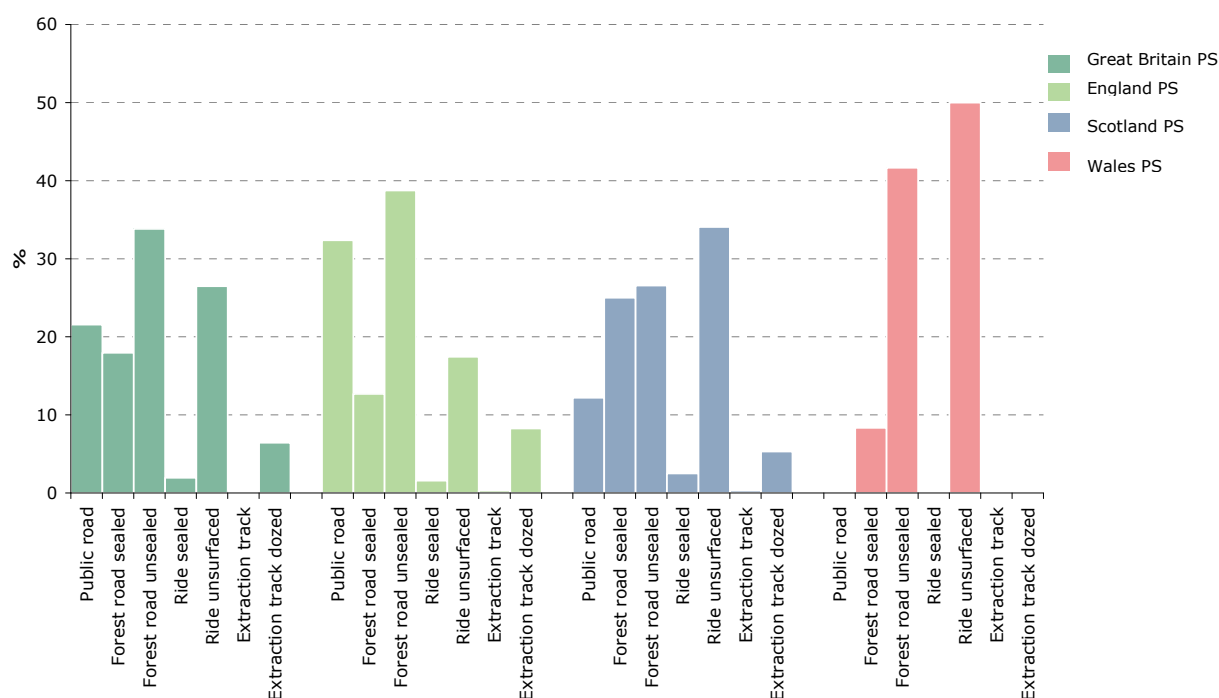
Types of access

A transport route is assessed and mapped as a linear feature regardless of its length and size within the sample square. The open space associated with the feature will *also* be mapped and assessed as a separate area as long as it meets the area criteria of ≥0.05ha within the square.

- Public Road - A road over which the public has the right of access. Also includes Private roads.

- Forest Road sealed surface - A road through the forest for use by the owner and workers – bituminised

- Forest Road unsealed surface - As above but metalled not bituminised

- Ride sealed surface - Rides are often vegetated, un-metalled or un-surfaced corridors often giving access to or through a forest. They also include de-classified category 1A roads that are no longer maintained but still surfaced.

- Ride unsurfaced - Rides are vegetated, un-metalled or un-surfaced corridors often giving access to or through a forest.

- Extraction rack: Dozed - A dozed path/corridor through the forest that is used to extract timber (Linear Feature assigned to the main Rack only)

- Extraction rack - A path/corridor through the forest that is used to extract timber (assign Linear Feature to the main Rack only)

The results show that most coniferous timber could be harvested if owners chose to do so. Most stands are physically thinnable or manageable in terms of wind risk, and slope and access do not appear to form substantial restricting factors across the private sector stands. However, a much higher proportion of stands show no physical signs of thinning and management. This difference probably reflects that owner choice and economics play a larger part in determining rates of harvesting than physical constraints. Only 1 % of stands assessed have a terrain that prohibits mechanised harvesting and 94% of stands can accommodate tracked or wheeled vehicles for the purposes of harvesting. Less than 10% of stands are more than 1 kilometre from roads that can accommodate a commercial timber wagon and the majority are within 200m of such. This roading assessment however does not take account of any restrictions that local authorities may place on the use of roads and in some areas this can be significant. It should also be noted that the surveyor assessment of haulage capacity is based upon a visual assessment of the load-bearing capacity of the road. In some cases the actual underlying construction and condition of the roads may not support sustained timber haulage.

Age and year of planting in NFI

The methodology section covers how yield class is assessed for the forecasts. Stand age data is used to assess yield class and to provide general age class information, so it is important to assess this correctly. Age estimation in the field can be difficult to achieve accurately, especially in older broadleaves and in some older conifers. To ensure the best possible data in this sensitive area the NFI has set up:

- in-depth field instruction is this area (see *NFI Survey Manual*)
- rigorous quality assessment procedures
- training to ensure field estimates are as accurate as possible.

However, the tree age data are largely subjective estimates, rather than being obtained by direct measurement, as is the case with dbh and height. It is therefore important to check and calibrate these estimates.

This was achieved by first comparing the field assessment of age of stands with other recorded mensurational data to check for consistency. Field assessments that passed these tests were then related to administrative records of planting years, where these existed and were recovered. The sources used for administrative data were Forestry Commission records on FC land or owners' inventory data on private sector land. Such records were recovered for about 10% of surveyed squares (including squares on FC land that have not been used in this forecast). In addition, increment boring of trees was performed in about 1% of surveyed squares as an accurate assessment of tree ages, for comparison with both assessed ages and administrative records.

After this data validation process, calibrating relationships between field assessment ages and ages determined from administrative planting records were constructed using statistical regression techniques. The field assessment ages of all stands in all surveyed squares were then adjusted according to the result of these calibrating relationships and these adjusted estimates have been used as final estimates of planting years and ages of stands in the NFI database.

The calibrations removed most of the subjective biases that were apparent in the field assessment data. The overall standard deviation of the resulting calibrated estimates of age about the ages according to administrative records was of the order of 8 years, but, as one would expect, calibrated assessments of ages of younger crops tended to exhibit much less difference from their ages according to administrative records.

Impact of restocking

There are two factors which both the 2005 and 2011 forecasts had to manage with reference to restock:

1. The forecasting of existing restocked sites
2. The forecasting of sites to be felled and restocked over the 25 year forecast period

In the 2011 forecast any crops that were restocked on the ground before 31 March 2011 will have been measured in the NFI survey (2010 to 2012) and will have been included in the forecast on that basis. In the 2005 forecast the inventory data used was surveyed between 1994 and 1998 and, as a consequence, assumptions had to be made on the rates of felling and type of restocking that occurred in the intervening period through to 2005. This will have led to some inaccuracies and variability in the 2005 forecast that is not present in the 2011 forecast.

For areas felled within the forecast period, the 2005 forecast included no restocking after clearfell for the FC estate. For the private sector estate it did include restocking and the restocking used was based upon industry opinion on current (as of 2005) restock practice. The 2011 forecast, however, does include 'like-for-like' restocking in the

forecasts. In the 2011 forecast, those crops which are predicted to be felled after 2012 will be replanted with the same species of the same yield class as the previous crop. This assumption is a simplification of what is likely to be a more complicated future practice, where planting approaches will be different in the future to those in place during planting of the crops harvested in the forecast period. An example of such differences would be the widely held opinion within the forest sector that through current planting practice many stands will increase their proportion of open space and broadleaves. Consideration should also be given to current forested area losses associated with renewable energy projects, open habitat restoration and the low proportion of coniferous species that are being replanted in some areas. The advent of improved stock and the potential of better tree growth conditions for second rotations could also be assessed.

The use of 'like-for-like' restocking is clearly an assumption and other replanting scenarios are possible in the future. The impact of restocking on production volumes is minimal, however, as these crops will come to maturity after the forecast period. A small volume does arise in later periods of the forecast; these arise from the early thinning of higher yield class crops that were felled early in the forecast period. The impact of this on the comparison between the 2005 and 2011 forecasts is not significant compared to some other factors, especially the improvement of the base inventory. In the future NFI will provide restocking scenarios, in a similar fashion to that of harvesting scenarios, to explore such assumptions further. The *Interpreting NFI Volume Forecasts* paper explores the impact of restocking in more detail.

The impact of current and future 'factors' on production

In the 2011 forecast an attempt has been made to highlight and separate the issues of measuring the growing stock from predicting how this growing stock may be managed and harvested in the future. To help achieve this, analyses have been performed using a number of alternative harvesting scenarios that illustrate the impact of various different approaches to harvesting upon future production (see figure 5). A number of scenarios have been evaluated, including biological potential with and without thinning, thin only on non-exposed sites, no harvesting and management based on 2005 industry expert opinion. The *Interpreting NFI Timber Volume Forecasts* paper explains further how rates of harvesting and thinning in particular can impact upon forecast volumes and the timing of their harvest. When interpreting the forecast presented here, it should be borne in mind that the scenarios in figure 5 and discussed in the *Interpreting NFI Timber Volume Forecasts* paper illustrate a range of possible alternative outcomes. In addition to these long-term harvesting choice-related factors, other factors are also likely to have an impact on production over the period of the forecast. These harvesting factors include:

- Tree health issues such as:
    - red band needle blight (also known as Dothistroma needle blight)
    - Phytophthora
- market and economy
- wind farms
- windblow
- heathland and open habitat restoration

The following sections present a snapshot of how these factors have been treated within the forecast and how current Forestry Commission and private sector policy would currently approach such issues. How these issues are addressed over time is a matter of owner policy.

The Forestry Commission approach to managing harvesting factors on the FC estate

Forest design plans are renewed every ten years and are subject to mid-term review. While the aggregate (national) impact of such reviews is unlikely to be significant in the first five years of the forecast, there is more uncertainty regarding the timing and nature of harvesting in subsequent periods. Forecast volumes and assortments of timber products post-2016 should therefore be regarded as a statement of likely availability rather than of definite management intent.

Outside the design planning process, factors (as listed above) can impinge upon the plan, and these then need to be accommodated within the planning process. If large unplanned volumes of timber are harvested (e.g. in response to windblow or disease outbreaks), these are likely to substitute for, rather than add to volumes scheduled from other unaffected stands through a mechanism of compensating adjustments to the management plans applying to such non-affected stands.

Factors that have the possibility of impacting at a national level and the policy on dealing with these are listed below:

- Dothistroma needle blight. This disease will reduce future yields but it is too early to evaluate these effects within this forecast. Standard practice in this area is generally one of active management and substitution where necessary in Corsican pine stands. Sanitation felling is rarely necessary and early and heavy thinning to minimise the level of infection is the usual FC estate prescription. Such fellings, where applied or anticipated to be applied are reflected within the forecast. Such action, however, is unlikely to prevent yield class from tapering off dramatically from point of infection in heavily infected stands, and volume production (from Corsican pine in particular) will be reduced as a result. This is not reflected within the forecast. Corsican pine forms a noteable element of the English growing stock, where this disease is an issue. In

Scotland Corsican pine represents a very small element of the growing stock and forms less of a problem. In the short term, in species such as lodgepole pine and Scots pine, sanitation felling is becoming a more necessary prescription. Where such volumes have been 'lost' due to infection, these will where possible be substituted with production from other areas, thereby maintaining production in the short term. However, if rates of infection are significant complete substitution will prove problematic. Also, as sanitation felling involves reduction in rotation length some reduction in overall production is anticipated, but not as of yet quantified. Forestry Commission Scotland anticipate that most of the necessary clearances will occur within the next 5 years.

- Phytophthora. This disease will reduce future yields but again it is too early to forecast these effects within this forecast. Infection is currently restricted in the main to the south west of England and west Wales, where the impact of Phytophthora is significant. There is some infection in west Scotland and recent surveys have seen an increase in its incidence in this area, so whilst this is not currently considered to be an issue in FC Scotland, that position may change in the future. Sanitation felling is the usual prescription for management and where this has occurred or has been planned this is reflected in the forecast. This has brought a great deal of larch production forward for harvesting in recent years and this trend is set to continue. Standard practice is to substitute this volume for other volume that was to have been harvested so that overall production remains the same in the short term. In such circumstances species and assortments will change. See the *Interpreting NFI Forecasts* paper for the forecast volumes associated with susceptible species.
- Market and economy. The Forestry Commission, at a country level, is committed to make a proportion of the volumes forecast for 2012–16 available to the market through a combination of existing contracts and new opportunities for purchase. Therefore, whether the market is buoyant or depressed, it will have minimal impact on FC estate production, the objective of which is to stabilise supply to the processors. Details of the level of commitment to this production are set out in the methodology.
- Wind farms. Standard practice is for timber substitution in relation to wind farms, so that when timber is harvested as the result of wind farm development an equivalent amount of timber that was due for harvest is withdrawn from the harvesting schedule elsewhere, so that overall production remains the same.
- Windblow. In most instances standard practice is to substitute volume brought to market due to windblow with timber already scheduled for harvest. The objective is to keep overall production levels commensurate with planned volume output. In such circumstances species and assortments will change. Occasionally windblow events are so extreme that they cannot be accommodated within the existing plan by such substitutions.
- Heathland and open habitat restoration. The Forestry Commission has an active policy of heathland and open habitat restoration. Forestry Commission policy is to bring the

timber on such sites to market and to substitute this for already scheduled timber, keeping production to the same level. These areas will then be removed from production permanently.

Private sector practice on managing harvesting factors

The private sector harvesting scenario used to generate the forecast is more susceptible to being affected by factors such as disease, windblow and windfarms than the FC management plans scenario. This is because the private sector by its nature has different compensatory facilities associated with these factors compared to that of the Forestry Commission. The private sector is not a single entity in terms of organisation and as such has no single plan of production. As a result it has no single set of target levels of production to adhere to or aim for. In the face of an emergent requirement to reschedule production, the opportunities and likelihood of substitution at a national level are much more limited. Private sector practices for managing harvesting factors are listed below:

- Dothistroma needle blight). Where possible the private sector is likely to adopt a similar approach to that of the Forestry Commission.
- Phytophthora. As noted above, although it is currently restricted in the main to the south west of England and west Wales, with some infection in west Scotland, the impact of Phytophthora can be significant in localised areas. Sanitation felling is the usual prescription and has brought a great deal of larch to the market in England and Wales in recent years and this trend is set to continue. However, since larch represents a small proportion of production volume, the overall impact of management of this disease should not be significant at a national level over the forecast period.
- Market and economy. Timber prices are significant determinants in the timing of domestic private sector timber production. Domestic timber prices have fluctuated significantly, with large swings in prices for standing timber and consequently large swings in the rates of harvesting activity. Beyond the actual physical nature and extent of the growing stock, such movements in price are likely to be a significant determinant in the future level of harvesting in the private sector estate.
- Wind farms. The approval of such projects that involve woodland loss are the responsibility of the planning authorities. As wind farms are a relatively recent phenomena there is no predominant approach adopted by the private sector on how the effect of clearfelling and woodland loss for wind farms is managed in terms of production regulation and thus how this could affect potential production is unknown.
- Windblow. Where possible the private sector is likely to adopt a similar approach to that of the Forestry Commission.
- Heathland and open habitat restoration. At present there is no uniform approach adopted by the private sector for the management of heathland and open habitat

restoration sites in terms of regulating production, but such activities are regulated by the Forestry Commission through the issue of felling licences.

The relationship between past forecasts and actual production

Figure 25 shows actual timber production in GB compared with past forecasts. Before 1995 there was a close similarity between forecast and realised production. After 1995 realised production has fallen below forecast. In the period 2006–12 realised production from the FC estate was similar to forecast volume. Realised private sector estate production compared to the 2005 forecast is difficult to estimate at present but, based on removals reported by harvesting companies, appears to have been reasonably close to forecast production across GB.

Figure 25. Average annual GB softwood forecast of availability and Forestry Commission and private sector production
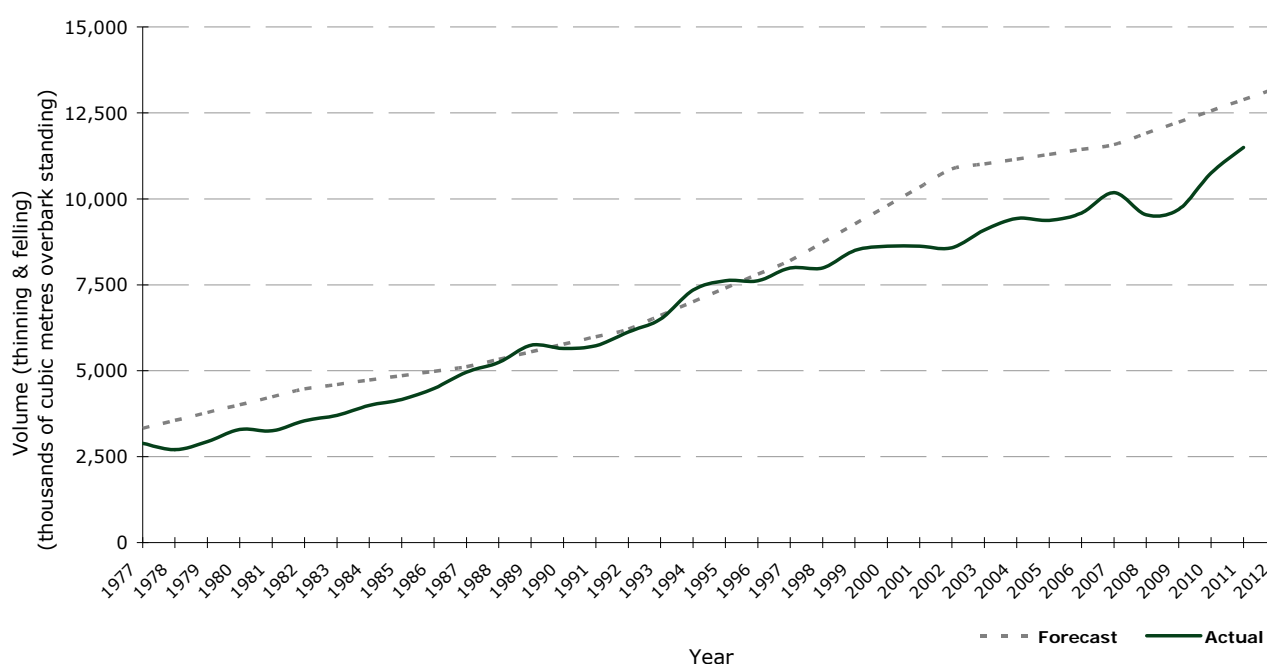
Table 13. Out-turn for 2007–11 against 2005 softwood forecast on the FC estate

(Average annual volume in thousands of cubic metres overbark standing)

2005 Forecast	5-year total	Annual
England	6,840	1,368
Scotland	16,160	3,232
Wales	3,945	789
Great Britain	**25,625**	**5,125**

Actual	5-year total	Annual	Actual v. forecast %
England	7,138	1,428	104
Scotland	15,410	3,082	95
Wales	3,892	778	99
Great Britain	**26,437**	**5,287**	**98**

Impact of production on standing volume and increment

The level and frequency of thinning and felling will have an impact on standing volumes over time. If removals exceed increment then standing volumes will be reduced and vice versa. The current standing volume for GB as of 31 March 2011 is 336 million cubic metres.

As the harvesting scenarios of this forecast are applied to the current standing volume, total standing volume moves to an average annual figure of 290 million cubic metres (excluding overdue timber) for the first period of the forecast (2012-16). By the last period of the forecast (2032-36) the average annual standing volume has moved to 235 million cubic metres. This reduction arises as forecast removals exceed forecast increment. Annual net increment is 15.2 million cubic metres for the first period (2012–16) and for the remaining periods ranges between 12.6 and 14.7 million cubic metres per annum. The forecast average annual cut for the forecast period is 16.0 million cubic metres, from which it can be concluded that increment is currently forecast to be less than potential harvest within GB and this is the cause of the reduction in standing volume. What eventually transpires depends on many factors, including the actual levels of harvest that occur and the levels of replanting.

A large determinant in the forecasted levels of total standing volume in GB is age class structure. GB's history of creating a man-made forest resource has created an uneven age class structure, which determines the evolution of standing volumes and net

increment. This is in contrast with forests of a more evenly distributed age, which results in a more stable evolution of standing volume and increment. Additionally, it should be noted that this is a snapshot of standing volume, taken over 25 years, looking at a fraction of the life cycle of the forests. If a 50 or 100-year window were to be used, a different perspective would be evident. In the GB context therefore it is important that the age profile of the forest resource is taken into account when drawing meaningful conclusions on sustainable forest management of the GB forest estate.

These forecasts predict that there will be a decline in standing volumes and also in annual net increment in the GB forest resource during the forecast period. This is as a result of expected future harvesting levels that are primarily driven by the age structure of the resource and the presumption to fell at a prescribed time. This harvesting removes older stands with higher increment and as these are felled and replaced with stands of younger trees, which have a lower annual increment, total annual increment is reduced. This result may instigate some debate on future alternative harvesting and management strategies with a long-term objective of achieving greater stability of the resource over time.

The reports *Standing timber volume for coniferous trees in Britain, GB 25-Year Forecast of Standing Coniferous Volume and Increment* and *Interpreting National Forest Inventory Timber Volume Forecasts* cover this subject in more detail.

Conclusions

The 2011 forecast is based upon the largest mensuration exercise ever undertaken in GB and this should give users of this information confidence in the levels of timber reported in the GB forests today, how these forests will grow over time and the forecasted levels of potential production.

In the private sector, when compared to previous forecasts of timber availability (such as the 2000 and 2005 forecasts), there has been a significant increase in the forecast amount of potentially available timber. This increase has mostly arisen from the improved techniques and methodologies used in the National Forest Inventory, which have improved our estimates of area, standing volume and yield class.

When and if this private sector timber is harvested will depend upon many factors, not least of which are the choices made by the sector. Since the private sector has a wide range of objectives and is not expected to manage its entire estate to maximise volume productivity throughout the 25 years covered by the 2011 forecast, production will vary from this estimate. For example this forecast relies on the assumption of higher levels of thinning and longer rotations than are currently practised in the main. The private sector forecast also 'sets aside' 42 million cubic metres of timber that is overdue for 'economic' felling and whether this timber comes to market is a significant source of uncertainty in this forecast. The timber could represent stands retained for a variety of reasons, such as for sustainable forest management purposes or material assets retained in place for later financial exploitation, each resulting in very different likelihoods of being harvested within a given period.

Actual timber production for GB has historically been less than forecast potential in the private sector. There are several reasons for this, including, for example, some stands being uneconomic to harvest, or owners' preferences (that may be driven by both custom and practice and economic factors).

The improved inventory has found more current standing volume overall and higher yield classes and this implies increased potential production in the future. To underline this point, if the industry prescriptions used in the 2005 forecast are applied to this new inventory, then potential production is still significantly higher (around 43%) than forecast in 2005.

The Forestry Commission management plans forecast is reasonably consistent with previous forecasts, but in comparison to the 2005 forecast there is a 4.7% reduction in production over the first three periods for GB. A significant element of this reduction is the result of Forestry Commission land sales. All the areas sold between March 2005 and

March 2011 have been removed from the Forestry Commission area (around 20,000 hectares of land - net) and have been transferred into the Private Sector area in the 2011 forecast, which has reduced Forestry Commission volumes and increased Private Sector volumes. Another 30,000 hectares of Forestry Commission land is marked for sale between 2011 and 2014 and these areas have been forecast separately, reducing the overall Forestry Commission figures. Whether this will occur is a matter of country policy. Another element that contributes to the reduction is Forestry Commission forest management policy, which currently requires retention of some stands and their volume for longer periods for sustainable forest management purposes. However, this picture of a reduction in Forestry Commission forecast production (at a GB level) varies between the countries; while production in both England and Scotland is projected to decline over the forecast period, production in Wales is projected to increase.

There is a commitment to bring much of this Forestry Commission timber to market in the first period of the forecast (2012-16), but the volumes forecasted for the remaining periods should be viewed as a 'signal of intent' for production. Historical precedent shows that there is a strong association between actual production and the production forecast for the Forestry Commission estate and if this continues, the production will form a comparatively 'stable' element of the forecast. However, over a period of 25 years, changes in policy may affect the profile of production arising from the Forestry Commission estate.

Changes in future levels of potential production may also result from changes in government policy emanating from the Forestry Commission and the devolved country administrations. This may either be indirectly through grants and regulation and other enabling activities on the private sector estate, or directly on the Forestry Commission estate via changes to forest management policy and land sales policy.

When drawing conclusions from this report it should also be noted that this is a snapshot of potential production, taken within a 25-year time period, looking at only a fraction of the life cycle of the forests. If a 50 or 100-year forecast were to be used, a different perspective on potential production would become evident.

Future work

This report has built on the NFI woodland area reports published in 2011 and the standing volume assessment published earlier in 2012. Other reports published explore the impacts of this potential production on future standing volume and increment. Later reports will cover the issue of biomass and carbon stocks in GB coniferous forests. Similar reports for broadleaved woodlands will be published in 2013 and further reports covering the impacts of different restocking scenarios on the forest resource and longer term forecasts will also be available in the coming years. Such scenarios can allow for

increased incidence of open space and broadleaves within future stands and for altering the type of species planted or yield classes predicted to be achieved. The latter two would help to assess alternative climate change adaptation scenarios. The information resources of the NFI will enable longer term forecasts to be run with more confidence and with more informative results than has been the case in the past. NFI plan to run 50 and 100 year forecasts before 2015. All such information is an essential part of planning for sustainable development in the forest products industry.

In addition to this information the National Forest Inventory will produce reports across a range of interests, including, for example, biodiversity, society's use of forests and climate change aspects.

Further information

A synthesis of this report, NFI Report *UK 25-Year Forecast of Softwood Availability*, is also available.

This report forms part of the NFI's UK 25-Year Forecast of Softwood Availability theme.. The other individual theme titles currently published are:

- GB 2011 Standing Coniferous Timber Volume
- GB 25-Year Forecast of Standing Coniferous Volume and Increment

The NFI has produced a suite of documents upon which this report is based. Further details on how the NFI has derived the forecast can be found in the NFI Methodology Paper *NFI Forecasts Methodology Overview* and the NFI Technical Documentation listed below. The assumptions used in building the forecast and how these should be interpreted are covered in the NFI Interpretation Paper *Interpreting NFI Timber Volume Forecasts*. The data presented in the tables and charts of this report are also available for use as NFI Data.

NFI Technical Documentation for all forest volume themes:

- *Specification of NFI Growing Stock Calculations*
- *Forecast Types*
- *Bulking Up Samples in the NFI*
- *Restocking in the Forecast*
- *NFI Survey Manual*
- *NFI Mensuration Protocol*
- *NFI Map Protocol*
- *Technical Glossary*
- *Growing Stock Volume Forecasts*
- *Volume Increment Forecasts*
- *Felling and Removals Forecasts*
- *Tree species*
- *Technical Glossary*

Also to be published in 2012 are:

- GB 25-Year Forecast of Coniferous Carbon Stocks
- GB 25-Year Forecast of Coniferous Biomass Stocks

All documents and data can be found on the NFI website (www.forestry.gov.uk/inventory).

Appendix A: Breakdown of the forecasts

Table A1. UK 2011 forecast of softwood availability for FC/NI estate and private sector estate broken down by time period, size class and region

Top diameter class	2012-16 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2017-21 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2022-26 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2027-31 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2032-36 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce
North West England																									
7-14cm	42	79	32	16	68	30	82	28	18	57	31	81	32	19	72	29	91	55	17	44	20	80	50	14	45
14-16cm	17	84	13	17	68	14	86	12	19	64	14	84	16	22	85	15	93	16	27	67	9	88	16	18	49
16-18cm	17	86	15	21	64	14	86	15	21	66	15	85	21	23	89	16	93	19	30	77	10	89	17	22	56
18-24cm	43	86	57	26	59	38	85	56	27	67	39	85	92	25	92	45	92	74	27	79	31	88	60	29	71
24-34cm	27	82	61	35	61	29	76	68	33	74	25	74	127	31	91	32	87	98	24	67	25	81	84	35	69
34-44cm	6	75	15	32	57	9	66	20	27	74	7	55	44	33	85	8	74	39	25	41	7	67	35	36	49
44-54cm	2	71	4	26	27	3	62	6	24	58	3	48	14	38	77	2	58	18	31	22	3	57	15	39	28
54+cm	1	67	3	35	12	2	66	4	42	24	2	38	10	36	68	1	28	23	38	28	2	37	12	38	13
Total	**155**	**82**	**200**	**23**	**60**	**138**	**80**	**209**	**23**	**67**	**136**	**79**	**356**	**24**	**87**	**147**	**89**	**341**	**19**	**58**	**107**	**82**	**288**	**24**	**57**
North East England																									
7-14cm	132	87	38	17	53	99	85	50	29	57	80	90	36	28	71	71	92	53	22	71	73	94	36	17	41
14-16cm	57	90	14	17	55	43	89	19	31	57	36	92	19	32	72	34	94	23	24	78	35	95	14	22	62
16-18cm	56	91	16	20	57	42	91	22	26	57	36	92	23	32	69	34	94	26	25	81	34	95	17	24	64
18-24cm	132	91	57	30	61	102	92	72	20	57	87	92	82	31	63	82	94	104	25	73	80	94	77	30	65
24-34cm	64	86	66	42	62	54	88	99	23	58	43	87	90	24	55	38	89	126	26	54	35	87	127	32	65
34-44cm	11	67	18	33	48	10	71	51	31	64	8	70	24	19	46	7	77	54	34	29	7	69	52	33	67
44-54cm	4	57	5	31	39	3	58	24	38	66	2	56	7	22	30	2	64	25	40	15	3	62	24	39	73
54+cm	2	58	7	47	81	3	51	65	56	89	3	54	4	36	12	2	60	26	43	11	3	59	18	32	52
Total	**458**	**88**	**221**	**26**	**58**	**355**	**88**	**403**	**22**	**64**	**295**	**90**	**285**	**25**	**60**	**272**	**92**	**437**	**21**	**56**	**270**	**92**	**366**	**25**	**63**
Yorkshire and the Humber																									
7-14cm	12	37	51	12	49	12	38	30	13	51	13	38	25	15	48	10	41	36	12	39	12	42	39	12	26
14-16cm	6	39	19	0	47	6	38	15	13	52	6	37	13	18	56	4	42	13	17	62	5	40	11	18	32
16-18cm	7	39	21	14	43	7	38	18	15	55	7	35	16	19	58	5	40	17	20	68	5	40	12	20	37
18-24cm	23	37	64	15	38	25	38	76	20	57	24	35	69	19	57	18	41	75	20	67	20	39	46	21	43
24-34cm	30	33	55	17	38	36	37	97	25	56	37	36	82	16	49	28	44	119	25	66	30	40	65	20	35
34-44cm	15	30	19	24	43	17	36	34	26	37	18	38	27	20	46	15	45	50	25	62	16	40	26	20	25
44-54cm	7	28	8	32	46	8	36	14	32	22	9	40	11	27	51	8	46	18	23	51	8	39	9	22	24
54+cm	4	19	13	45	22	5	34	19	44	10	6	36	12	36	61	6	35	15	27	17	7	36	10	43	15
Total	**105**	**34**	**249**	**13**	**41**	**115**	**37**	**303**	**18**	**49**	**119**	**36**	**256**	**14**	**52**	**96**	**43**	**343**	**19**	**60**	**102**	**40**	**219**	**15**	**32**
East Midlands																									
7-14cm	9	11	15	23	23	7	8	9	21	19	6	8	8	19	15	5	11	7	22	12	4	7	7	19	11
14-16cm	4	7	5	15	22	3	9	5	20	22	3	9	4	19	14	2	11	4	25	11	2	8	2	23	17
16-18cm	4	5	6	14	22	3	7	6	18	22	3	9	5	19	15	2	10	5	27	10	2	8	3	25	13
18-24cm	14	4	23	15	18	13	5	23	18	24	13	6	24	23	15	11	7	28	29	11	12	6	16	26	19
24-34cm	22	2	32	22	10	22	2	34	28	23	23	2	45	38	10	20	3	58	30	12	24	3	29	27	29
34-44cm	12	2	13	31	5	12	1	14	34	24	13	1	24	51	5	12	1	25	28	15	14	2	16	30	32
44-54cm	6	1	6	34	3	7	1	5	39	30	7	1	11	62	2	6	1	10	36	17	7	2	8	36	29
54+cm	4	1	1	71	1	5	1	1	76	0	5	1	4	56	1	6	1	3	37	30	5	2	10	45	20
Total	**75**	**4**	**102**	**17**	**14**	**73**	**3**	**98**	**22**	**23**	**72**	**3**	**124**	**35**	**10**	**64**	**4**	**140**	**26**	**13**	**70**	**4**	**92**	**24**	**25**
East England																									
7-14cm	49	0	23	16	26	23	0	27	20	15	15	0	17	19	12	10	0	18	20	13	8	1	20	17	5
14-16cm	11	0	14	12	12	10	0	9	16	14	6	0	8	18	13	4	0	8	26	17	3	0	6	24	10
16-18cm	9	0	11	13	11	12	0	11	15	11	8	0	10	16	13	6	0	10	29	19	5	0	8	29	7
18-24cm	25	0	38	12	9	41	0	42	13	8	37	0	40	17	10	32	0	52	29	21	25	0	43	31	8
24-34cm	34	0	44	14	9	45	0	69	19	6	53	0	68	24	5	64	0	90	23	18	60	0	102	26	9
34-44cm	19	0	19	18	10	21	0	35	25	6	20	0	33	27	6	30	0	48	26	11	30	0	65	23	10
44-54cm	10	0	8	22	10	11	0	16	32	6	8	1	14	25	9	12	0	27	28	10	13	0	36	25	12
54+cm	8	0	6	46	3	8	0	16	40	6	5	1	11	30	14	8	0	18	26	9	6	0	49	31	13
Total	**165**	**0**	**160**	**11**	**12**	**171**	**0**	**227**	**16**	**8**	**152**	**0**	**200**	**19**	**8**	**166**	**0**	**272**	**21**	**15**	**150**	**0**	**329**	**21**	**10**

Top diameter class	2012-16 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2017-21 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2022-26 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2027-31 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce	2032-36 FC/FS volume (000 m³ obs)	% spruce	Private sector volume (000 m³ obs)	SE %	% spruce
South East England and London																									
7-14cm	17	6	69	10	29	11	7	47	10	24	8	5	47	16	15	6	7	50	13	11	6	6	46	11	9
14-16cm	5	9	26	9	22	5	8	24	11	22	3	6	19	12	20	3	7	16	12	21	2	5	15	12	16
16-18cm	5	10	28	10	20	5	10	28	11	21	4	6	26	13	20	3	8	19	11	22	3	5	18	13	19
18-24cm	20	11	94	11	17	19	12	110	11	18	18	7	116	14	20	15	10	91	11	25	14	6	80	14	25
24-34cm	32	11	126	14	12	32	12	152	12	15	29	10	181	14	19	29	15	186	14	25	28	9	163	17	23
34-44cm	16	12	64	18	8	16	12	68	15	15	15	10	87	16	19	17	18	101	15	25	16	11	87	19	19
44-54cm	8	12	32	22	7	8	12	31	17	15	8	10	45	19	18	9	18	49	18	25	9	12	41	23	16
54+cm	6	11	50	36	3	6	11	31	25	19	7	11	48	23	16	11	16	58	24	30	11	12	32	38	13
Total	**108**	**10**	**490**	**12**	**15**	**101**	**11**	**490**	**10**	**17**	**93**	**9**	**568**	**12**	**19**	**92**	**14**	**570**	**12**	**24**	**89**	**9**	**482**	**15**	**20**
South West England																									
7-14cm	26	48	60	11	36	21	47	57	12	30	17	41	47	15	35	13	39	78	13	24	13	42	93	15	37
14-16cm	10	49	23	11	32	8	52	21	12	32	6	48	15	12	35	5	43	21	18	49	4	38	27	24	45
16-18cm	10	47	28	13	33	9	51	27	14	34	7	49	18	14	33	6	44	22	19	50	4	38	28	27	53
18-24cm	31	43	118	17	36	29	45	114	15	37	23	47	82	15	31	24	46	82	16	49	17	39	90	30	61
24-34cm	37	38	161	19	41	39	34	200	20	46	36	39	141	19	32	37	44	138	17	51	29	41	106	22	58
34-44cm	17	36	63	22	41	19	30	99	22	48	20	35	64	22	33	21	40	79	23	58	17	39	41	22	52
44-54cm	8	36	25	25	40	9	28	44	24	46	11	34	28	25	31	12	38	44	26	62	9	36	17	26	50
54+cm	8	27	17	52	32	9	24	24	24	14	12	26	19	35	20	17	28	41	34	66	14	22	13	35	34
Total	**146**	**42**	**496**	**15**	**38**	**143**	**39**	**586**	**16**	**41**	**133**	**39**	**415**	**16**	**32**	**135**	**41**	**505**	**15**	**50**	**107**	**37**	**414**	**19**	**51**
West Midlands																									
7-14cm	13	13	22	21	52	12	14	14	23	52	10	13	9	20	36	7	10	26	24	17	9	12	66	29	37
14-16cm	4	14	10	18	46	3	17	7	22	49	3	13	5	24	38	2	13	3	18	37	2	11	21	50	67
16-18cm	4	14	11	17	41	4	16	10	31	56	4	14	6	23	29	3	13	4	19	45	2	11	23	56	75
18-24cm	16	14	45	22	26	14	15	50	32	52	15	12	37	23	33	12	14	21	20	48	9	12	89	55	75
24-34cm	28	14	92	29	16	24	16	105	31	42	32	9	82	29	37	29	14	54	25	49	22	11	122	34	50
34-44cm	15	16	50	30	17	14	17	57	26	33	22	8	50	41	48	20	15	39	34	45	17	11	60	27	29
44-54cm	8	18	24	30	19	7	18	29	29	28	12	8	27	52	59	12	15	23	38	42	10	11	31	31	20
54+cm	7	14	14	34	38	8	17	38	50	63	14	6	30	66	76	14	14	26	55	28	18	16	34	36	32
Total	**94**	**14**	**266**	**23**	**24**	**86**	**16**	**311**	**26**	**44**	**111**	**9**	**245**	**34**	**46**	**99**	**14**	**196**	**26**	**40**	**89**	**12**	**446**	**32**	**49**
North Scotland																									
7-14cm	148	19	173	10	48	87	25	141	15	56	81	22	118	13	49	83	25	132	12	45	87	27	219	13	40
14-16cm	51	26	52	12	44	35	29	63	18	63	35	26	52	17	60	37	28	66	14	51	37	30	100	15	44
16-18cm	46	30	50	13	42	34	33	66	19	63	36	29	60	19	66	38	30	82	16	54	38	34	116	16	46
18-24cm	103	37	127	19	38	89	38	177	21	57	97	35	184	22	74	103	34	282	17	57	106	39	390	16	53
24-34cm	63	43	99	36	47	69	41	152	30	27	76	39	140	29	77	80	35	219	20	58	84	43	307	18	58
34-44cm	17	44	26	44	60	23	38	58	40	12	25	35	26	32	64	26	32	48	32	59	28	38	56	26	50
44-54cm	7	44	5	53	68	9	36	26	44	15	10	31	6	34	36	10	29	16	43	64	11	30	10	26	20
54+cm	4	43	1	52	31	6	37	7	58	42	7	32	2	42	26	8	33	4	39	24	7	34	7	45	7
Total	**438**	**30**	**533**	**16**	**45**	**353**	**34**	**689**	**19**	**46**	**367**	**31**	**588**	**20**	**67**	**385**	**31**	**850**	**16**	**55**	**399**	**35**	**1,205**	**15**	**50**
North East Scotland																									
7-14cm	91	44	159	9	42	66	54	140	14	48	67	53	182	10	45	59	56	241	9	33	44	48	232	8	25
14-16cm	34	44	57	8	35	27	53	59	10	46	28	53	65	10	47	25	59	67	13	51	18	54	68	11	30
16-18cm	34	46	59	9	32	28	54	66	11	45	30	53	76	12	44	27	60	75	14	51	20	58	77	13	32
18-24cm	93	51	197	11	28	84	56	225	16	43	91	55	283	13	41	89	63	270	16	45	72	63	289	13	34
24-34cm	88	57	225	15	27	94	61	259	17	42	100	58	363	17	36	102	64	335	16	34	94	64	403	14	31
34-44cm	35	60	96	23	25	38	63	111	21	46	41	61	138	19	32	42	62	137	19	28	41	61	197	19	29
44-54cm	16	61	47	28	24	17	64	55	27	51	18	61	51	23	28	18	59	56	22	24	19	60	99	22	28
54+cm	8	62	39	33	18	10	67	57	33	40	12	57	43	44	36	13	56	42	36	29	16	61	60	32	35
Total	**398**	**51**	**880**	**11**	**30**	**363**	**58**	**973**	**13**	**44**	**387**	**56**	**1,200**	**12**	**39**	**375**	**61**	**1,222**	**11**	**37**	**323**	**60**	**1,424**	**11**	**30**

Top diameter class	2012-16 FC/FS volume (000 m³ obs)	2012-16 FC/FS % spruce	2012-16 Private sector volume (000 m³ obs)	2012-16 Private SE %	2012-16 Private % spruce	2017-21 FC/FS volume (000 m³ obs)	2017-21 FC/FS % spruce	2017-21 Private sector volume (000 m³ obs)	2017-21 Private SE %	2017-21 Private % spruce	2022-26 FC/FS volume (000 m³ obs)	2022-26 FC/FS % spruce	2022-26 Private sector volume (000 m³ obs)	2022-26 Private SE %	2022-26 Private % spruce	2027-31 FC/FS volume (000 m³ obs)	2027-31 FC/FS % spruce	2027-31 Private sector volume (000 m³ obs)	2027-31 Private SE %	2027-31 Private % spruce	2032-36 FC/FS volume (000 m³ obs)	2032-36 FC/FS % spruce	2032-36 Private sector volume (000 m³ obs)	2032-36 Private SE %	2032-36 Private % spruce
East Scotland																									
7-14cm	32	50	139	9	73	33	55	99	9	70	27	51	89	9	62	21	53	91	10	38	21	50	99	10	45
14-16cm	14	54	58	11	73	14	59	41	8	72	12	55	41	10	69	10	60	33	14	58	10	51	35	12	59
16-18cm	15	57	63	13	71	15	60	49	10	72	13	58	51	11	71	11	64	41	15	62	11	53	41	14	70
18-24cm	45	59	214	18	71	45	62	172	15	70	40	64	200	14	71	36	69	163	15	68	37	57	196	17	80
24-34cm	48	61	205	21	68	47	64	223	25	68	43	70	214	19	66	43	68	191	17	67	39	62	310	18	81
34-44cm	21	62	55	24	56	18	67	86	30	75	19	72	57	22	64	19	63	69	19	52	16	64	106	20	74
44-54cm	10	62	21	31	51	8	70	30	40	87	9	74	18	26	72	9	60	29	23	39	8	64	36	26	65
54+cm	6	66	13	53	17	3	66	32	55	94	6	76	11	44	48	7	63	28	34	30	7	63	28	33	41
Total	**190**	**58**	**768**	**15**	**68**	**183**	**62**	**732**	**17**	**72**	**169**	**64**	**681**	**13**	**67**	**155**	**64**	**646**	**12**	**58**	**148**	**58**	**851**	**14**	**73**
South Scotland																									
7-14cm	352	84	336	8	87	295	85	324	8	88	234	85	453	9	91	199	88	472	9	87	176	87	269	11	79
14-16cm	160	87	138	10	89	141	88	148	10	88	116	89	223	11	92	100	90	227	10	93	87	90	138	12	85
16-18cm	168	89	151	11	90	152	89	177	10	89	128	90	277	11	92	114	91	288	10	93	98	91	176	12	88
18-24cm	442	91	483	15	92	429	91	592	12	92	382	92	1,064	11	93	368	93	1,208	10	95	306	93	757	12	90
24-34cm	267	92	402	20	89	297	91	555	16	91	296	94	1,102	13	95	303	94	1,415	12	96	256	95	973	14	89
34-44cm	58	88	83	22	78	71	87	160	20	85	82	92	284	19	94	79	92	402	15	94	69	95	284	17	85
44-54cm	20	83	20	27	63	23	81	53	24	77	29	89	76	32	89	24	88	117	20	90	21	93	76	24	80
54+cm	11	67	12	35	72	14	71	14	45	63	19	82	22	53	83	15	79	68	31	73	15	88	45	55	56
Total	**1,478**	**88**	**1,624**	**13**	**89**	**1,422**	**89**	**2,022**	**11**	**89**	**1,287**	**91**	**3,501**	**11**	**93**	**1,203**	**92**	**4,198**	**10**	**94**	**1,028**	**92**	**2,719**	**11**	**87**
West Scotland																									
7-14cm	286	81	238	8	86	269	82	240	9	91	241	83	219	10	93	239	78	246	11	86	177	85	240	12	81
14-16cm	133	84	82	8	85	128	86	115	11	91	118	86	115	12	95	113	82	136	12	89	89	87	124	13	86
16-18cm	140	86	80	9	84	136	88	136	12	91	129	88	150	13	95	124	84	174	12	90	101	89	162	13	88
18-24cm	383	89	205	12	82	382	90	467	15	96	371	90	598	15	95	361	88	703	13	92	316	91	646	13	89
24-34cm	241	92	146	20	80	261	93	410	23	98	263	94	543	18	92	259	92	720	14	93	256	94	666	15	90
34-44cm	47	93	39	32	77	55	94	95	32	87	62	95	113	30	87	63	94	175	20	90	64	95	140	19	86
44-54cm	10	92	14	45	74	12	93	25	40	74	17	94	35	55	90	19	94	41	28	85	20	96	22	35	84
54+cm	4	85	3	50	34	4	78	14	55	10	6	87	52	75	94	9	87	20	45	63	8	89	13	54	74
Total	**1,245**	**87**	**809**	**10**	**82**	**1,247**	**88**	**1,500**	**15**	**93**	**1,207**	**89**	**1,826**	**15**	**93**	**1,187**	**86**	**2,215**	**12**	**91**	**1,032**	**91**	**2,014**	**13**	**88**
Wales																									
7-14cm	195	71	99	15	58	196	71	92	16	62	169	71	89	16	72	130	68	88	16	55	153	72	117	17	60
14-16cm	84	72	43	18	58	81	72	41	18	71	74	74	42	18	74	61	71	34	20	70	72	75	51	21	69
16-18cm	89	72	49	18	58	84	73	56	19	73	79	75	52	19	75	70	74	40	22	73	84	76	61	22	73
18-24cm	258	74	180	18	56	249	74	241	19	77	233	75	231	20	75	219	78	146	23	72	281	80	224	22	77
24-34cm	218	76	218	20	48	230	77	372	21	72	207	74	329	19	67	190	80	209	26	65	217	82	217	22	81
34-44cm	71	78	94	31	43	80	79	143	23	61	73	75	134	25	48	67	79	100	27	51	61	77	67	25	81
44-54cm	28	77	44	42	44	34	79	53	31	46	32	75	62	35	36	30	78	47	30	38	28	75	25	34	75
54+cm	15	71	68	75	70	24	74	28	36	57	26	65	68	42	17	27	65	49	34	40	30	65	29	38	70
Total	**958**	**74**	**793**	**19**	**53**	**979**	**75**	**1,025**	**17**	**69**	**893**	**74**	**1,008**	**18**	**62**	**795**	**75**	**713**	**19**	**60**	**927**	**77**	**791**	**18**	**75**
Northern Ireland																									
7-14cm	80	90	4	-	90	69	90	3	-	90	57	90	3	-	90	58	87	6	-	87	50	87	6	-	87
14-16cm	48	90	2	-	90	40	90	2	-	90	35	90	2	-	90	36	87	3	-	87	30	87	3	-	87
16-18cm	65	90	3	-	90	56	90	2	-	90	50	90	2	-	90	50	87	4	-	87	42	87	4	-	87
18-24cm	247	90	11	-	90	240	90	9	-	90	220	90	10	-	90	214	87	18	-	87	174	87	16	-	87
24-34cm	121	90	5	-	90	147	90	6	-	90	151	90	7	-	90	143	87	12	-	87	142	87	13	-	87
34-44cm	11	90	1	-	90	11	90	0	-	90	10	90	1	-	90	13	87	1	-	87	13	87	1	-	87
44-54cm	3	90	0	-	90	3	90	0	-	90	4	90	0	-	90	3	87	0	-	87	4	87	0	-	87
54+cm	4	90	0	-	90	5	90	0	-	90	3	90	0	-	90	3	87	0	-	87	3	87	0	-	87
Total	**579**	**90**	**26**	**-**	**90**	**572**	**90**	**22**	**-**	**90**	**529**	**90**	**25**	**-**	**90**	**519**	**87**	**44**	**-**	**87**	**458**	**87**	**44**	**-**	**87**

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Notes:
1. Volumes for FC/FS estate based upon Forestry Commission inventory and management plans.
2. Volumes for private sector estate based upon NFI data and a harvesting scenario of biological potential constrained by wind risk
3. Individual values in these tables do not always sum to the totals due to rounding.

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Table A2. GB 2011 forecast broken down by time period, region and principal species

Principal species	2012-16 FC volume (000m³ obs)	2012-16 Private sector volume (000m³ obs)	2012-16 SE%	2017-21 FC volume (000m³ obs)	2017-21 Private sector volume (000m³ obs)	2017-21 SE%	2022-26 FC volume (000m³ obs)	2022-26 Private sector volume (000m³ obs)	2022-26 SE%	2027-31 FC volume (000m³ obs)	2027-31 Private sector volume (000m³ obs)	2027-31 SE%	2032-36 FC volume (000m³ obs)	2032-36 Private sector volume (000m³ obs)	2032-36 SE%
North West England															
All conifers	155	200	23	138	209	23	136	356	24	147	341	19	107	288	24
Sitka spruce	122	97	43	110	111	39	105	259	32	130	151	37	86	145	42
Scots pine	6	29	39	7	19	25	6	25	27	3	80	32	3	34	39
Corsican pine	2	0	75	6	1	98	5	0	77	4	0	77	4	2	85
Norway spruce	5	24	26	1	29	28	2	52	57	1	48	43	1	18	30
Larches	8	54	42	8	22	46	10	9	35	6	34	25	9	37	18
Douglas fir	1	1	91	1	1	82	2	0	97	1	0	75	2	1	87
Lodgepole pine	8	3	71	4	2	93	5	3	54	1	19	95	1	39	81
Other conifers	1	4	50	1	21	87	1	4	49	1	6	45	1	12	69
North East England															
All conifers	458	221	26	355	403	22	295	285	25	272	437	21	270	366	25
Sitka spruce	345	106	53	284	162	35	257	154	44	242	200	34	242	156	44
Scots pine	16	47	18	10	100	31	7	80	29	5	161	42	7	103	44
Corsican pine	3	0	97	2	1	97	2	0	97	1	-	-	2	-	-
Norway spruce	59	23	33	28	97	60	8	17	36	7	44	56	7	74	64
Larches	8	20	49	6	16	39	5	18	66	5	18	36	5	23	27
Douglas fir	2	4	76	2	4	70	2	11	44	1	7	64	2	3	85
Lodgepole pine	23	6	47	20	17	73	12	11	42	9	3	61	3	3	62
Other conifers	2	18	74	2	9	65	1	7	49	1	3	79	3	3	80
Yorkshire and the Humber															
All conifers	105	249	13	115	303	18	119	256	14	96	343	19	102	219	15
Sitka spruce	32	65	25	41	133	34	39	98	29	38	191	33	39	51	42
Scots pine	31	44	19	29	62	34	33	66	26	23	75	26	24	66	29
Corsican pine	6	19	53	6	43	56	5	9	48	3	4	36	2	3	45
Norway spruce	3	38	38	2	16	23	4	36	34	3	14	27	2	20	29
Larches	20	42	29	20	30	38	19	29	32	13	36	25	17	41	20
Douglas fir	3	6	49	4	4	51	4	4	34	5	6	52	5	4	31
Lodgepole pine	6	29	58	11	5	49	13	3	37	8	7	44	10	17	68
Other conifers	3	6	33	3	9	38	3	14	63	3	8	47	4	16	57
East Midlands															
All conifers	75	102	17	73	98	22	72	124	35	64	140	26	70	92	24
Sitka spruce	1	1	110	1	-	-	1	-	-	1	-	-	1	-	-
Scots pine	22	40	22	20	31	19	17	84	49	17	92	33	15	55	34
Corsican pine	43	28	46	45	18	49	47	21	73	39	25	84	48	6	54
Norway spruce	2	13	35	1	22	49	2	12	37	2	18	41	2	23	47
Larches	1	17	44	1	11	81	1	5	64	2	1	52	2	7	57
Douglas fir	0	2	86	0	15	92	0	0	80	1	3	80	0	-	-
Lodgepole pine	3	-	-	2	-	-	2	-	-	1	-	-	1	-	-
Other conifers	3	1	91	2	2	69	2	1	70	3	1	91	2	1	91
East England															
All conifers	165	160	11	171	227	16	152	200	19	166	272	21	150	329	21
Sitka spruce	-	3	75	0	3	75	0	3	76	0	3	78	0	4	100
Scots pine	22	67	18	23	79	18	13	79	18	21	117	33	14	201	28
Corsican pine	136	38	23	141	85	30	134	78	46	139	71	46	133	56	75
Norway spruce	0	16	28	0	14	29	0	14	31	0	39	60	0	28	63
Larches	1	19	45	1	7	89	1	7	75	1	5	38	1	12	25
Douglas fir	3	3	48	3	19	66	2	2	46	3	10	85	2	7	72
Lodgepole pine	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Other conifers	3	13	32	3	19	28	1	17	30	2	27	46	0	22	35

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Principal species	2012-16 FC volume (000m³ obs)	Private sector volume (000m³ obs)	SE%	2017-21 FC volume (000m³ obs)	Private sector volume (000m³ obs)	SE%	2022-26 FC volume (000m³ obs)	Private sector volume (000m³ obs)	SE%	2027-31 FC volume (000m³ obs)	Private sector volume (000m³ obs)	SE%	2032-36 FC volume (000m³ obs)	Private sector volume (000m³ obs)	SE%
South East England and London															
All conifers	108	490	12	101	490	10	93	568	12	92	570	12	89	482	15
Sitka spruce	0	12	53	0	17	47	0	35	59	0	3	82	0	2	76
Scots pine	25	159	22	19	150	18	18	219	20	15	250	20	14	218	23
Corsican pine	38	62	30	40	106	29	40	106	40	30	46	39	34	9	40
Norway spruce	11	60	16	11	68	17	8	71	21	13	133	28	8	93	27
Larches	4	29	24	4	62	36	4	25	46	4	29	26	4	37	41
Douglas fir	12	49	40	12	29	28	12	34	63	15	32	68	13	9	30
Lodgepole pine	0	0	107	0	0	107	0	5	107	0	-	-	0	-	-
Other conifers	18	115	34	15	82	27	11	64	29	14	69	21	14	108	41
South West England															
All conifers	146	496	15	143	586	16	133	415	16	135	505	15	107	414	19
Sitka spruce	45	139	40	39	167	46	37	41	30	40	86	43	29	126	55
Scots pine	6	27	20	7	32	22	6	56	29	5	70	33	4	49	32
Corsican pine	25	64	48	22	31	76	20	14	89	15	2	57	14	5	43
Norway spruce	16	49	18	16	73	24	15	91	41	15	166	31	11	85	38
Larches	11	66	28	12	37	29	12	23	43	11	42	18	11	60	16
Douglas fir	30	130	29	29	141	26	30	86	31	35	65	27	31	58	22
Lodgepole pine	2	0	105	1	0	105	1	0	105	1	2	105	0	-	-
Other conifers	12	38	21	17	103	35	12	109	30	12	79	43	7	45	32
West Midlands															
All conifers	94	266	23	86	311	26	111	245	34	99	196	26	89	446	32
Sitka spruce	7	13	78	8	51	109	6	-	-	6	-	-	3	164	79
Scots pine	13	82	54	13	60	37	26	45	48	19	87	54	12	99	38
Corsican pine	21	12	47	24	4	63	24	3	80	21	2	80	16	31	65
Norway spruce	7	51	29	6	86	47	5	112	69	8	78	33	8	54	39
Larches	10	3	67	11	4	63	16	1	44	10	17	32	7	24	25
Douglas fir	28	50	59	20	53	54	26	1	72	21	3	48	34	5	61
Lodgepole pine	1	2	106	2	2	106	1	17	106	1	-	-	1	1	102
Other conifers	7	49	67	3	46	49	8	65	36	13	9	55	8	68	61
North Scotland															
All conifers	438	533	16	353	689	19	367	588	20	385	850	16	399	1,205	15
Sitka spruce	119	226	30	105	303	28	105	379	31	114	449	24	133	590	22
Scots pine	81	80	18	93	149	43	107	89	16	106	129	26	99	190	33
Corsican pine	1	2	108	0	2	108	0	2	108	0	34	108	0	-	-
Norway spruce	14	14	47	14	12	51	9	12	51	5	18	46	9	12	54
Larches	26	80	55	23	26	60	19	21	37	23	16	48	24	48	43
Douglas fir	17	24	77	16	111	63	11	1	89	16	3	66	14	12	76
Lodgepole pine	177	105	28	95	85	27	111	83	14	117	199	34	117	352	26
Other conifers	4	-	-	6	-	-	4	-	-	3	0	73	2	0	73
North East Scotland															
All conifers	398	880	11	363	973	13	387	1,200	12	375	1,222	11	323	1,424	11
Sitka spruce	183	237	26	190	408	24	197	392	24	214	416	27	183	316	27
Scots pine	72	455	15	68	393	15	77	536	16	70	630	14	66	785	15
Corsican pine	6	-	-	2	-	-	7	-	-	3	-	-	9	1	108
Norway spruce	21	26	31	19	24	33	20	72	53	15	36	37	11	114	53
Larches	28	92	40	28	56	51	24	56	64	21	49	22	18	70	21
Douglas fir	14	12	37	11	15	38	10	67	62	10	32	62	11	14	52
Lodgepole pine	69	39	32	42	42	49	50	64	55	39	47	51	23	113	48
Other conifers	5	14	44	2	31	70	2	8	58	2	8	54	2	13	56

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Principal species	2012-16 FC volume (000m³ obs)	2012-16 Private sector volume (000m³ obs)	2012-16 SE%	2017-21 FC volume (000m³ obs)	2017-21 Private sector volume (000m³ obs)	2017-21 SE%	2022-26 FC volume (000m³ obs)	2022-26 Private sector volume (000m³ obs)	2022-26 SE%	2027-31 FC volume (000m³ obs)	2027-31 Private sector volume (000m³ obs)	2027-31 SE%	2032-36 FC volume (000m³ obs)	2032-36 Private sector volume (000m³ obs)	2032-36 SE%
East Scotland															
All conifers	190	768	15	183	732	17	169	681	13	155	646	12	148	851	14
Sitka spruce	95	491	20	108	488	25	101	411	19	93	324	21	82	588	21
Scots pine	42	76	15	35	125	29	27	154	24	29	138	21	26	118	24
Corsican pine	3	-	-	2	-	-	2	-	-	1	-	-	1	-	-
Norway spruce	15	33	25	5	37	28	7	46	31	6	51	35	3	30	28
Larches	12	124	41	11	59	34	11	50	40	11	77	33	7	84	21
Douglas fir	6	4	39	4	7	45	3	6	46	2	4	39	4	16	59
Lodgepole pine	13	14	65	16	5	50	15	5	50	12	19	61	24	4	54
Other conifers	3	20	71	3	3	72	2	3	73	1	28	97	1	3	51
South Scotland															
All conifers	1,478	1,624	13	1,422	2,022	11	1,287	3,501	11	1,203	4,198	10	1,028	2,719	11
Sitka spruce	1,265	1,341	15	1,221	1,742	13	1,138	3,162	12	1,077	3,804	11	931	2,257	13
Scots pine	9	27	24	8	89	37	8	65	51	7	70	45	7	122	46
Corsican pine	1	3	64	1	3	64	1	3	64	1	4	61	0	2	72
Norway spruce	42	97	32	41	62	23	28	104	38	28	124	39	17	109	40
Larches	62	116	32	75	130	35	53	129	31	57	109	34	51	100	28
Douglas fir	9	9	44	11	9	43	9	7	44	8	8	46	7	20	78
Lodgepole pine	85	22	40	60	12	44	42	12	42	19	54	39	10	53	42
Other conifers	5	10	49	5	21	72	8	7	50	6	11	46	5	47	60
West Scotland															
All conifers	1,245	809	10	1,247	1,500	15	1,207	1,826	15	1,187	2,215	12	1,032	2,014	13
Sitka spruce	1,034	658	12	1,069	1,388	16	1,051	1,696	15	995	1,996	13	922	1,743	14
Scots pine	12	17	35	11	49	47	7	12	37	7	13	34	4	19	31
Corsican pine	1	-	-	1	-	-	1	-	-	0	-	-	0	56	69
Norway spruce	50	9	58	35	13	55	24	8	65	31	14	66	13	20	66
Larches	55	93	34	55	58	56	46	78	55	49	64	42	38	42	40
Douglas fir	3	1	75	4	1	75	4	1	82	6	0	102	9	3	102
Lodgepole pine	79	19	41	66	37	66	65	10	39	89	98	50	40	105	48
Other conifers	11	12	57	7	12	56	9	14	51	9	19	48	6	17	45
Wales															
All conifers	958	793	19	979	1,025	17	893	1,008	18	795	713	19	927	791	18
Sitka spruce	636	396	33	660	684	24	601	602	23	560	380	31	674	557	24
Scots pine	15	20	49	23	17	53	15	18	61	10	21	54	13	9	55
Corsican pine	18	9	41	24	24	66	29	39	51	22	1	60	12	4	98
Norway spruce	70	26	41	70	26	41	59	25	42	40	49	59	43	34	40
Larches	82	191	33	90	83	39	84	44	59	67	109	45	79	68	30
Douglas fir	44	104	51	48	111	55	53	99	46	47	81	61	72	30	35
Lodgepole pine	29	10	34	28	11	33	20	10	34	19	11	35	9	53	52
Other conifers	64	30	37	36	59	60	31	159	67	29	56	52	24	31	51

Appendix B: Comparison of PS 2011 and earlier forecasts using equivalent management data

Table B1. Comparison of 2000, 2005 and 2011 softwood availability forecasts for the private sector

	2000	2005	2011	% change 2000 to 2011	% change 2005 to 2011
England					
Allocated overdue	4,109	3,537	0		
Unallocated overdue	6,782	7,854	21,632		
2007-11	1,966	1,858	-	-	-
2012-16	2,122	2,002	2,468	16	23
2017-21	2,202	2,155	2,522	15	17
2022-26	2,057	2,201	2,087	1	-5
2027-31	1,960	2,025	2,285	17	13
2032-36	1,806	1,825	2,244	24	23
Cumulative production	57,515	58,896	79,659	39	35
Scotland					
Allocated overdue	6,521	8,677	0		
Unallocated overdue	9,047	3,661	40,188		
2007-11	4,443	3,661	-	-	-
2012-16	5,351	4,380	4,530	-15	3
2017-21	5,713	4,840	5,899	3	22
2022-26	6,108	5,006	6,286	3	26
2027-31	6,164	5,042	5,810	-6	15
2032-36	5,650	4,877	6,602	17	35
Cumulative production	153,976	124,388	185,819	21	49
Wales					
Allocated overdue	1,071	1,262	0		
Unallocated overdue	1,311	455	4,337		
2007-11	669	669	-	-	-
2012-16	731	746	821	12	10
2017-21	714	761	903	26	19
2022-26	652	746	843	29	13
2027-31	609	661	559	-8	-15
2032-36	553	544	509	-8	-6
Cumulative production	17,611	17,743	22,515	28	27
Great Britain					
Allocated overdue	11,701	13,475	0		
Unallocated overdue	17,140	11,970	66,158		
2007-11	7,077	6,188	-	-	-
2012-16	8,204	7,128	7,818	-5	10
2017-21	8,630	7,756	9,324	8	20
2022-26	8,817	7,954	9,216	5	16
2027-31	8,733	7,728	8,654	-1	12
2032-36	8,008	7,245	9,355	17	29
Cumulative production	229,102	201,027	287,993	26	43

Notes:

1. Different rounding conventions have been adopted in the 2011 forecast compared to earlier forecasts. Earlier forecasts rounded all volumes downwards to the nearest 1000 m³ below, whereas the 2011 forecast rounds values to the nearest 1000 m³. Country totals were derived by summation of rounded values in earlier forecasts, whereas in the 2011 forecast they are calculated from the pre-rounded values before rounding.
2. Cumulative production is over the period 2012-2036.
3. The 2011 forecast uses the "felling and thinning to the 2005 industry view" harvesting scenario,

Figure B1. Comparison of private sector forecasts for 1995, 2000, 2005 and 2011
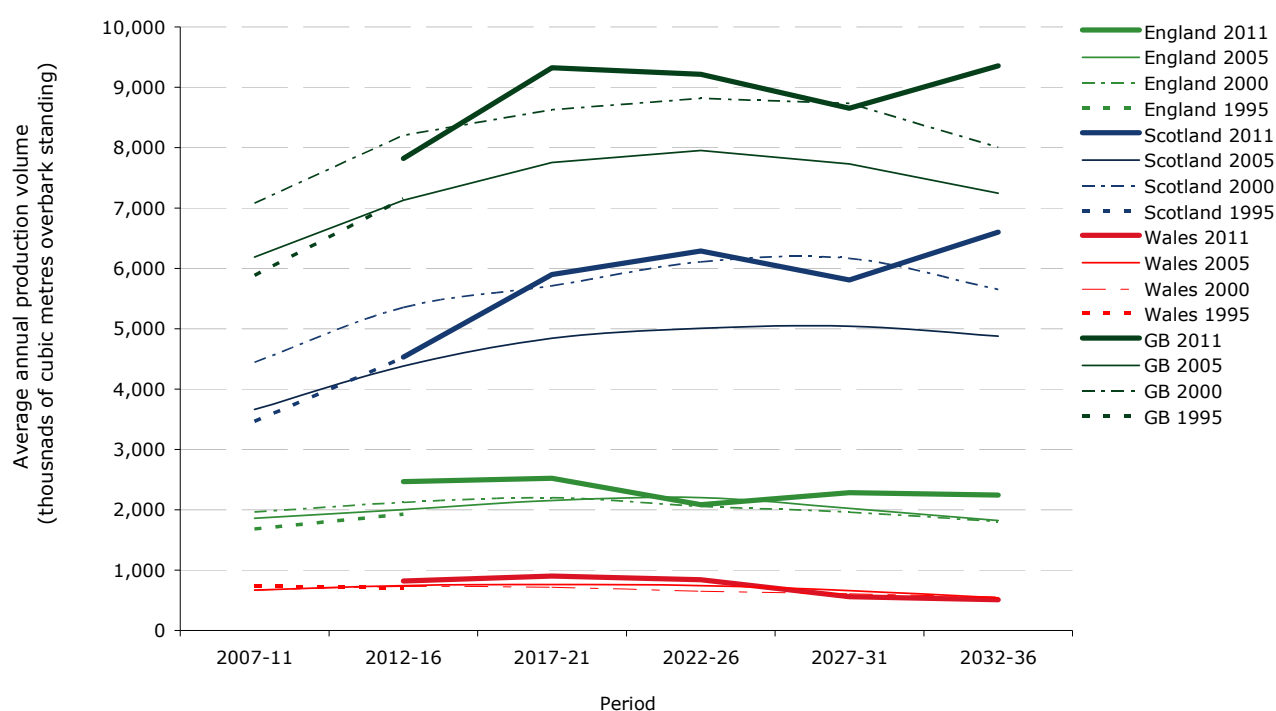
Note:

1. The differences between the 2005 and 2011 forecasts displayed in Figure B1 represent the impact of using inventory data arising from the NFI in 2011, updating of models between 2005 and 2011.
2. The 2011 forecast uses the "felling and thinning to the 2005 industry view" harvesting scenario,

Appendix C: Mensuration data

Figure C1. All conifers dbh distribution
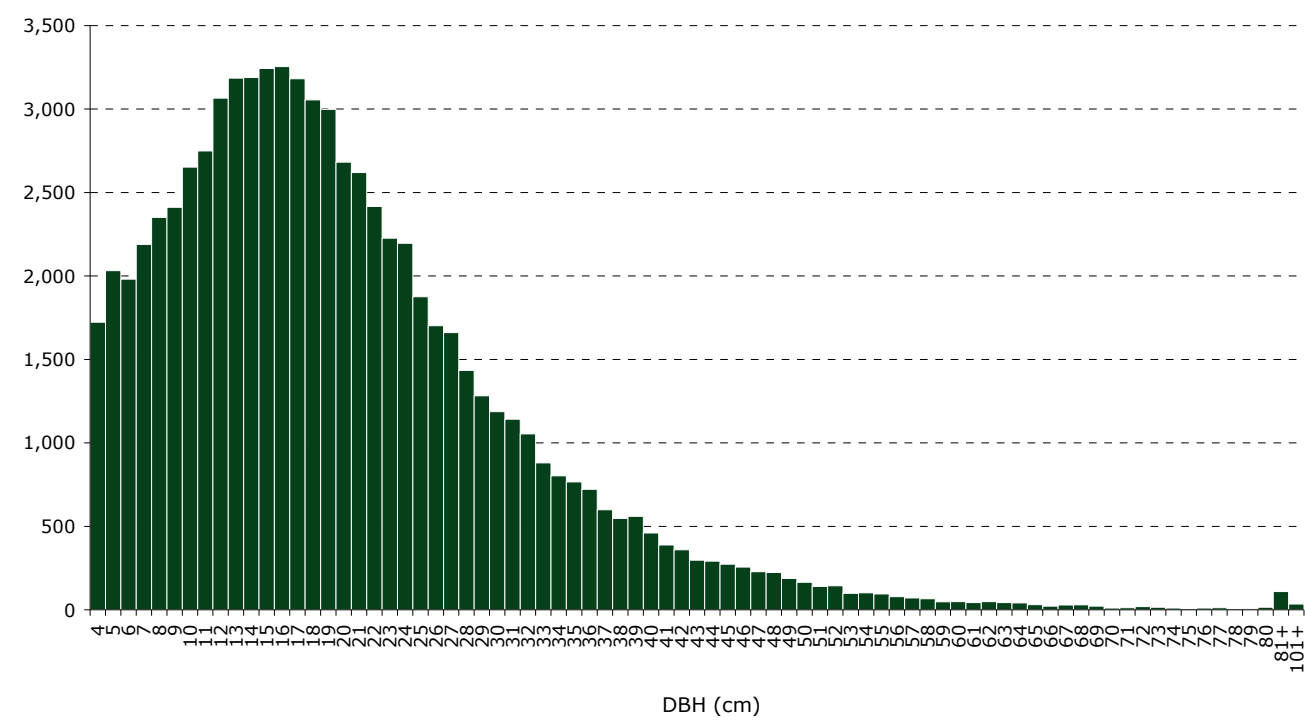
Source National Forest Inventory

Figure C2. Sitka spruce dbh distribution

DBH (cm)
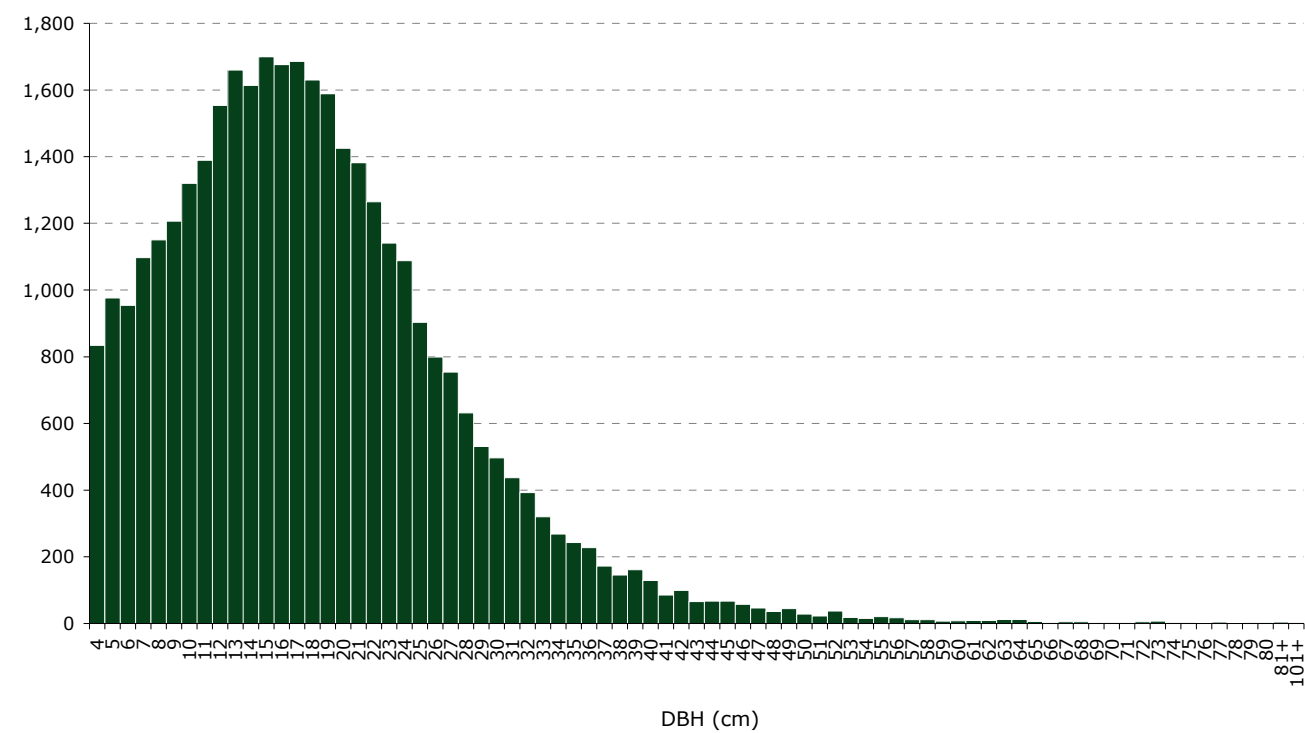
Figure C3. Scots pine dbh distribution

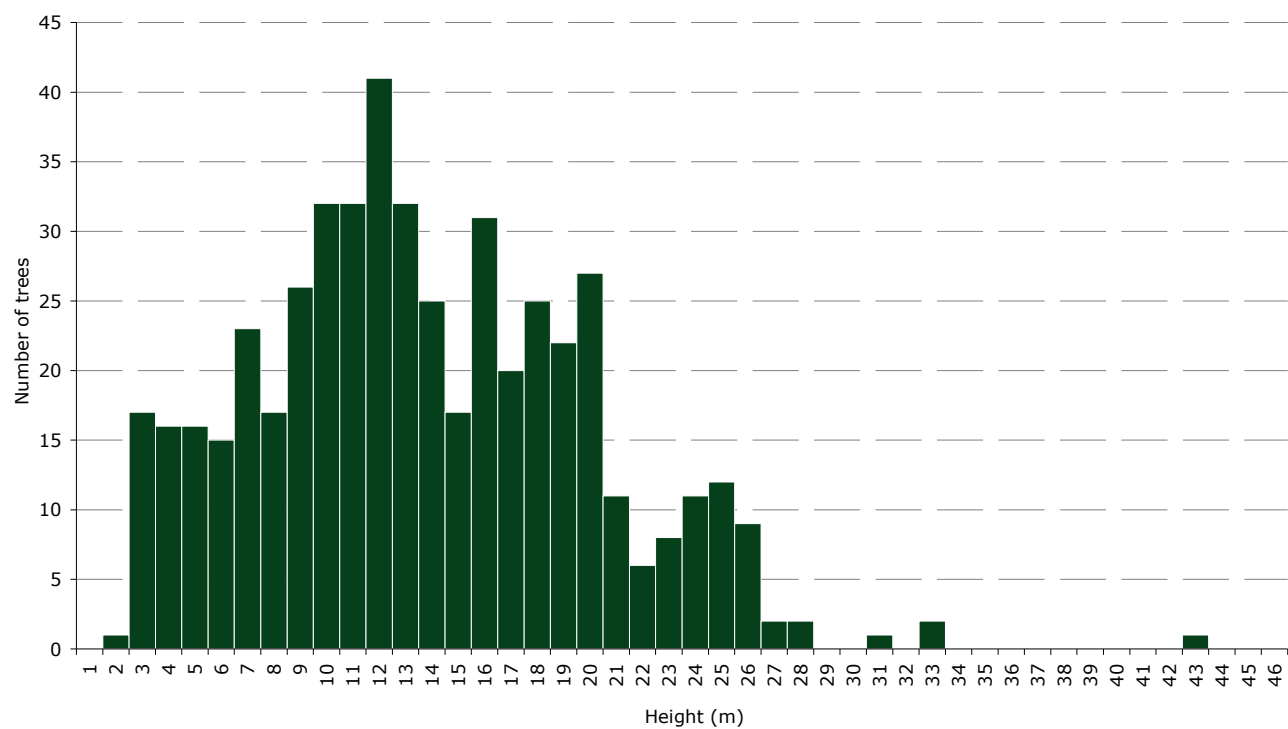DBH (cm)
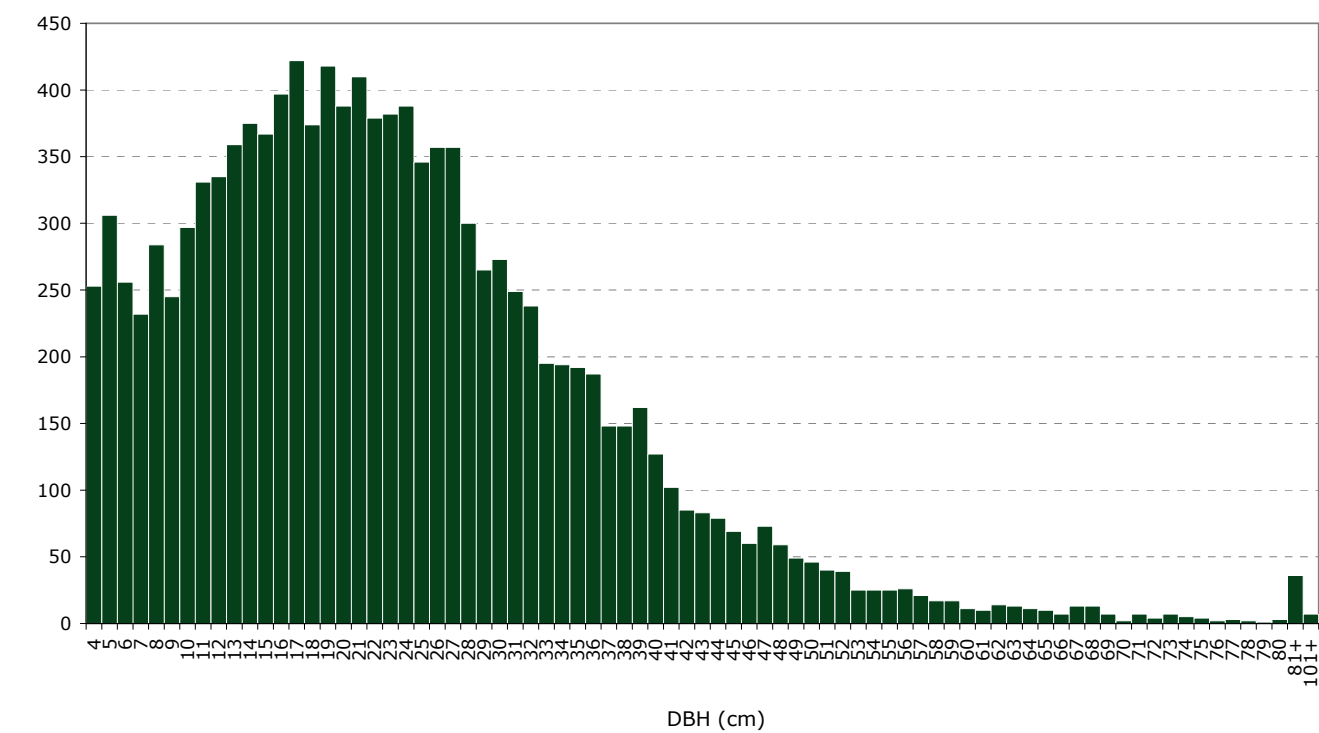
Figure C4. Norway spruce dbh distribution
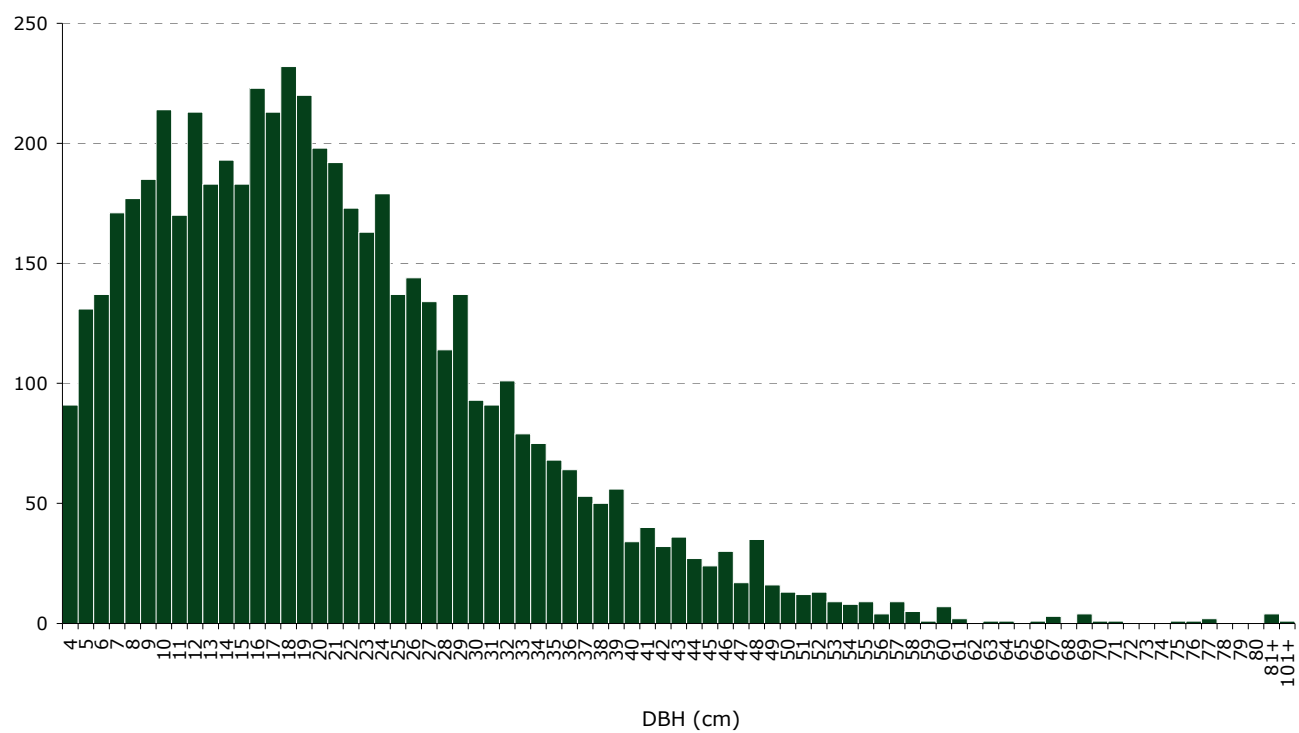
Source National Forest Inventory

Figure C5. Coniferous tree height distribution found in NFI sample plots
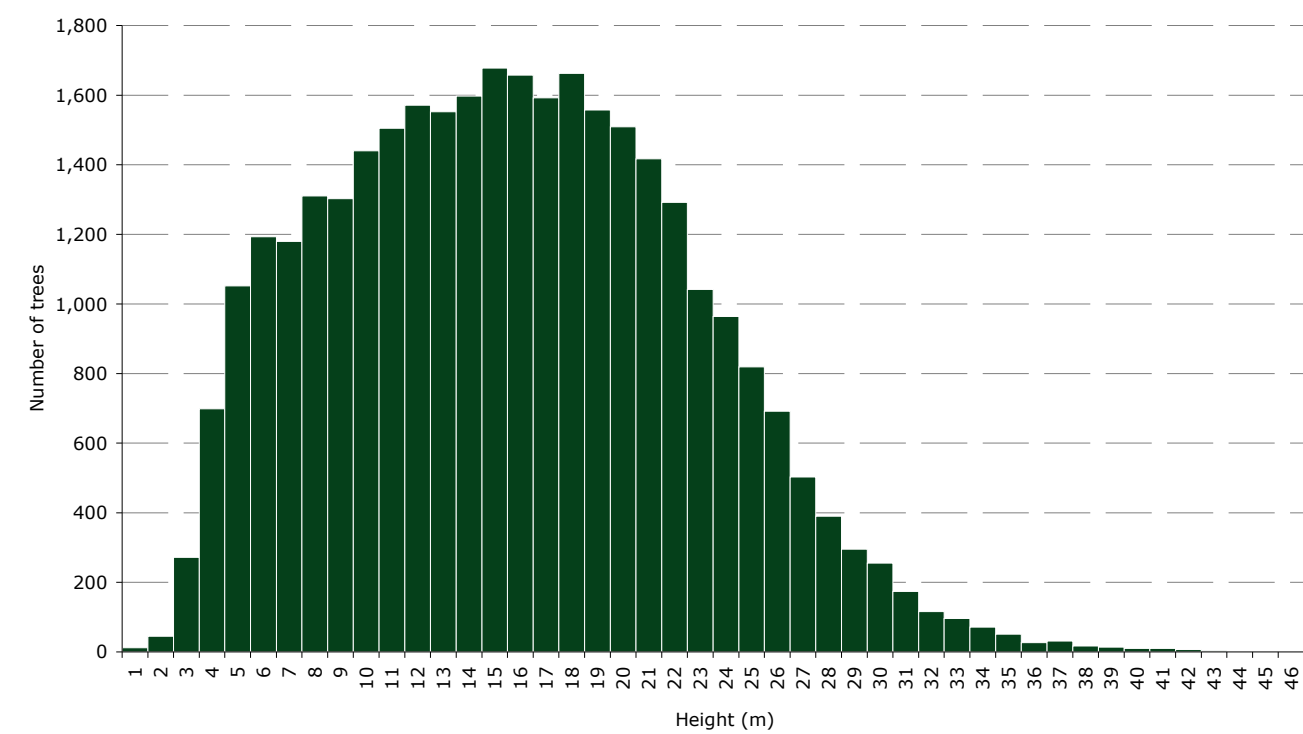
Source National Forest Inventory

Figure C6. Coniferous tree height distribution found in NFI sample plots where DAMS score >= 16

Source National Forest Inventory

Appendix D Stocked area by age class

Figure D1. Stocked area by age class for the Private sector estate as at 31 March 2011
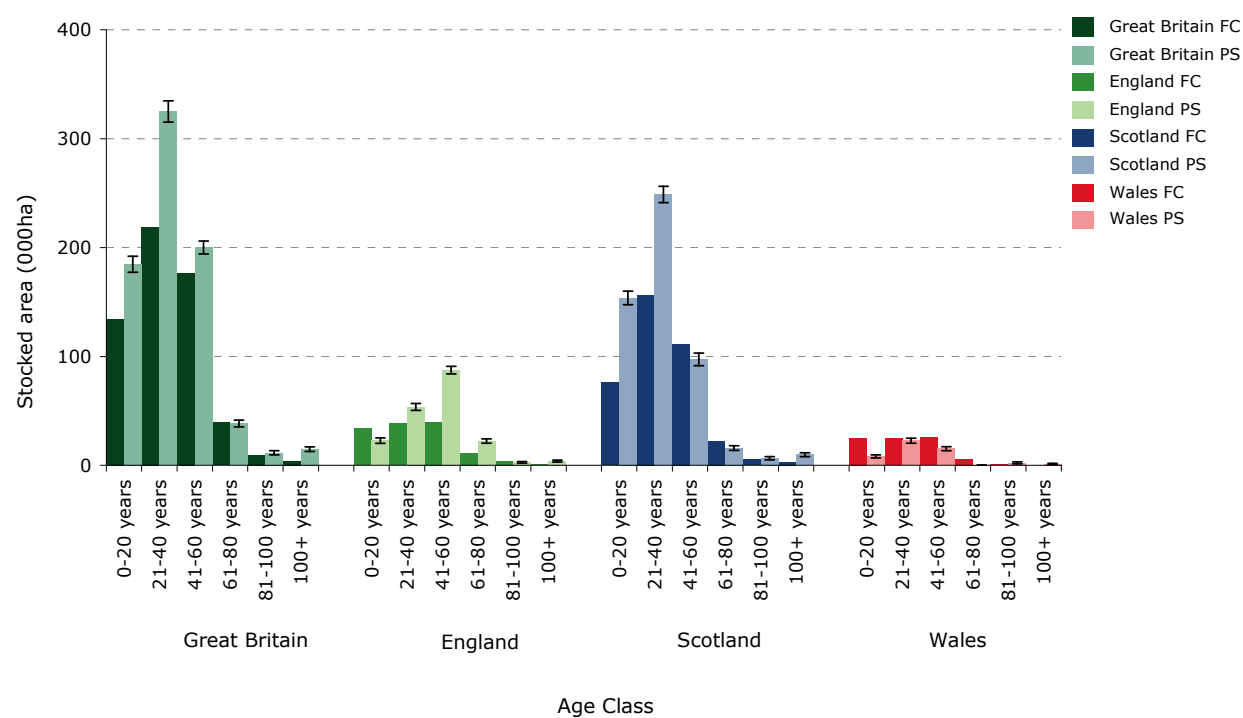
Appendix E: Yield classes by species and countries

Table E1. Mean yield classes on the FC estate

FC	Mean yield class weighted by area (age 15-50)								
	All conifers	Sitka spruce	Scots pine	Corsican pine	Norway spruce	Larches	Douglas fir	Lodgepole pine	Other conifers
England	13.91	13.81	11.24	14.72	15.41	10.88	17.88	7.01	16.14
Scotland	12.07	13.89	7.60	8.99	12.89	7.86	13.84	7.09	12.43
Wales	13.93	14.48	10.01	12.60	14.76	11.18	15.71	7.86	16.18
Great Britain	12.68	13.97	8.60	14.56	14.41	9.32	16.29	7.12	15.13

Notes:
1. Calculated on stands of conifer between the ages of 15 and 50 years.
2. Means are weighted by area of stands.

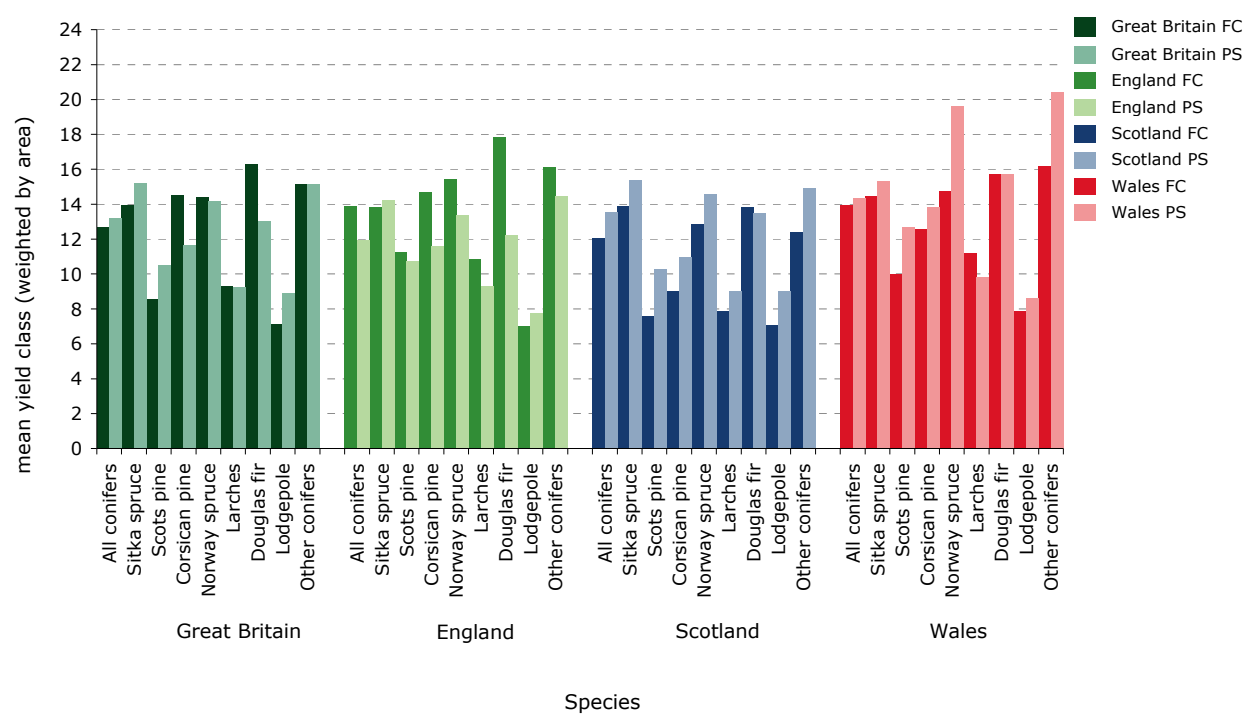## Table E2. Mean yield classes on the private sector estate

Private Sector	Mean yield class weighted by area (age 15-50)								
	All conifers	Sitka spruce	Scots pine	Corsican pine	Norway spruce	Larches	Douglas fir	Lodgepole pine	Other conifers
England	11.96	14.22	10.75	11.61	13.37	9.30	12.20	7.75	14.44
Scotland	13.52	15.36	10.30	10.97	14.57	9.05	13.51	9.05	14.91
Wales	14.38	15.31	12.67	13.86	19.64	9.84	15.74	8.61	20.42
Great Britain	13.20	15.24	10.49	11.64	14.18	9.24	13.04	8.92	15.15

Notes:
1. Calculated on stands of conifer between the ages of 15 and 50 years.
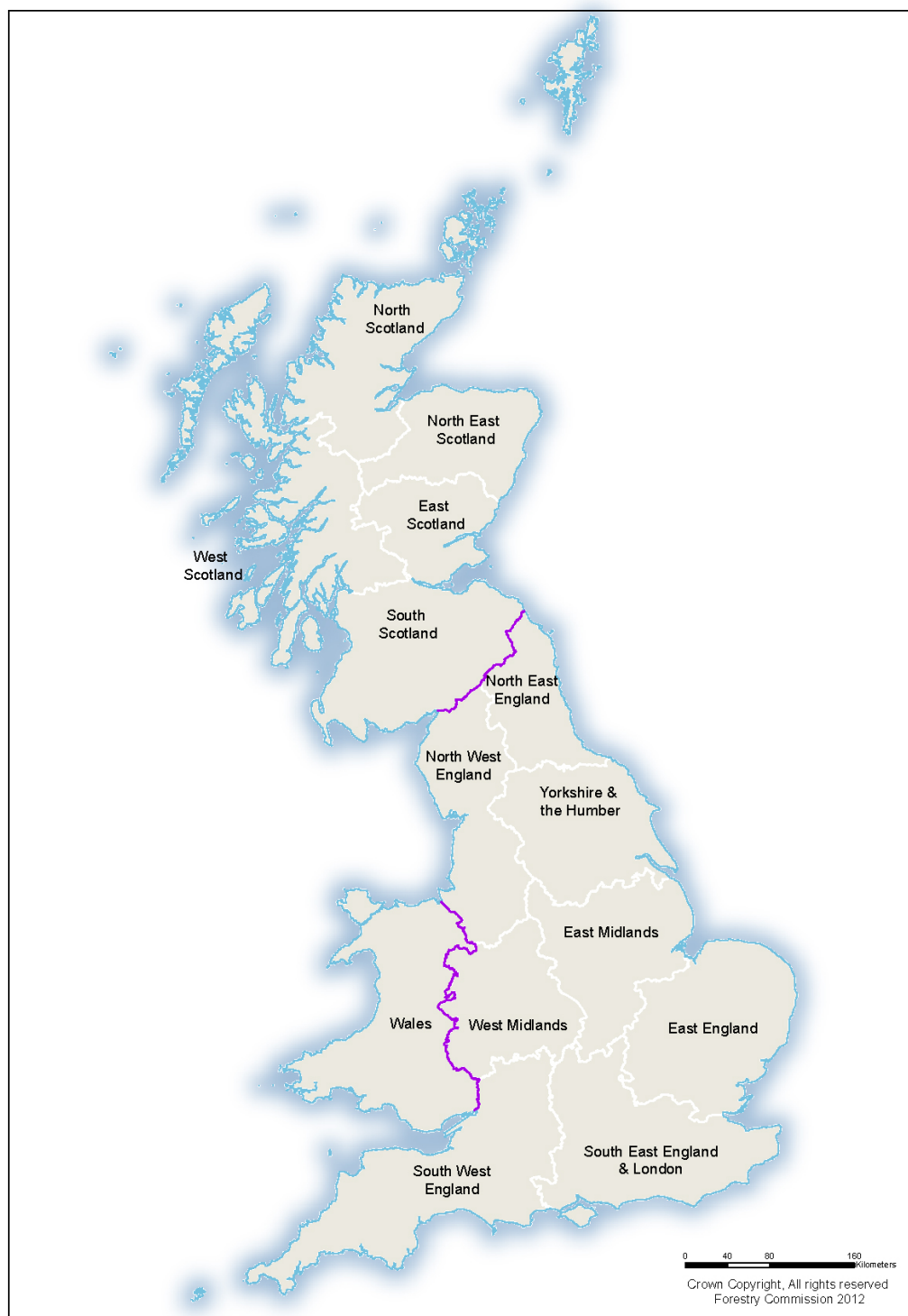2. Means are weighted by area of stands.

Figure E1. Mean yield classes

Source Forestry Commission

Appendix F: GB forecast zones

North
Scotland

North East
Scotland

East
Scotland

West
Scotland

South
Scotland

North East
England

North West
England

Yorkshire &
the Humber

East Midlands

Wales   West Midlands   East England

South East England
& London

South West
England

0   40   80   160
                              Kilometers

Appendix G: Surveying/squares further info and figures

Table G1. Square distribution within GB

Number of squares surveyed	Number of Private sector squares surveyed	Number of Private sector squares containing coniferous species	Number of Private sector squares containing broadleaved species
4922	4036	3050	3061

Table G2. Square distribution within NFI reporting regions

Region	Number of squares	Number of Private sector squares	Number of Private sector squares with coniferous trees	Number of Private sector squares with broadleaved trees
North West England	258	219	152	193
North East England	150	95	77	77
Yorkshire & The Humber	509	365	226	332
East Midlands	173	149	75	147
East England	287	209	132	201
South East England & London	589	482	332	473
South West England	428	385	249	376
West Midlands	110	106	75	102
North Scotland	258	225	201	93
North East Scotland	337	324	306	204
East Scotland	335	272	223	192
South Scotland	671	542	497	252
West Scotland	474	352	298	158
Wales	343	311	207	261

Variations in regional sampling intensities vary for two reasons. Firstly as sampling is with probability proportional to size, regions with larger forest areas will be allocated more squares for sampling. Secondly, progress in surveying can be uneven due to operational constraints.

As the survey progress's more squares will be measured and added to this tally. This will improve the standard errors associated with estimates or forecasts in those regions.

Some regions have higher levels of squares than would be expected on the basis of relative scale of woodland area alone. This is because those regions have purchased additional sampling and surveying in their region to improve the accuracy of information in their region. This process is called the NFI 'top up' scheme and any organisation can buy additional survey work to improve the accuracy of estimates for particular
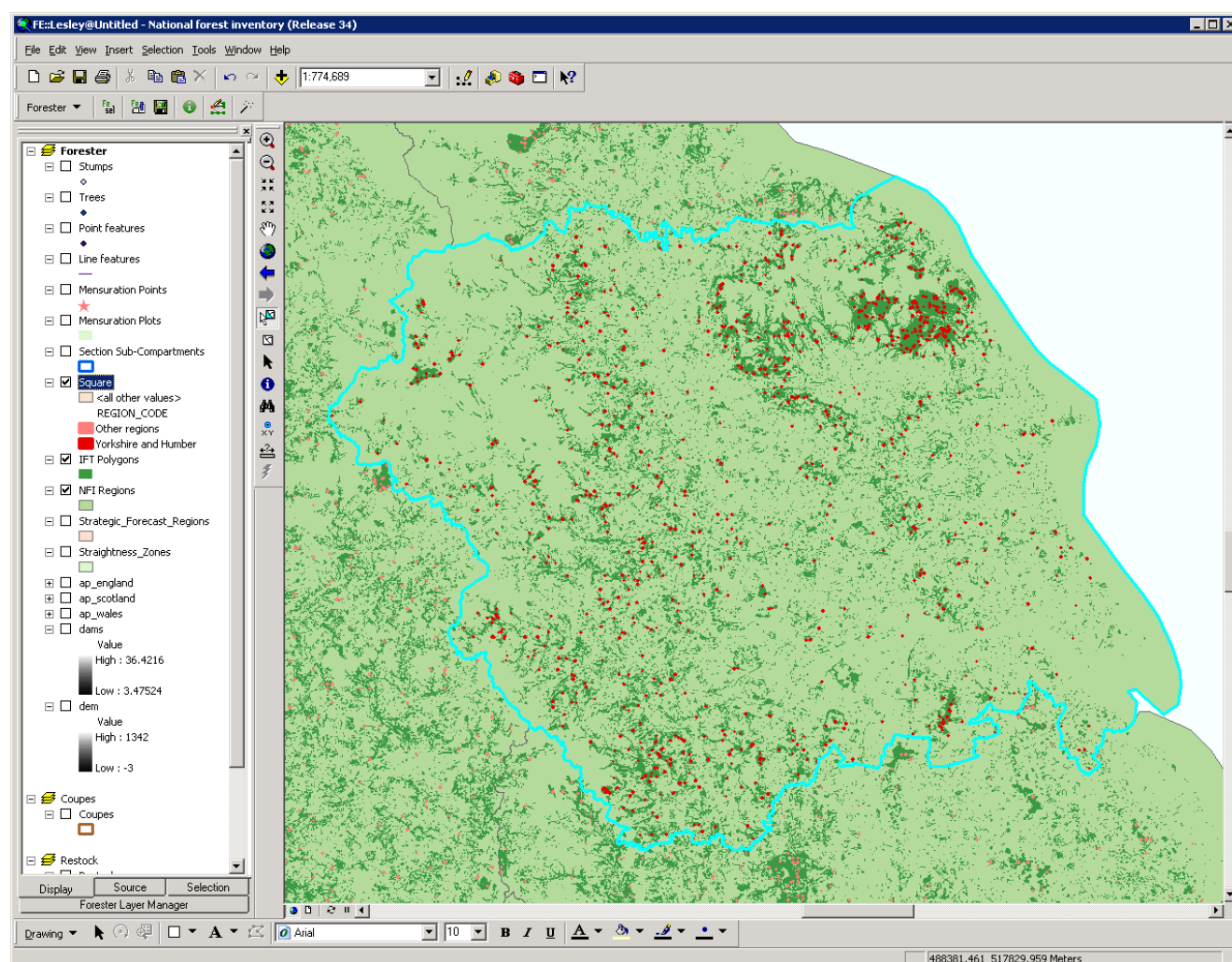
geographic areas or other specific features of GB woodlands. Information and advice on the scheme can be found by contacting: mark.lawrence@forestry.gsi.gov.uk
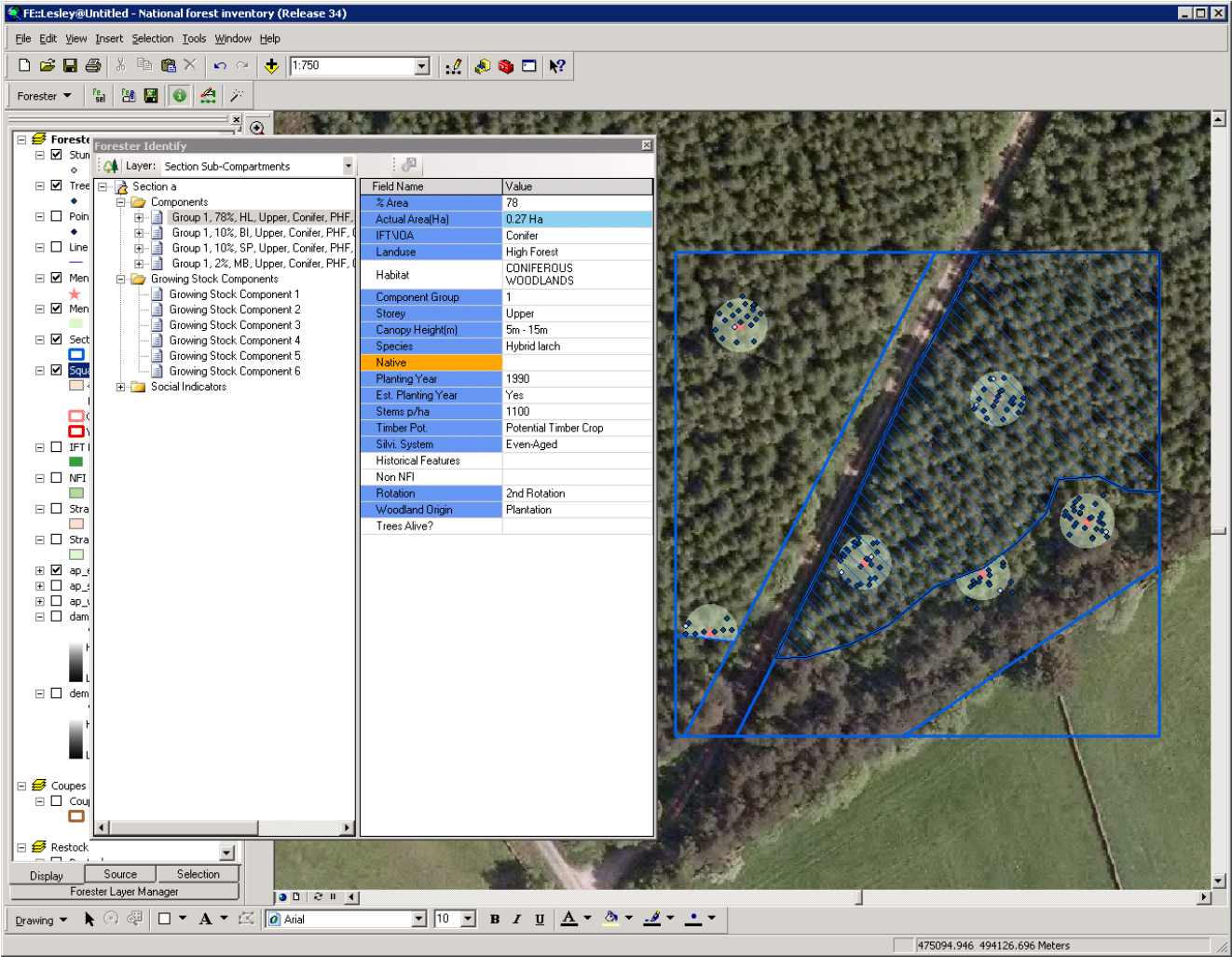
Appendix H: Square data

Figure H1. Squares in Yorkshire and Humber region

The dark green areas represent mapped woodland and the red points are the location of sample squares.

Figure H2. A sample square

The sample square has been stratified into landuse of a relatively homogeneous nature, coniferous forest, broadleaved forest, road and agriculture. The forested areas are further stratified by species type and other discriminating factors. A series of attributes are assessed at the stand level, such as species, management, storey structure and canopy height, some of these can be seen in the dialogue box on the left. At each forest strata advanced statistical and GIS software locates a series of sample plots (green circles), where individual trees are mapped and measured (blue points).

NFI Statistical Analysis Report
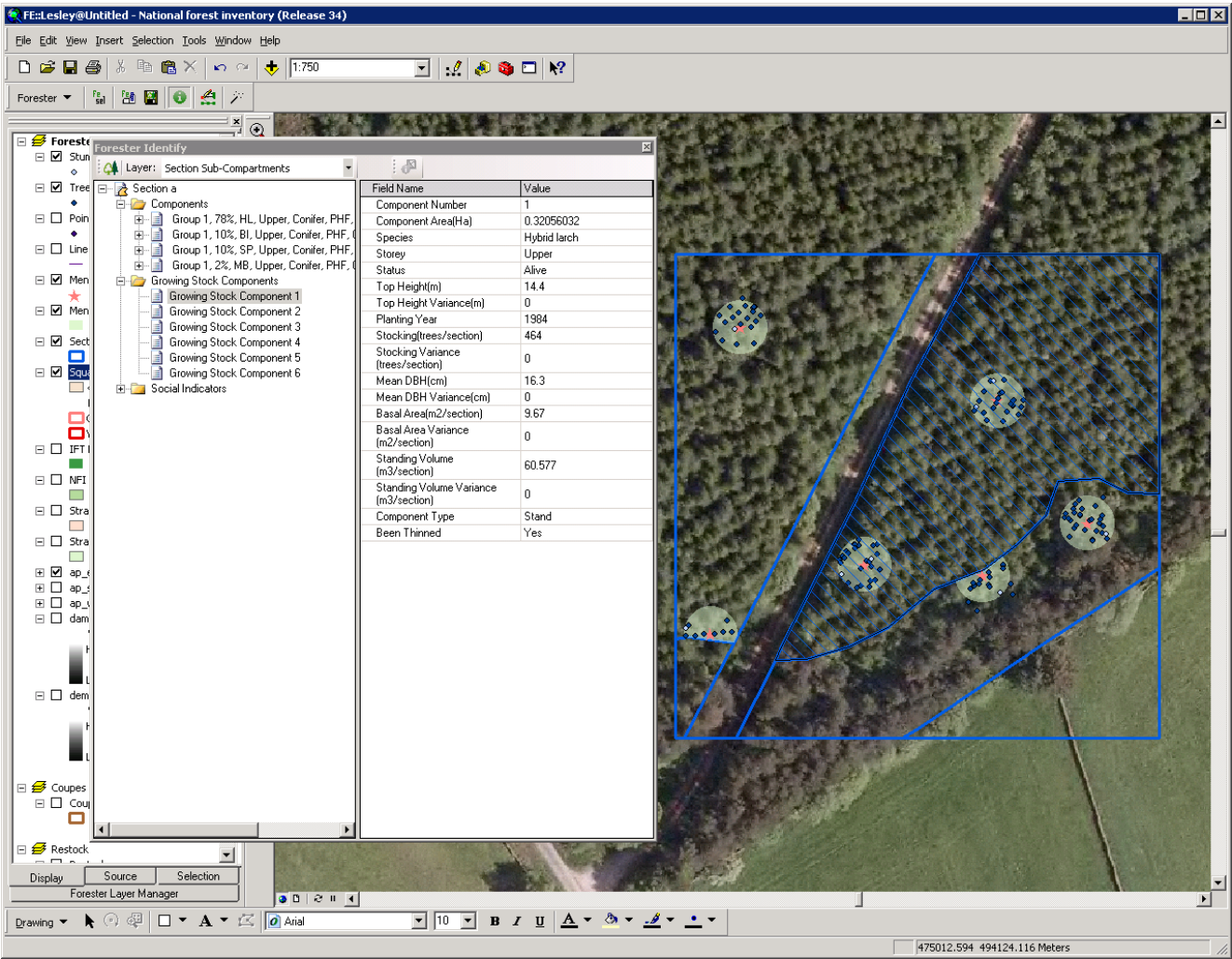
Figure H3. Plots and individual trees
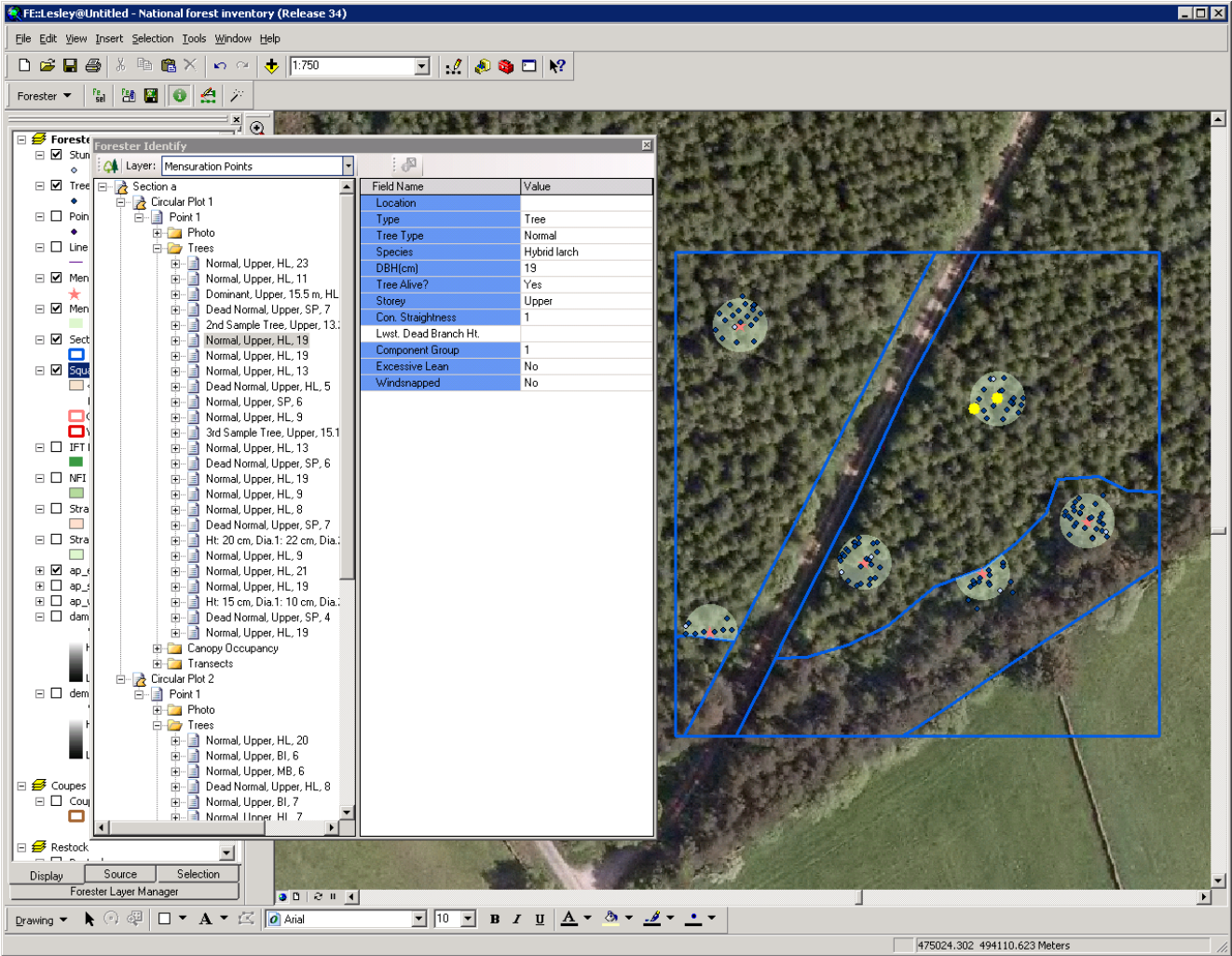
The surveyor locates each plot and marks the site with a metal peg. At each plot all trees over 4cm are recorded and mapped. All trees have a series of mensuration measures taken and, on a sub-sample of trees, height and crown measures are taken.

NFI Statistical Analysis Report

Figure H4. Calculated growing stock

The assessments and measurements taken at each plot are then fed into the NFI Growing Stock Calculator software routine, which calculates top height, stocking, mean DBH and basal area for each tree component in each stand.

Glossary

actual production	Timber actually felled and removed from the forest. The Forestry Commission keeps records of actual production for its estate, while estimates for the Private sector come from receipts reported by timber processors. These figures are available from Forestry Commission Statistics
age class	A grouping of trees into specific age ranges, for classification purposes.
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 hectares) within (e.g. rides, glades, ponds).
availability	A term to describe what timber could potentially be available for harvesting within a forest area.
biological potential	A term applied to forecast scenarios with the objective of maximising timber production. It typically involves felling stands in the year of maximum MAI and Management table thinning. It may not take account of factors that constrain thinning and felling (e.g. wind risk or pest attack). The forecast results set out in this report involve constraints on thinning and times of felling to take account of wind risk.
broadleaves	Trees and shrubs that belong to the angiosperm division of the plant kingdom (as distinct from the gymnosperm division that includes conifers). Most in the UK have laminar leaves and are deciduous. Sometimes referred to as 'hardwoods'.
clearfelling	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.
conifers	Trees and shrubs that belong to the gymnosperm division of the plant kingdom (as distinct from the angiosperm division that includes broadleaves). Conifers mostly have needles or scale-like leaves and are usually evergreen. Sometimes referred to as 'softwoods'.
cumulative volume production	The total volume of timber that is forecast to be produced over the entire forecast period, including any overdue timber
DAMS (detailed aspect methodology score)	A measure of exposure at a particular location. Can be used as a proxy indicator of the risk of catastrophic wind damage to a stand of trees. May be used to influence decisions on thinning and timing of clearfelling where wind is a risk factor.
dbh (diameter at breast height)	The diameter of a tree (overbark) at breast height, which is usually defined as 1.3 metres along the axis of the stem from the ground.
design plan	A holistic spatial and temporal plan covering the main aspects of long-term woodland management such as felling and restocking.
Dothistroma needle blight	An important disease of conifers (especially pines) which causes premature needle defoliation, resulting in loss of yield and, in severe cases, tree death. Also known as Red Band needle blight.
FC estate (Forestry Commission estate)	Forests, woodlands, open land and other property managed by the Forestry Commission.
felling plan	A spatial and temporal plan of harvesting activity within a woodland.

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 metres), whether in large tracts (generally called forests) or smaller areas known by a variety of terms (including woods, copses, spinneys or shelterbelts).
Forestry Commission	The government department responsible for the regulation of forestry, implementing forestry policy and management of state forests in GB. Forestry policy is devolved, with the exception of common issues, addressed on a GB or UK basis, such as international forestry, plant health and forestry standards.
FS (Forest Service of Northern Ireland)	An agency within the Department of Agriculture and Rural Development in Northern Ireland responsible for the regulation of forestry and the management of state forests in Northern Ireland.
Great Britain (GB)	England, Scotland and Wales.
high forest	Woodland which is not managed as coppice or pollards and which may or may not be managed for timber.
increment	The increase in volume of a tree or a stand over a year or annualised over a specified period measured either in m^3 per year or in m^3 per hectare per year. See also Mean annual increment (MAI).
like-for-like restock	Replacement of felled trees by species with similar productivity. Usually taken to mean, after a period of two years, replacement of felled trees with trees of the same species and yield class.
maximising productivity	The management of woodland to maximise volume production by thinning at the MTI.
mensuration	The science of measuring time and distance, used in forestry to mean the measurement of standing and felled timber.
Maximum MAI (maximum mean annual increment) (MMAI)	The age at which a stand reaches the maximum average rate of volume increment which it can achieve. Felling the stand at this age will ensure that the stand reaches its highest average production per annum for its lifespan, thus optimising the stand in terms of volume production over the long term.
Mean annual increment (MAI)	The average annual rate of volume production from year of planting to a given year, expressed in m^3 per hectare per year. In even-aged stands it is calculated by dividing cumulative volume production by age.
MTT (management table thinning)	A sequence of thinnings prescribed by Forestry Commission yield tables over the life of a forest stand. Management table thinning refers to the pattern of thinning recommended in these yield tables. In standard yield tables the thinnings are set to an intensity which aims to maximise diameter increment whilst also maintaining maximum cumulative volume production
MTI (marginal thinning intensity)	The maximum sustainable intensity of thinning defined as 70% of yield class per hectare per year (m^3/ha/year).
NATIONAL FOREST INVENTORY (National Forest Inventory)	An inventory run by the Forestry Commission, set up in 2009, to provide a record of key information about GB forests and woodlands.
overbark	Used as a definition when the volume of wood includes the bark.
overdue	Timber contained in stands that are beyond the felling age prescribed by the harvesting scenario at the start of the forecast
Phytophthora	Fungus-like pathogens that can cause extensive damage and mortality to trees and other plants.
planned production	The volumes and assortments published in the removals forecast,

	reflecting the cumulative impact of managing the FC estate (as of 31 March 2011) in accordance with approved forest design and thinning plans.
potential production	A forecast which will not necessarily transpire. As the private sector estate forecast makes assumptions about future levels of harvest, and the assumptions may not transpire, this forecast is one of potential production.
private sector estate	Forests and woodlands in the UK not owned or managed by the Forestry Commission or FS. 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.
production forecast	A forecast of softwood volume production based on a firm plan of harvesting
restocking plan	A spatial and temporal plan covering replacement planting in harvested areas.
softwood	The wood of coniferous trees or the conifers themselves.
stand	A relatively uniform collection of trees (from either artificial or natural regeneration), composed, for example, of a single species or a single age class.
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).
standing volume	the live stemwood and useable branchwood of trees (up to 7 cm top diameter). It excludes roots, below ground stump material, small branches, foliage and deadwood. For Private sector woodland only, it also excludes standing volume in trees in woodlands of less than 0.5 hectares. Usually expressed as m^3 overbark standing (m^3 obs).
stem wood	The woody material forming the above ground main growing shoot(s) of a tree or stand of trees. The stem includes all woody volume above ground with a diameter greater than 7 cm overbark. Stemwood includes wood in major branches where there is at least 3 m of 'straight' length to 7 cm top diameter.
Sustainable (forest management)	The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity and vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions at local, national and global levels, and that does not cause damage to other ecosystems.
terminal height	The top height of a stand at which risk of wind damage is expected to reach a level necessitating clearfelling.
thinning	The removal of a proportion of trees in a forest after canopy closure, usually to promote growth and greater value in the remaining trees.
timber	The woody product from felled trees, which is destined for construction material, pulp or paper industries.
top diameter	The diameter of the smaller (top) end of a log, often used to define different categories of wood products (e.g. sawlogs, roundwood, pulp) and merchantable timber.
top height	The mean total height of the 100 largest dbh trees per hectare.
UK (United Kingdom)	Great Britain plus Northern Ireland.
volume per hectare	The woody volume of trees (measured in m^3/ha).
windthrow/windblow	Uprooting of trees by the wind. Windthrow can be endemic – i.e. that

	caused by frequently recurring peak winds – or catastrophic – an infrequent occurrence associated with exceptionally strong winds where large areas/numbers of trees are blown down
yield class (YC)	An index used in the UK of the potential productivity of even-aged stands of trees based on maximum MAI. It reflects the potential productivity of the site for the tree species growing on it.