

GB 25-year forecast of standing coniferous volume and increment

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Summary

The National Forest Inventory provides a record of the size and distribution of forests and woodlands in Great Britain and information on key forest attributes. This Inventory Report gives an estimate of the standing timber volume (as of 31 March 2011) in living coniferous trees within Great Britain's woodlands and forests and a forecast of standing volume and increment* during the next 25 years. These forecasts are conditional upon forests being managed as currently planned on the Forestry Commission estate and as assumed in the Private sector estate. The report also includes estimates and forecasts for England, Scotland and Wales, broken down by Forestry Commission and Private sector ownership.

- Total standing coniferous volume in all forests and woodlands in Great Britain is forecast to be an average annual amount of 290 million m³ in the period 2012–16 and to decrease to 235 million m³ by the period 2032–36, contingent on certain assumptions about timber harvesting being realised.
 - o The overall Great Britain decrease from 2012–16 to 2032–36 is reflected in decreases in the forecasts for each individual country: 65 to 49 million m³ in England, 192 to 162 million m³ in Scotland, and 33 to 23 million m³ in Wales.
 - o Total standing coniferous volume on the Forestry Commission estate decreases from 115 million m³ to 95 million m³.
 - o Total standing coniferous volume on the Private sector estate decreases from 175 million m³ to 139 million m³.
- The forecast of average annual increment for Great Britain decreases from 15 million m³ in the period 2012–16 to 13 million m³ in the period 2032–36, which is lower than the projected harvesting rate of 16.5 million m³ and accounts for the reduction in standing volume.
- Harvesting rates exceed those of increment largely due to the post-Second World War boom in planting. The trees that were established at that time are now reaching maturity while, on the other hand, planting rates over the last 25 years have been relatively low.
- The predominant harvesting practice of felling crops at economic maturity or earlier, without some form of overall co-ordination, would perpetuate this trend.
- These standing volumes **exclude** 46 million m³ of timber that is overdue for felling, 42 million m³ of which occur in the Private sector estate.

*Standing coniferous volume is defined as live coniferous stemwood 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 hectare. 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.

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Introduction

This report provides the first published Forestry Commission forecast of standing coniferous timber volume in Great Britain (GB). After giving an estimate of the current total standing coniferous volume (as of 31 March 2011) it goes on to forecast how these volumes and increments may change over time. These results are broken down by age class, size class, country and region.

This report is one of a series arising from the current National Forest Inventory (NFI), which is carried out by the Forestry Commission to provide accurate, up-to-date information about the size, distribution, composition and condition of the forests and woodlands in GB. This information is essential for developing and monitoring policies and guidance to support sustainable forest management.

The current NFI, which began in 2009 (the first cycle is due for completion in 2015), is a multipurpose operation that has involved the production of a forest map for GB and a continuing programme of field surveys of the mapped forest and woodland areas. Information and data collected by the NFI will be used for a number of purposes, including current estimates and 25-year forecasts of forest metrics such as:

- Timber availability
- Carbon storage
- Biomass

Estimates of aspects of the biodiversity and social value of forests and woodlands will also be provided by the NFI.

This Inventory Report sets out a 25-year forecast (as at 31 March 2011) for standing coniferous volume and increment for all forests and woodlands in GB. Results for standing broadleaved volume will be published in 2013. Further information on this and other NFI outputs is available from www.forestry.gov.uk/inventory.

Standing coniferous volume and increment

A direct estimate of standing coniferous volume in GB was published in April 2012 (National Forest Inventory Report: *Standing Timber Volume for Coniferous Trees in Britain*). This new report forecasts how that standing volume will evolve over time under prescribed approaches to harvesting, giving a breakdown of volume by age class and size class, and by country and NFI region (see Figure 14).

The forecast of standing coniferous volume and increment is the new foundation for the Forestry Commission GB forecast of softwood availability, which is published every five years. These forecasts cover softwood availability from the Forestry Commission (FC)

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estate (in GB), the Forest Service (FS) estate (in Northern Ireland), and potential softwood availability from the Private sector (UK wide). A softwood availability forecast is being published in parallel with this current document.

The Forestry Commission, in conjunction with the Forest Service in Northern Ireland, has produced a production forecast of timber at approximately five-year intervals since 1964. The production forecast estimates the amount of coniferous stemwood timber that is expected to be produced from UK forests over a 20 or 25-year period. The aims of these exercises have been to provide robust information to help both the growers and processors of timber to plan and invest appropriately in the sector.

The 2011 forecast widens the objectives of this traditional forecast to include the impact of the thinning and felling arising from the forecast on the standing coniferous volume and increments presented within this report. This approach usefully couples the production forecast with standing coniferous volume estimates and will help policy-makers in GB to assess the sustainability of current practice and policy in timber harvesting and how it affects GB standing coniferous volume and increment.

How standing volume and increment are forecast

Forecasts of total standing timber volume and increment are determined by:

- Woodland area
- Woodland characteristics (e.g. age, yield class, rate of tree growth)
- Number and size of trees
- Rates of harvesting
- Rates of replanting and planting

The estimates and forecasts have been derived through assessing how much standing coniferous volume there is in the forests today, how quickly the forests are growing (and gaining standing volume/increment) and when and how much of this growth in standing volume 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 (the latter two are referred to as mensuration data). Forestry Commission growth and yield models are then applied to this data to predict how fast the forests will grow over the forecast period. Using this forecast of growth, assumptions are then made about which stands of trees will be cut and when. This forms the basis of deriving a standing volume forecast. The annual gain in standing volume is known as the increment.

The forecasts of standing volume and increment in this report have been derived separately for the FC estate and for the Private sector estate, as described in more detail in the sections on each below, but summarised here. They are based on the same principles but use different data sources. For the FC estate, information on woodland area and woodland characteristics has been extracted from the Forestry Commission's long-established sub-compartment database (SCDB) and input to the Forestry Commission's Forecast system. For the Private sector estate, the estimates were derived from results obtained to date from the NFI, which were then processed through the same Forecast system. The NFI provides parameters such as total woodland area and the age and size of trees and, by implication, their rate of growth. For both sectors, the forecasts are contingent upon the assumptions made about the execution and timing of future thinnings, fellings and replanting on felled sites.

Forecasts for the Forestry Commission estate

Predicting tree growth/increment

The FC estate forecast was derived from the Commission's 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 data is combined with Forestry Commission growth and yield models, Forestry Commission felling and thinning plans (held as individual felling and thinning coupes across the entire estate) and is processed through the Forestry Commission's Forecast system to produce timber volume and increment forecasts (and the 2011 standing coniferous volume estimates).

Predicting rates of harvest

A large element in establishing a forecast of standing volume is to forecast rates of harvest or removals from that standing volume. For the FC estate the forecast of removals from standing volume is based upon full felling and thinning plans as noted above. This use of approved Forestry Commission harvest plans means that forecast levels of harvest and thus standing volume forecasts are more likely to reflect what actually happens over time than if no plans were in place. However, the Forestry Commission plans do evolve over time and there is the requirement to maintain some flexibility in their application for operational purposes. Such flexibility is reflected in the Forestry Commission marketing plans.

Forestry Commission marketing plans

The volumes published in this standing volume and increment forecast 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 that date. However, these plans evolve over time to reflect emergent policies and events and consequently actual standing volumes will vary from this forecast. For the first period of the forecast (2012–16) 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 $\pm 5\%$, through a combination of new and existing contracts.
- Forestry Commission Scotland is committed to bring 3.2 million m³ per annum ($\pm 5\%$) 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.
- The forecast commits Forestry Commission Wales to bring to market at least 80% of forecast volume in the period 2012–16 through a combination of new and existing contracts.

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For the Forestry Commission the forecast beyond 2016 is a signal of intent only, but is based upon existing plans. As noted above, these will evolve over time, but are expected to be broadly adhered to.

While taking into account the flexibility around the future implementation of the plans, having the felling and thinning plans in place nevertheless gives a strong 'backbone' to predicting removals from the FC estate. Thus, the Forestry Commission forecast of standing coniferous volume is less susceptible to uncertainty about future removals than a forecast with no plans in place. It therefore results in a relatively firm prediction of standing coniferous volume and increment.

A full account of the FC estate methodology can be found in the *NFI Forecasts Methodology Overview* paper and the *Felling and Removals Forecasts* technical documentation.

Forecasts for the Private sector estate

Predicting tree growth/increment

For the Private sector estate, the 2011 standing coniferous volume and increment forecasts follow the same basic approach as that for the FC estate (as do the softwood availability forecasts, which contribute to these), but the data used is quite different. Compared to previous Private sector forecasts, the 2011 forecasts do not rely so heavily on industry expertise in the fields of estimating both the growing rates and likely future felling and thinning regimes in the Private sector.

Indeed, one of the drivers behind establishing the NFI in 2009 was the lack of contemporary hard data on GB forests and one of the NFI's main aims has been to provide an accurate picture of the growing stock by assessing extent and type of woodland through mapping and direct measurement. In addition, the NFI has also captured data on the biodiversity and social aspects of forests.

For the inventory of the Private sector estate, the NFI produced a 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. It is based upon 25-cm resolution colour aerial photography for England and Scotland and 40-cm resolution aerial photography for Wales. The map was validated and updated using satellite imagery, from 2007 and 2009, which gave an independent cross-check of woodland present. Satellite imagery was also used to identify areas of recently felled forests and woodland. Particular attention was paid to identifying areas of woodland loss verified as being due to the establishment of renewable energy projects or the restoration of habitats. Field survey work is used to refine the map-based estimates of woodland areas, felled areas and to measure detailed aspects of the forest. This map

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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. 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.

A total of 4,036 sample one hectare squares were surveyed in mapped areas of Private sector estate forests. This was a sub-sample of a statistically designed sample representing all GB forested areas on the NFI map. 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 attributes were measured. On average around two stands were found per square, resulting in 8,052 stands being assessed for the Private sector estate production forecast. Within each stand, field-based computer systems were used to locate two to three 100 m² (0.01 ha) circular plots, within which all trees over 4 cm DBH were mapped, species identified and diameters measured. This resulted in 228,311 trees being measured. For 59,334 of these trees, additional observations were taken of tree height and crown dimensions. These measurements provided the basis of estimating the standing coniferous volume of stands of trees. All squares and plot locations were marked on the ground with metal pegs and their GPS data were recorded. At least 8% were remeasured by an independent quality assurance team.

The *NFI Forecasts Methodology Overview* and *NFI Survey Manual* papers describe this methodology in detail.

Predicting rates of harvest

Harvesting rates in the Private sector are harder to predict than for the Forestry Commission. In the Private sector estate there is neither a comprehensive record of felling and thinning plans nor a commitment to harvest a given volume from these plans. Without such specific harvesting plans in place, assumptions have had to be made about rates of harvesting on the Private sector estate to produce a forecast of removals and of consequent future standing volume and increment. The Private sector forecasts are therefore highly contingent upon the realisation of these assumptions and it is important to be aware of them when interpreting the forecasts. The assumptions used have been developed through extensive consultation with Private sector estate owners and timber processors. Their development involved preparing and assessing a range of likely future harvesting scenarios on the Private sector estate, based upon different harvesting assumptions. For each of these scenarios forecasts were prepared and their resultant outcomes were assessed. Out of this range of scenarios one was chosen for the main forecasts, but the other scenarios are also available for comparison.

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In the selected scenario, the NFI has used a prescriptive and formulaic future harvesting scenario to model potential future production and standing volume from the Private sector. The approach used is that all the Private sector forests are assumed to be managed under a biological potential regime, within which it is assumed that stands not predicted to be subject to windthrow risk will be regularly thinned then clearfelled at the age of maximum mean annual increment (MMAI). This is an industry standard measure, which maximises timber yield over time in a formulaic and widely understood manner.

The concept of maximising productivity is explored further in the paper *Interpreting NFI Timber Volume Forecasts*. For thinning a similar approach was taken by applying a series of best practice prescriptions set out in Forestry Commission management table thinning (MTT). This was applied in all areas assessed not to be significantly at risk from windthrow if thinned. No thinning was assumed in areas of high exposure. Areas of high exposure were defined as those scored with a detailed aspect methodology score (DAMS) of 16 or above. Additionally, forests in these high exposure areas are assumed to be felled on attaining a height of 25 m, if this is before the age of maximum MAI. This is a broad-brush approach to wind risk and the outputs are sensitive to varying both the DAMS threshold and the height at which stands are assumed to be felled.

More information on this approach and the alternative harvesting scenarios considered 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. The results from these individual sample squares were scaled up to the Private sector forest area derived from the NFI map to give estimates for the Private sector estate. This new data was used in conjunction with the Forestry Commission growth and yield models to produce forecasts of future standing coniferous volume and, by applying the harvesting scenario, a range of forecasts of both standing volume and timber removals over a 25-year period. This is the basis of the Private sector estate standing coniferous volume forecast for GB.

As the forecast is based on the NFI field sample, a sampling standard error (SE) can be assigned to the forecasts of standing volume and increment. This gives a measure of the accuracy of the forecasts, contingent upon the assumptions made about removals.

Factors common to both forecasts

Restocking of areas projected to be felled

To produce the forecasts, it has been assumed that forests projected to be felled within the forecast period are replaced on a like-for-like basis. This means that stands are replaced with trees of the same species and yield class as the previously felled stand. This 'virtual' planting is assumed to occur two years after felling. This takes account of the fact that areas felled will normally be replanted and the new crop will subsequently gain standing volume. The standing volume arising from such planting will begin to accumulate when trees reach 7 cm DBH. This will start to occur some 5 to 10 years after planting, dependent on species and growth rates. As trees increase their growth rate as they age, this impact will increase through the 25-year forecast period. The standing volumes arising from such areas will have little to no impact in the first periods of the forecast, but in the later periods can contribute up to 15% of standing volume. The standing volume of replanted crops are included in the forecasts of future standing volume.

This like-for-like assumption is a simplification of what is likely to be a more complicated situation, as planting strategies in future may be different to the strategies that were in place when the previous crop was planted, some 30 or more years ago.

Planting practice at any point in time will depend upon Private sector practice and government policy, as both influence the rate and type of replanting in forests. The result of this will be that future replanting will not entirely follow the assumptions used to derive this forecast.

An example of such differences would be the widely held opinion within the forest sector that many stands will exhibit a future increase in the proportion of open space and broadleaves in many situations. Consideration should also be given to current forest area losses associated with renewable energy projects, open habitat restoration and the low proportion of coniferous species (see *Forestry Statistics*) that are being replanted in some areas. However, although restocking does impact on standing volumes, differences between the type and level of restocking are not likely to impact greatly on a 25-year forecast of standing volume and increment. The impact will, however, become more apparent in longer-term forecasts with a substantially longer forecast horizon.

In the coming years the NFI will provide additional forecasts based on a wider range of replanting scenarios. As part of this, NFI will undertake a study of the impact of recent restocking policies on net forest area and the impact of different future potential restocking scenarios. This will be undertaken in order to analyse how different replanting approaches impact upon future standing coniferous volume and increment.

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As a part of this work, the impact of renewable energy projects and habitat restoration, as well as additional new planting (afforestation), will be assessed.

The impact of different rates of replanting are explored further in the *Interpreting NFI Timber Volume Forecasts* paper.

Overdue timber

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

In most harvesting scenarios overdue timber represents a significant amount of standing volume (around 14%). Whether this volume will be harvested, and when, will depend upon a number of factors including owner choices, physical and biological constraints, and the characteristics of the stands involved. For example, stands may be managed for long-term amenity retention and may never be felled. Such stands are often older than the assumed norm for the scenario and this indicates a definite proportion of woodland that is being managed out of the 'norm'. This view is reinforced by the fact that, whichever harvesting scenario was chosen in the forecast, there was always some overdue timber. However, it is not known why they have not been felled and conversely it is not known why they may be felled.

Considering these and other factors, it was observed that a significant proportion of this timber may never be harvested and the standing volume associated with overdue timber is therefore treated as a 'special case' and its volume is reported separately. This separate data enables assessments to be made about how much of this timber may be harvested and how much this will impact on standing volume and increment profiles over time.

Additionally, as a result of applying scenarios consistently, all areas felled as overdue will be restocked on a like-for-like basis, as is the case with 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 start to contribute more significantly to standing volume.

Currently clearfelled area

Forest area that was identified as clearfelled in the field survey is not included in these forecasts. It is probable that a significant proportion of this area will be replanted and

will contribute to standing volume, increment, production, carbon sequestered and biomass in the future. Assuming no replanting in all cases is likely to result in a small underestimate in the forecasts of future standing volumes and increments, especially in later years of the forecast. This conservative approach was taken because the NFI has no information on what was previously growing on Private sector sites and therefore lacks the information required for the application of like-for-like restocking. The Forestry Commission does have such information on what was grown on its own estate, but to maintain parity in the estimates between the two sectors it was decided not to include clearfelled areas for both sectors. This approach is consistent with the approach taken by all previous forecasts.

Changes in land use and land management

Land use can change over time from forest to non-forest and from non-forest to forest, and this will impact on standing volume and increment. There is a general presumption that forested land stays forested in accordance with the UK Forestry Standard, but land use will occasionally change from forest to non-forest. Conversely, other land uses, such as agricultural land, can be afforested. Additionally, at any point in time there are active sales and purchases of land and such transactions may involve a change in management and sometimes in land use.

Forests are harvested differently under different ownership types and, as a standing volume and increment forecast is significantly influenced by the rate and type of harvesting, the NFI has needed to make assumptions about the ownership of forests in the future, since this is expected to affect how they will be harvested over the forecast period. For example, sales of Forestry Commission land often involve a change in approach to harvesting (and thus standing volume) and they correspondingly involve a change in approach within the forecasting process. The following situations are considered to be those that impact most on standing volume:

1. Forested land transferring from one ownership to another, while 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.

For situations 2, 3, 4 and 5 the NFI field work will take account of any land-use changes that have happened up until 31 March 2011 by measuring these on the ground. For potential future changes in land use and ownership the assumption used in the forecasts is that land use does not change. This assumption could either over- or underestimate the area and the amount of available growing stock in the future. However, since there is no quantifiable evidence base to take account of such changes,

and as current rates of new planting and woodland loss are low in relation to the overall woodland area (see National Forest Inventory Woodland Area Statistics for GB), they have not been accounted for in the current forecasts. Potential future purchases of land for afforestation, or afforestation in general, are therefore not included within the forecasts.

There is evidence to support standing volume being influenced by factor 1, however, such as differences in the rates of thinning and age of clearfelling between the Forestry Commission and Private sector estates. This is specifically accounted for in the forecasts and Forestry Commission sales of land are discussed in the following section.

Forestry Commission sales of land

Differences in age class distributions and rates of thinning between Forestry Commission and Private sector ownership show that past management of the two sectors has been different. Also, the forecasting of future levels of harvesting between the two sectors is different, with the FC estate forecast using existing harvesting plans to drive the forecast and the Private sector forecast using harvesting scenarios. To take account of this factor, the forecast must make assumptions about past, current and potential land sales on the FC estate, because after such land sales the Forestry Commission thinning and felling plans which drive this part of the forecast will no longer apply. This is covered in three main ways:

1. Removing any forest areas already sold from the Forestry Commission SCDB and transferring this area to the Private sector forecast.
2. Accounting for planned disposals. The Forestry Commission flags the year of any planned disposals within the SCDB 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.
3. The assumption of this forecast is that ownership in the future will remain constant (excluding those areas covered in point 2).

Results for standing volume and increment

The NFI estimates that the standing coniferous volume in GB, as of 31 March 2011 is 336 million m³. A full breakout by species can be found in the *Standing Timber Volume for Coniferous Trees in Britain* report. For the purposes of the 25-year forecast average annual standing volumes are presented for each five-year period. These estimates utilise harvesting assumptions in their derivation and these impact immediately on reported standing volume, taking account of overdue stands, Forestry Commission disposals and assumed felling and thinning. The paper on *Interpreting NFI Timber Volume Forecasts* discusses how such factors constrain and influence the timing and amount of timber that will be harvested and how this will impact upon standing volume and increment. Such factors account for the reduction from 336 million m³ as of 31 March 2011 to 290 million m³ average annual standing volume for the period 2012–16.

Standing coniferous volume is defined as the volume of stemwood to 7 cm top diameter in m³ overbark, including stump (above-ground) and utilisable branch wood (of minimum 3 m in length and 7 cm top diameter). In the figures and tables, m³ obs refers to m³ overbark standing.

The baseline date of the forecasts is 31 March 2011. The forecasts start 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. Volumes are presented as annual averages within each five-year period.

The forecasts include the restocking of crops that are felled within the forecast period on a like-for-like basis, where felled crops are replaced with crops of the same species and yield class after a two-year fallow period. Forecasts exclude overdue timber and also exclude existing clearfelled land found within the NFI survey.

Harvesting regimes used for the FC estate are based upon Forestry Commission felling and thinning plans as of 31 March 2011. The Private sector forecasts are based upon management to maximum MAI and MTT, constrained by wind risk factors.

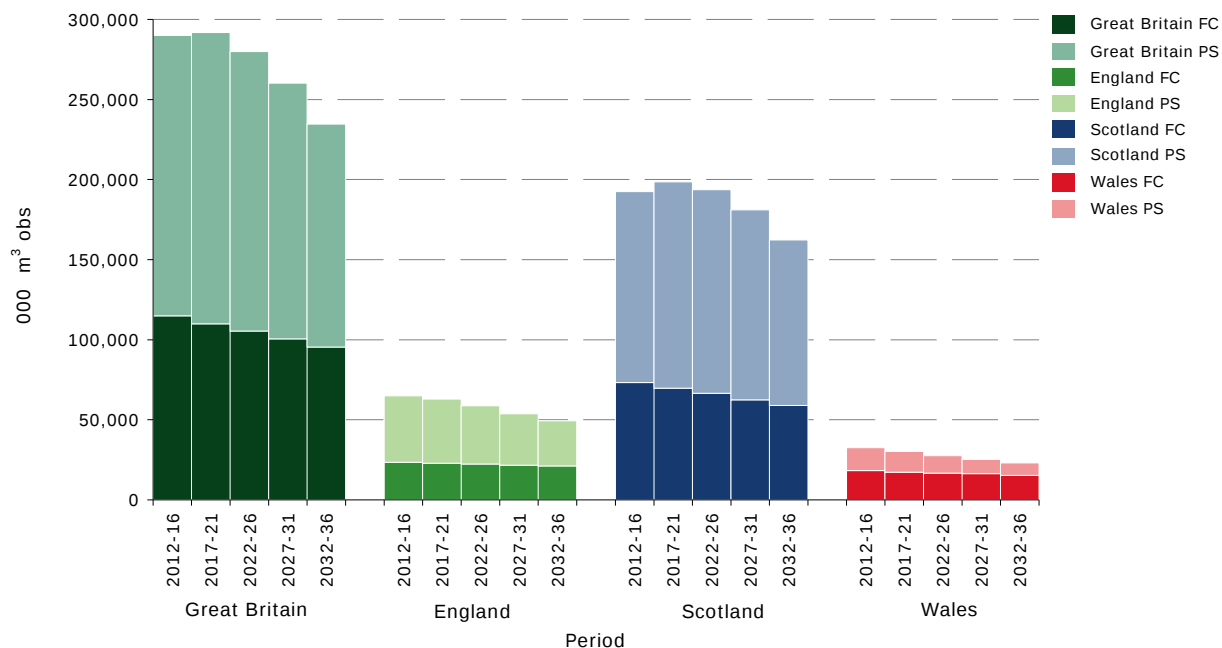
Entries in tables have been independently rounded, so may not add to the totals shown.

Data for the Private sector estate is based upon a sample and is provided with associated sampling standard errors (SE).

The standing coniferous volume forecasts for GB are shown in Figure 1 and Table 1.

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Figure 1. 25-year forecast of average annual standing coniferous volume.



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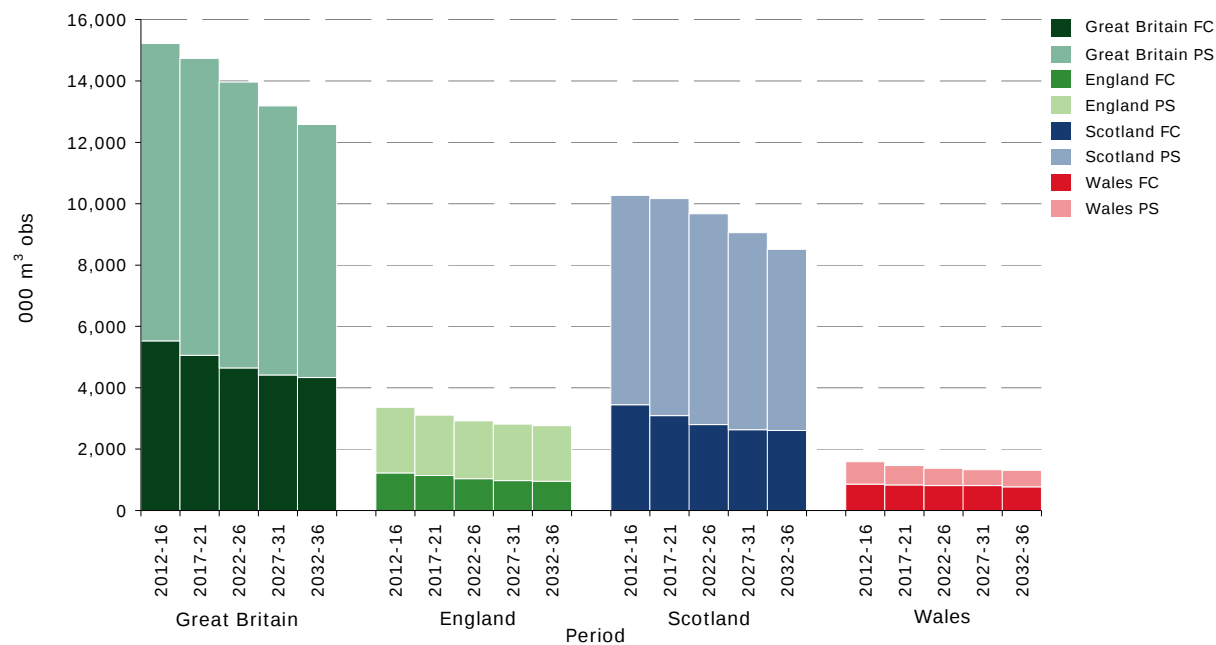
Table 1. 25-year forecast of average annual standing coniferous volume.

Forecast period	FC	Private sector		Total
	(000m ³ obs)	(000m ³ obs)	SE%	(000m ³ obs)
England				
2012-16	23,389	41,626	3	65,015
2017-21	22,874	40,094	4	62,968
2022-26	22,317	36,386	4	58,702
2027-31	21,633	32,183	4	53,816
2032-36	21,121	28,276	4	49,396
Scotland				
2012-16	73,237	119,210	2	192,448
2017-21	69,682	128,866	2	198,548
2022-26	66,526	127,120	2	193,646
2027-31	62,421	118,654	2	181,075
2032-36	58,924	103,304	3	162,228
Wales				
2012-16	18,195	14,391	7	32,585
2017-21	17,338	12,834	8	30,172
2022-26	16,624	10,962	9	27,587
2027-31	16,429	8,885	10	25,314
2032-36	15,364	7,725	10	23,089
Great Britain				
2012-16	114,821	175,227	2	290,048
2017-21	109,894	181,794	2	291,688
2022-26	105,467	174,468	2	279,935
2027-31	100,483	159,722	2	260,205
2032-36	95,408	139,305	2	234,714

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The average annual coniferous volume increment forecasts for GB are shown in Figure 2 and Table 2. Net increment is defined as volume growth, inclusive of harvested volumes, less losses due to natural mortality, including endemic windthrow.

Figure 2. 25-year forecast of average annual coniferous net increment.



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Table 2. 25-year forecast of average annual coniferous net increment.

Forecast period	FC	Private sector		Total
	(000m ³ obs)	(000m ³ obs)	SE%	(000m ³ obs)
England				
2012-16	1,224	2,136	3	3,360
2017-21	1,137	1,966	3	3,103
2022-26	1,036	1,885	3	2,921
2027-31	975	1,837	4	2,812
2032-36	955	1,813	4	2,768
Scotland				
2012-16	3,442	6,828	2	10,270
2017-21	3,090	7,076	2	10,166
2022-26	2,800	6,869	2	9,668
2027-31	2,630	6,420	2	9,051
2032-36	2,608	5,900	2	8,508
Wales				
2012-16	861	731	6	1,592
2017-21	832	636	7	1,468
2022-26	810	563	7	1,374
2027-31	810	514	8	1,324
2032-36	774	535	8	1,309
Great Britain				
2012-16	5,528	9,694	2	15,222
2017-21	5,059	9,678	2	14,738
2022-26	4,646	9,317	2	13,963
2027-31	4,415	8,771	2	13,187
2032-36	4,336	8,248	2	12,585

Volume not in the forecast

The following stands, volumes and areas have been removed from 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 gauged. Consequently, a view may be taken as to whether or not these volumes should be added to the figures already quoted in the main forecasts to provide an assessment of total standing volume and increment.

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Overdue timber

Table 3 shows that there is estimated to be about 46 million m³ of overdue coniferous timber. 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.

Table 3. Overdue timber.

	FC	Private sector		Total	FC estate	Private sector		Total
	volume (000m ³ obs)	volume (000m ³ obs)	SE%	volume (000m ³ obs)		area (000 ha)	area (000 ha)	area (000 ha)
England	912	18,866	7	19,778	3.4	38.5	6	41.9
Scotland	794	19,443	10	20,237	2.9	39.8	8	42.7
Wales	2,194	3,501	25	5,694	5.0	6.0	22	11.0
Great Britain	3,900	41,810	6	45,710	11.2	84.3	5	95.6

Note: The harvesting regimes used to define what is overdue (or not) for the FC estate are Forestry Commission felling and thinning plans and, for the Private sector estate, biological potential constrained by wind risk.

As a proportion of stocked woodland area and total standing volume, England has a higher percentage of overdue timber than Scotland or Wales.

Forestry Commission sales of land

As of 31 March 2011, the Forestry Commission SCDB had around 30,000 hectares flagged for disposal. This disposal programme is an indication of intent and may change over time. Forestry Commission policy on sales of land is the responsibility of the respective Ministers of each country and, as policy evolves over time, sales may or may not occur over the forecast period. This area and the standing volume forecast arising from it are accounted for separately, and the standing volumes are shown in Table 4.

Table 4. 25-year forecast of standing volume for Forestry Commission flagged disposals assuming biological potential.

Country	2012-16	2017-21	2022-26	2027-31	2032-36
	volume (000 m ³ obs)	volume (000 m ³ obs)	volume (000 m ³ obs)	volume (000 m ³ obs)	volume (000 m ³ obs)
England	806	701	631	595	594
Scotland	4,813	4,961	4,638	4,018	3,371
Wales	-	-	-	-	-
Great Britain	5,620	5,662	5,269	4,612	3,965

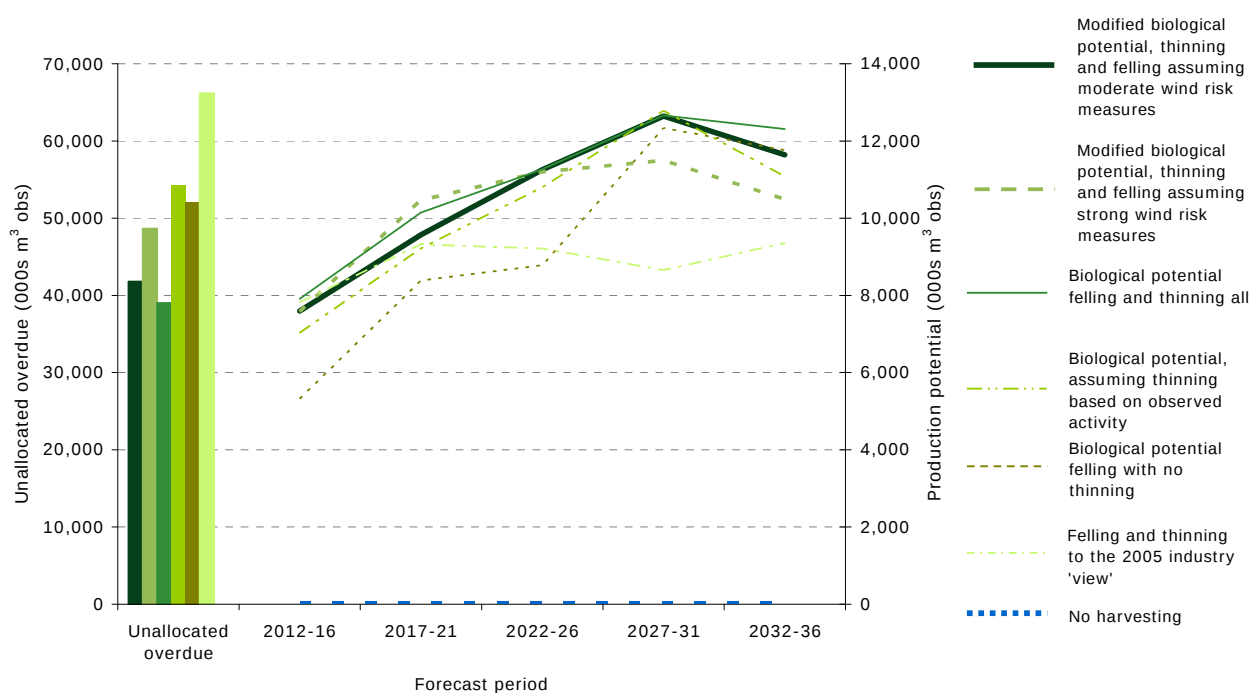
Notes:

1. The harvesting scenario used is that of biological potential constrained by wind risk.
2. Whether this land is sold or not is subject to future land sales policy.

The range of potential harvesting scenarios

As discussed in the section on ‘How standing volume and increment are forecast’, a range of potential harvesting scenarios were applied to the standing volume forecast to assess the different impacts on standing volume. Out of these scenarios, the biological potential harvesting scenario with moderate wind risk constraints, was chosen to derive the Private sector standing volume and increment values in the tables and figures in this report. To illustrate the impact of choosing this scenario over the others, the production profile arising from it has been presented alongside those of the others in Figure 3. It can be seen that the harvesting scenario chosen is one of many potential scenarios; by choosing this scenario we are forecasting one option for future standing volume and increment. Most other scenarios forecast less harvesting, which would elevate standing volume and increment over the forecast period. Conversely, a few scenarios forecast more harvesting, which would depress standing volume. The industry’s own predictions of harvesting rates used to create the 2005 production forecast would further depress standing volumes. This needs to be borne in mind when appraising the forecast results and it should be noted that actual profiles may take the path of any of these or other possible scenarios. An explanation of each scenario and the impacts of such assumptions on the forecast are explored in the NFI Interpretation Paper: *Interpreting National Forest Inventory Timber Volume Forecasts*.

Figure 3. The impact of different harvesting scenarios upon 25-year timber production potential for the Private sector (GB).



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Standing volume forecasts broken down by age class, size class and location

Table 5 shows standing volume forecasts for GB and the individual countries broken down by age class in selected years (2012, 2017, 2022, 2027, 2032).

Table 5. 25-year forecast of average annual standing volume per age class.

England	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
2012				
0-20 years	551	878	17	1,430
21-40 years	6,502	12,829	7	19,330
41-60 years	11,249	25,792	5	37,040
61-80 years	3,947	2,836	15	6,783
81-100 years	1,301	193	43	1,495
100+ years	207	0	-	207
Total	23,757	42,528	3	66,285
2017				
0-20 years	484	315	21	798
21-40 years	6,436	10,610	8	17,046
41-60 years	9,738	24,711	6	34,449
61-80 years	4,803	6,307	11	11,111
81-100 years	1,625	48	78	1,673
100+ years	210	0	-	210
Total	23,296	41,992	4	65,287
2022				
0-20 years	366	553	16	919
21-40 years	6,305	8,820	9	15,125
41-60 years	8,397	21,316	6	29,712
61-80 years	5,406	7,471	10	12,878
81-100 years	1,966	45	52	2,012
100+ years	300	0	-	300
Total	22,741	38,205	4	60,945
2027				
0-20 years	328	1,822	7	2,149
21-40 years	5,452	5,734	12	11,186
41-60 years	7,928	17,263	7	25,191
61-80 years	5,842	9,943	8	15,784
81-100 years	1,856	456	31	2,312
100+ years	728	0	-	728
Total	22,134	35,217	4	57,351
2032				
0-20 years	608	3,706	6	4,314
21-40 years	4,562	4,777	16	9,339
41-60 years	7,335	13,090	8	20,424
61-80 years	5,554	8,397	10	13,950
81-100 years	2,242	275	42	2,517
100+ years	1,176	0	-	1,176
Total	21,476	30,245	5	51,720

Scotland	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
2012				
0-20 years	1,143	4,615	9	5,758
21-40 years	28,014	70,078	4	98,092
41-60 years	34,806	37,033	6	71,840
61-80 years	8,475	2,634	18	11,109
81-100 years	2,149	440	44	2,590
100+ years	1,109	0	-	1,109
Total	75,695	114,801	2	190,496
2017				
0-20 years	1,188	4,261	7	5,449
21-40 years	20,649	53,901	5	74,550
41-60 years	33,241	63,924	5	97,165
61-80 years	11,967	4,012	17	15,979
81-100 years	2,958	604	39	3,562
100+ years	1,138	0	-	1,138
Total	71,142	126,702	2	197,844
2022				
0-20 years	1,320	3,982	7	5,302
21-40 years	17,210	46,957	5	64,167
41-60 years	30,748	74,219	5	104,967
61-80 years	13,679	6,011	14	19,690
81-100 years	3,990	605	35	4,595
100+ years	1,254	0	-	1,254
Total	68,201	131,774	2	199,975
2027				
0-20 years	1,088	3,456	9	4,544
21-40 years	15,082	45,248	5	60,330
41-60 years	27,585	68,363	5	95,948
61-80 years	14,563	8,498	12	23,061
81-100 years	4,163	508	36	4,671
100+ years	1,805	0	-	1,805
Total	64,287	126,073	3	190,360
2032				
0-20 years	1,922	4,319	8	6,240
21-40 years	12,989	32,705	5	45,694
41-60 years	23,237	56,810	5	80,047
61-80 years	13,636	11,927	11	25,563
81-100 years	5,871	219	55	6,090
100+ years	2,727	0	-	2,727
Total	60,382	105,980	3	166,362

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Wales	FC	Private sector		Total
	volume (000 m³ obs)	volume (000 m³ obs)	SE%	volume (000 m³ obs)
2012				
0-20 years	586	358	37	944
21-40 years	4,636	7,439	12	12,074
41-60 years	9,600	6,723	16	16,323
61-80 years	3,057	0	-	3,057
81-100 years	328	0	-	328
100+ years	19	0	-	19
Total	18,226	14,520	8	32,746
2017				
0-20 years	460	257	23	717
21-40 years	4,745	4,899	17	9,644
41-60 years	7,677	8,682	13	16,359
61-80 years	4,466	1	92	4,466
81-100 years	540	0	-	540
100+ years	20	0	-	20
Total	17,907	13,840	8	31,747
2022				
0-20 years	322	245	29	567
21-40 years	5,033	3,113	19	8,146
41-60 years	6,396	8,335	13	14,731
61-80 years	4,523	1	92	4,524
81-100 years	675	0	-	675
100+ years	43	0	-	43
Total	16,993	11,694	9	28,687
2027				
0-20 years	381	428	22	809
21-40 years	4,759	1,735	20	6,494
41-60 years	5,890	6,698	14	12,588
61-80 years	4,718	344	57	5,062
81-100 years	743	0	-	743
100+ years	104	0	-	104
Total	16,594	9,205	10	25,800
2032				
0-20 years	644	910	18	1,555
21-40 years	4,295	2,107	18	6,402
41-60 years	5,233	5,113	18	10,346
61-80 years	3,881	280	51	4,161
81-100 years	1,241	0	-	1,241
100+ years	260	0	-	260
Total	15,554	8,410	11	23,965

Great Britain	FC	Private sector		Total
	volume (000 m³ obs)	volume (000 m³ obs)	SE%	volume (000 m³ obs)
2012				
0-20 years	2,280	5,851	8	8,131
21-40 years	39,151	90,346	4	129,496
41-60 years	55,655	69,548	4	125,203
61-80 years	15,479	5,470	12	20,949
81-100 years	3,779	634	33	4,413
100+ years	1,334	0	-	1,334
Total	117,678	171,848	2	289,527
2017				
0-20 years	2,132	4,834	7	6,965
21-40 years	31,830	69,410	4	101,240
41-60 years	50,656	97,318	4	147,974
61-80 years	21,236	10,320	9	31,556
81-100 years	5,123	652	36	5,775
100+ years	1,368	0	-	1,368
Total	112,345	182,533	2	294,878
2022				
0-20 years	2,009	4,779	6	6,788
21-40 years	28,549	58,889	4	87,438
41-60 years	45,541	103,870	4	149,411
61-80 years	23,609	13,483	8	37,092
81-100 years	6,632	651	33	7,282
100+ years	1,597	0	-	1,597
Total	107,935	181,672	2	289,608
2027				
0-20 years	1,796	5,706	6	7,502
21-40 years	25,293	52,717	5	78,010
41-60 years	41,403	92,324	4	133,727
61-80 years	25,123	18,785	7	43,907
81-100 years	6,763	964	24	7,727
100+ years	2,637	0	-	2,637
Total	103,015	170,496	2	273,511
2032				
0-20 years	3,174	8,935	5	12,109
21-40 years	21,846	39,589	5	61,435
41-60 years	35,805	75,013	4	110,818
61-80 years	23,071	20,604	7	43,674
81-100 years	9,354	494	34	9,848
100+ years	4,163	0	-	4,163
Total	97,412	144,635	2	242,047

Figures 4 to 8 illustrate the average annual standing volume per age class at each of these points in time.

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Figure 4. Forecast of standing volume within age classes at 2012.

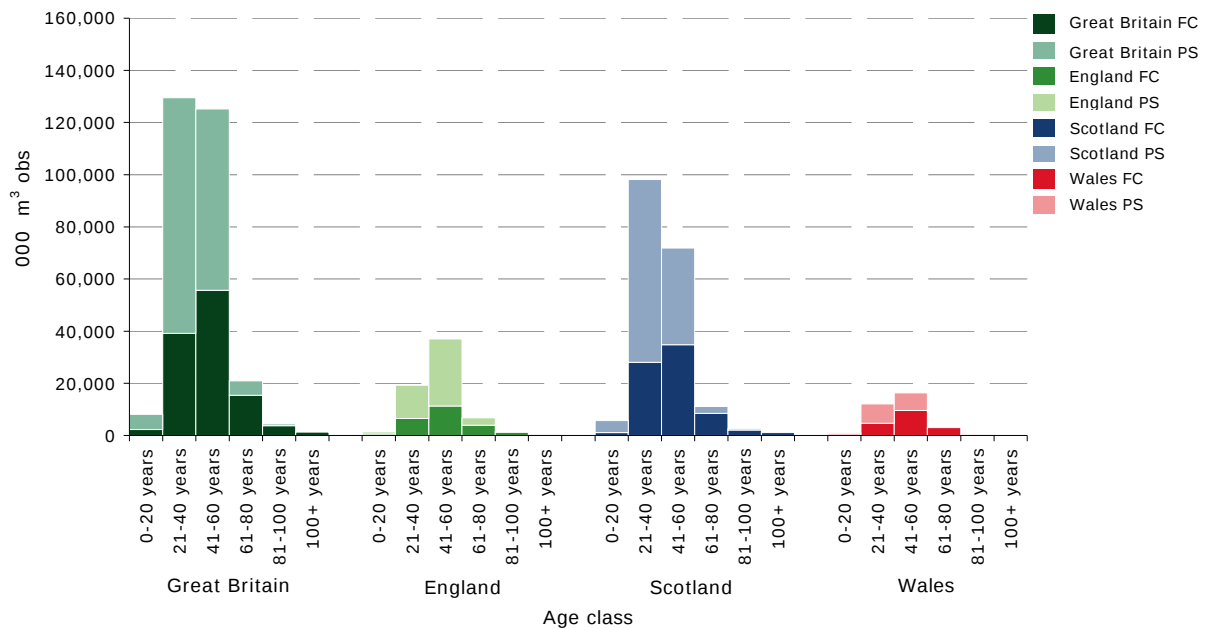
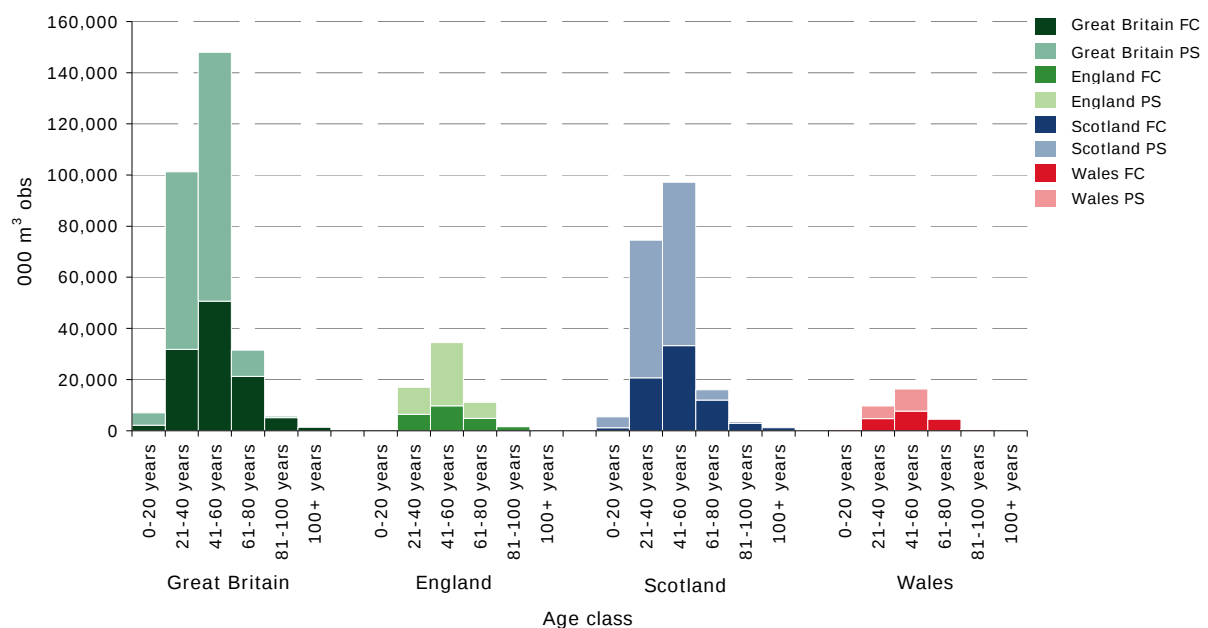


Figure 5. Forecast of standing volume within age classes at 2017.



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Figure 6. Forecast of standing volume within age classes at 2022.

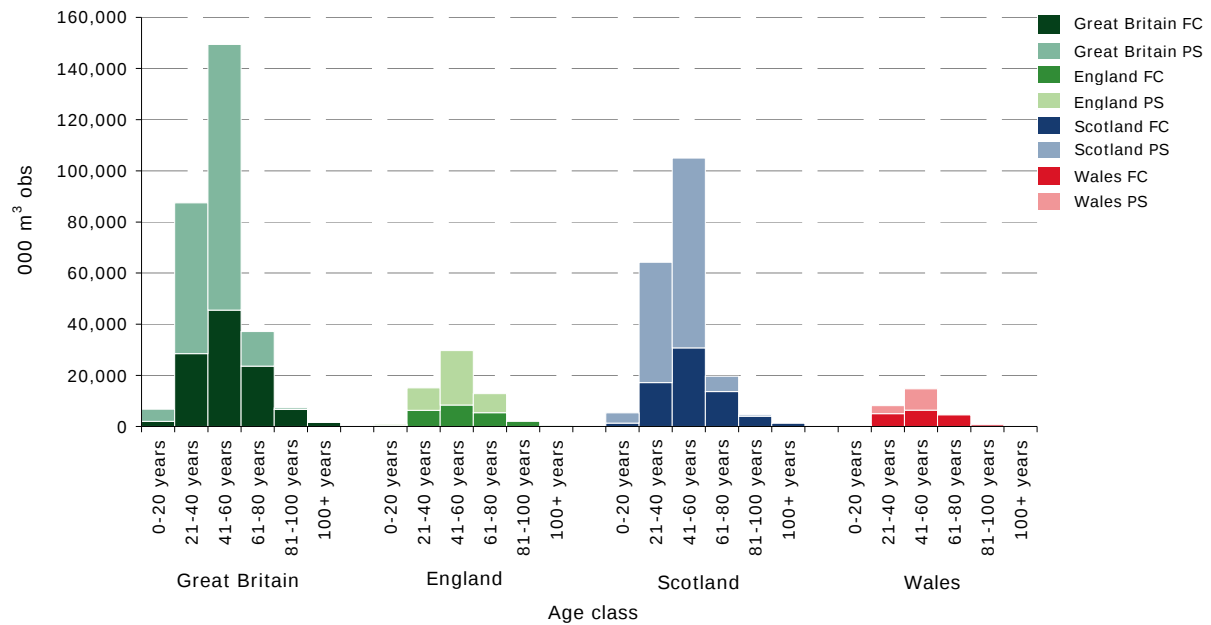
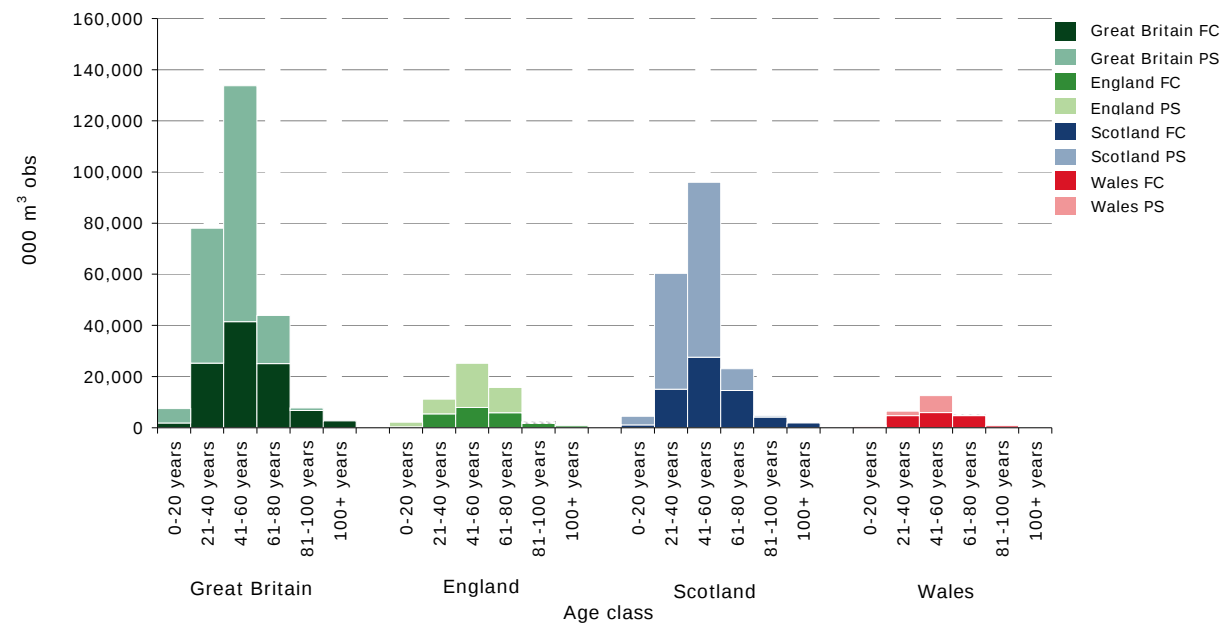


Figure 7. Forecast of standing volume within age classes at 2027.



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Figure 8. Forecast of standing volume within age classes at 2032.

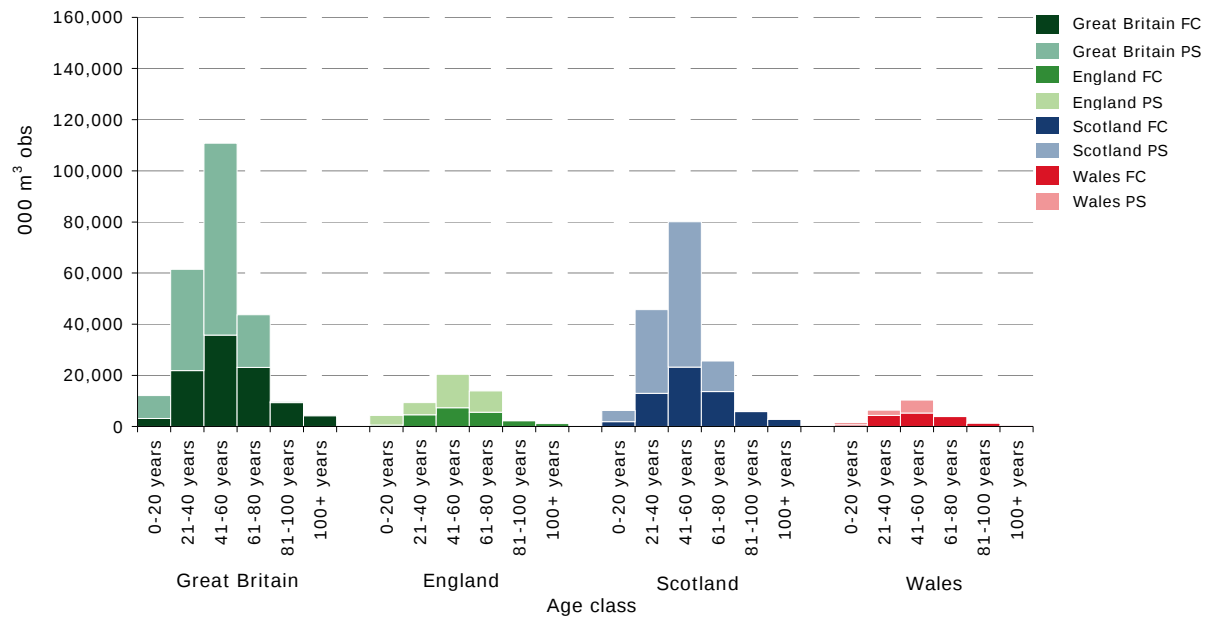


Table 6 shows standing volume forecasts for GB and the individual countries broken down by mean stand DBH ranges in the same selected years.

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Table 6. 25-year forecast of standing volume in mean stand DBH ranges.

England	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
2012				
0-7 cm	-	12	25	12
7-10 cm	126	301	17	427
10-15 cm	1,930	1,825	12	3,755
15-20 cm	4,755	4,633	10	9,388
20-30 cm	6,406	14,746	7	21,152
30-40 cm	5,028	12,976	7	18,004
40-60 cm	4,789	6,713	10	11,502
60-80 cm	576	735	27	1,310
80+ cm	146	587	51	733
Total	23,757	42,528	3	66,285
2017				
0-7 cm	-	10	50	11
7-10 cm	113	181	18	294
10-15 cm	1,620	1,369	14	2,990
15-20 cm	4,293	3,441	13	7,733
20-30 cm	5,872	13,953	7	19,825
30-40 cm	4,803	13,231	7	18,034
40-60 cm	5,619	8,614	9	14,232
60-80 cm	776	675	29	1,451
80+ cm	199	517	55	717
Total	23,296	41,992	4	65,287
2022				
0-7 cm	-	32	14	32
7-10 cm	113	305	12	419
10-15 cm	1,364	1,200	15	2,564
15-20 cm	4,383	2,791	18	7,174
20-30 cm	5,296	12,569	7	17,865
30-40 cm	4,429	11,207	8	15,636
40-60 cm	5,896	9,345	8	15,241
60-80 cm	1,044	665	19	1,709
80+ cm	216	90	48	306
Total	22,741	38,205	4	60,945
2027				
0-7 cm	-	17	31	17
7-10 cm	143	801	9	944
10-15 cm	1,260	1,460	10	2,719
15-20 cm	4,399	3,148	19	7,547
20-30 cm	4,585	9,139	9	13,725
30-40 cm	4,225	10,474	9	14,699
40-60 cm	5,789	9,032	9	14,821
60-80 cm	1,481	968	22	2,448
80+ cm	252	179	37	431
Total	22,134	35,217	4	57,351
2032				
0-7 cm	-	12	35	12
7-10 cm	253	814	11	1,067
10-15 cm	1,203	1,957	8	3,160
15-20 cm	4,454	2,514	10	6,968
20-30 cm	4,117	8,314	11	12,431
30-40 cm	3,918	8,199	10	12,116
40-60 cm	5,449	7,140	10	12,589
60-80 cm	1,748	1,087	24	2,835
80+ cm	334	206	34	540
Total	21,476	30,245	5	51,720

Scotland	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
2012				
0-7 cm	-	109	18	109
7-10 cm	382	1,310	9	1,692
10-15 cm	9,423	9,313	7	18,735
15-20 cm	26,549	26,068	6	52,617
20-30 cm	27,088	55,321	5	82,409
30-40 cm	7,495	15,512	10	23,007
40-60 cm	4,396	6,517	16	10,913
60-80 cm	329	629	38	958
80+ cm	33	23	70	55
Total	75,695	114,801	2	190,496
2017				
0-7 cm	-	96	25	96
7-10 cm	416	1,070	8	1,485
10-15 cm	6,869	8,597	6	15,466
15-20 cm	22,291	21,476	7	43,767
20-30 cm	27,330	66,481	4	93,811
30-40 cm	8,189	19,561	9	27,749
40-60 cm	5,558	8,146	15	13,704
60-80 cm	455	1,243	31	1,698
80+ cm	34	32	1	66
Total	71,142	126,702	2	197,844
2022				
0-7 cm	-	53	31	53
7-10 cm	345	1,241	8	1,586
10-15 cm	5,822	9,205	6	15,027
15-20 cm	19,210	19,267	7	38,477
20-30 cm	27,168	67,118	4	94,286
30-40 cm	8,582	26,047	8	34,629
40-60 cm	6,397	7,550	14	13,947
60-80 cm	641	1,119	29	1,760
80+ cm	37	173	88	209
Total	68,201	131,774	2	199,975
2027				
0-7 cm	-	6	46	6
7-10 cm	325	1,546	8	1,871
10-15 cm	5,303	8,142	7	13,445
15-20 cm	17,710	20,564	7	38,275
20-30 cm	24,892	55,684	5	80,576
30-40 cm	8,403	29,466	7	37,869
40-60 cm	6,666	9,354	12	16,020
60-80 cm	929	1,081	29	2,010
80+ cm	59	229	74	288
Total	64,287	126,073	3	190,360
2032				
0-7 cm	-	9	39	9
7-10 cm	646	878	14	1,524
10-15 cm	4,680	7,026	8	11,706
15-20 cm	16,501	22,251	7	38,751
20-30 cm	21,112	38,773	5	59,885
30-40 cm	9,374	25,533	8	34,906
40-60 cm	6,743	10,648	11	17,392
60-80 cm	1,239	667	33	1,906
80+ cm	88	195	14	282
Total	60,382	105,980	3	166,362

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Wales	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
2012				
0-7 cm	-	11	52	11
7-10 cm	115	78	28	193
10-15 cm	1,652	827	26	2,479
15-20 cm	3,823	1,919	21	5,743
20-30 cm	7,809	5,025	15	12,834
30-40 cm	2,646	4,742	20	7,388
40-60 cm	2,017	1,439	31	3,456
60-80 cm	117	478	109	595
80+ cm	47	0	-	47
Total	18,226	14,520	8	32,746
2017				
0-7 cm	-	19	66	19
7-10 cm	99	58	37	157
10-15 cm	1,616	771	26	2,387
15-20 cm	3,759	1,793	22	5,552
20-30 cm	7,280	5,052	16	12,332
30-40 cm	2,657	2,757	25	5,414
40-60 cm	2,251	3,274	25	5,525
60-80 cm	192	116	59	308
80+ cm	53	0	-	53
Total	17,907	13,840	8	31,747
2022				
0-7 cm	-	1	51	1
7-10 cm	115	171	38	286
10-15 cm	1,141	619	21	1,760
15-20 cm	3,748	1,791	23	5,540
20-30 cm	6,742	4,207	18	10,949
30-40 cm	2,597	1,714	30	4,311
40-60 cm	2,284	3,134	26	5,418
60-80 cm	301	12	71	312
80+ cm	66	45	90	111
Total	16,993	11,694	9	28,687
2027				
0-7 cm	-	3	78	3
7-10 cm	145	210	45	355
10-15 cm	1,062	587	21	1,649
15-20 cm	3,253	1,916	22	5,169
20-30 cm	6,989	3,116	21	10,105
30-40 cm	2,518	1,200	32	3,718
40-60 cm	2,189	1,769	29	3,958
60-80 cm	363	386	73	749
80+ cm	75	18	90	93
Total	16,594	9,205	10	25,800
2032				
0-7 cm	-	4	77	4
7-10 cm	214	129	28	343
10-15 cm	1,252	857	25	2,109
15-20 cm	2,461	1,842	20	4,303
20-30 cm	6,828	3,275	20	10,102
30-40 cm	2,313	659	42	2,972
40-60 cm	1,977	1,291	39	3,268
60-80 cm	423	354	79	777
80+ cm	87	0	-	87
Total	15,554	8,410	11	23,965

Great Britain	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
2012				
0-7 cm	-	132	16	132
7-10 cm	623	1,689	8	2,312
10-15 cm	13,005	11,964	6	24,969
15-20 cm	35,127	32,621	5	67,748
20-30 cm	41,304	75,091	4	116,395
30-40 cm	15,169	33,230	6	48,399
40-60 cm	11,202	14,669	9	25,872
60-80 cm	1,021	1,842	33	2,863
80+ cm	226	610	49	836
Total	117,678	171,848	2	289,527
2017				
0-7 cm	-	126	22	126
7-10 cm	627	1,308	7	1,936
10-15 cm	10,106	10,737	6	20,843
15-20 cm	30,343	26,709	6	57,053
20-30 cm	40,482	85,486	4	125,969
30-40 cm	15,648	35,549	6	51,197
40-60 cm	13,428	20,034	8	33,462
60-80 cm	1,423	2,034	22	3,457
80+ cm	286	550	52	836
Total	112,345	182,533	2	294,878
2022				
0-7 cm	-	86	20	86
7-10 cm	573	1,718	8	2,291
10-15 cm	8,327	11,024	6	19,351
15-20 cm	27,342	23,849	6	51,191
20-30 cm	39,206	83,894	4	123,100
30-40 cm	15,608	38,968	6	54,576
40-60 cm	14,577	20,029	8	34,606
60-80 cm	1,985	1,797	19	3,782
80+ cm	318	308	53	626
Total	107,935	181,672	2	289,608
2027				
0-7 cm	-	26	24	26
7-10 cm	613	2,557	7	3,170
10-15 cm	7,625	10,188	6	17,814
15-20 cm	25,362	25,628	6	50,991
20-30 cm	36,466	67,940	4	104,406
30-40 cm	15,146	41,140	6	56,286
40-60 cm	14,644	20,155	7	34,799
60-80 cm	2,773	2,435	20	5,208
80+ cm	386	426	43	812
Total	103,015	170,496	2	273,511
2032				
0-7 cm	-	25	25	25
7-10 cm	1,113	1,821	8	2,934
10-15 cm	7,135	9,841	6	16,976
15-20 cm	23,416	26,607	6	50,023
20-30 cm	32,056	50,361	5	82,418
30-40 cm	15,604	34,391	6	49,995
40-60 cm	14,169	19,080	8	33,249
60-80 cm	3,410	2,108	21	5,519
80+ cm	509	401	19	910
Total	97,412	144,635	2	242,047

Figures 9 to 13 illustrate forecasts of standing volume within mean stand DBH ranges at each of these future points in time.

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Figure 9. Forecasts of standing volume within mean stand DBH ranges in 2012.

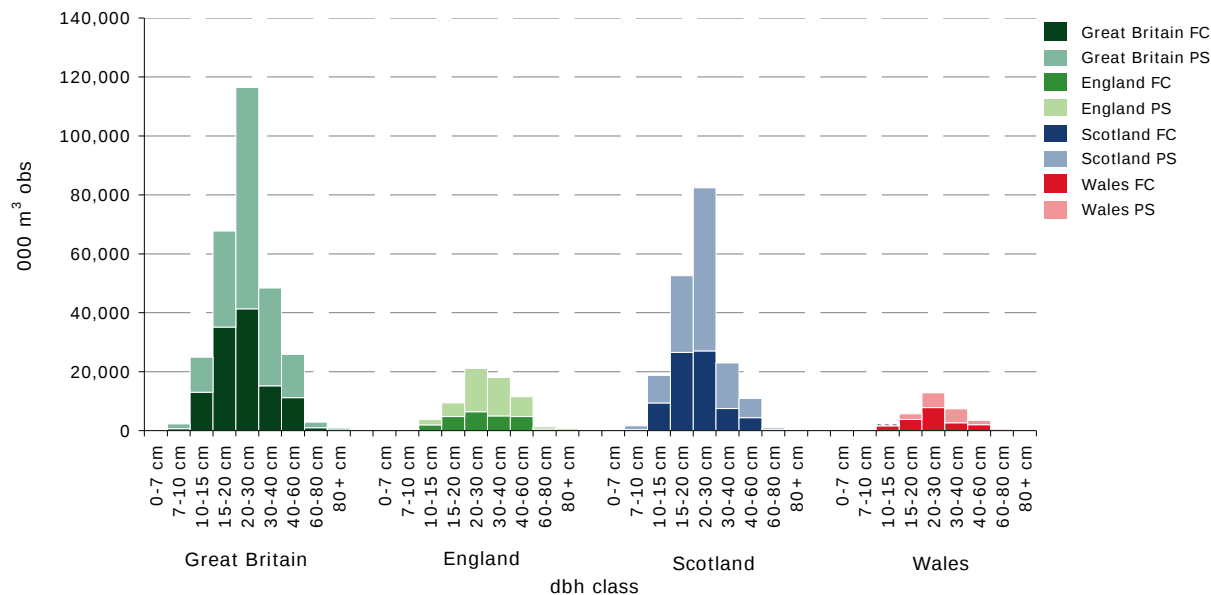
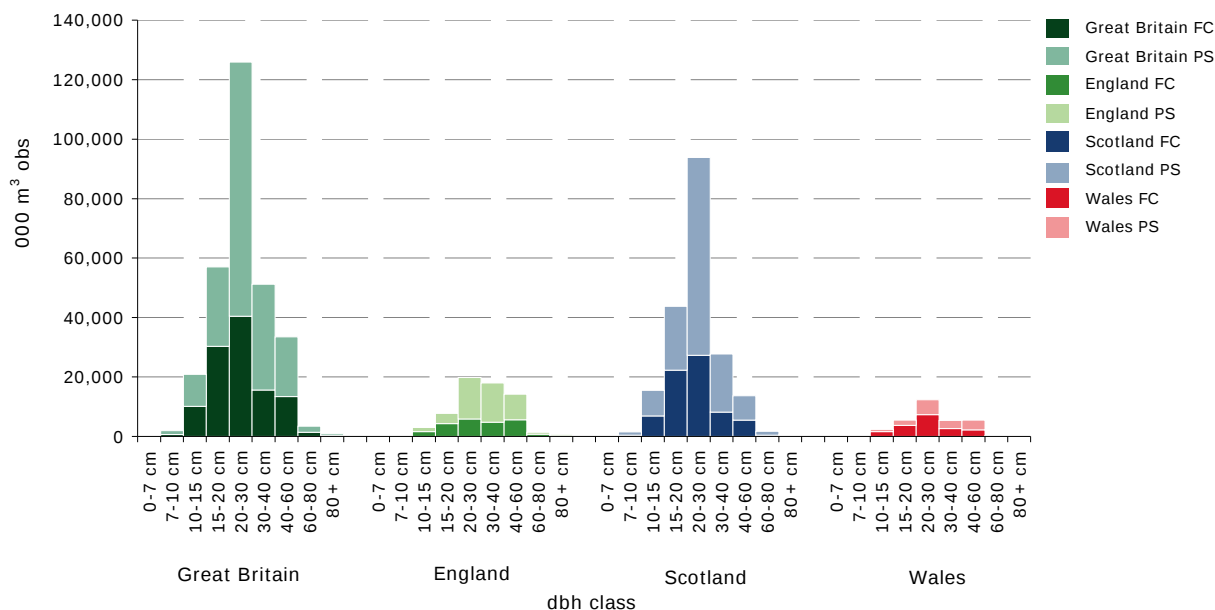


Figure 10. Forecasts of standing volume within mean stand DBH ranges in 2017.



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Figure 11. Forecasts of standing volume within mean stand DBH ranges in 2022.

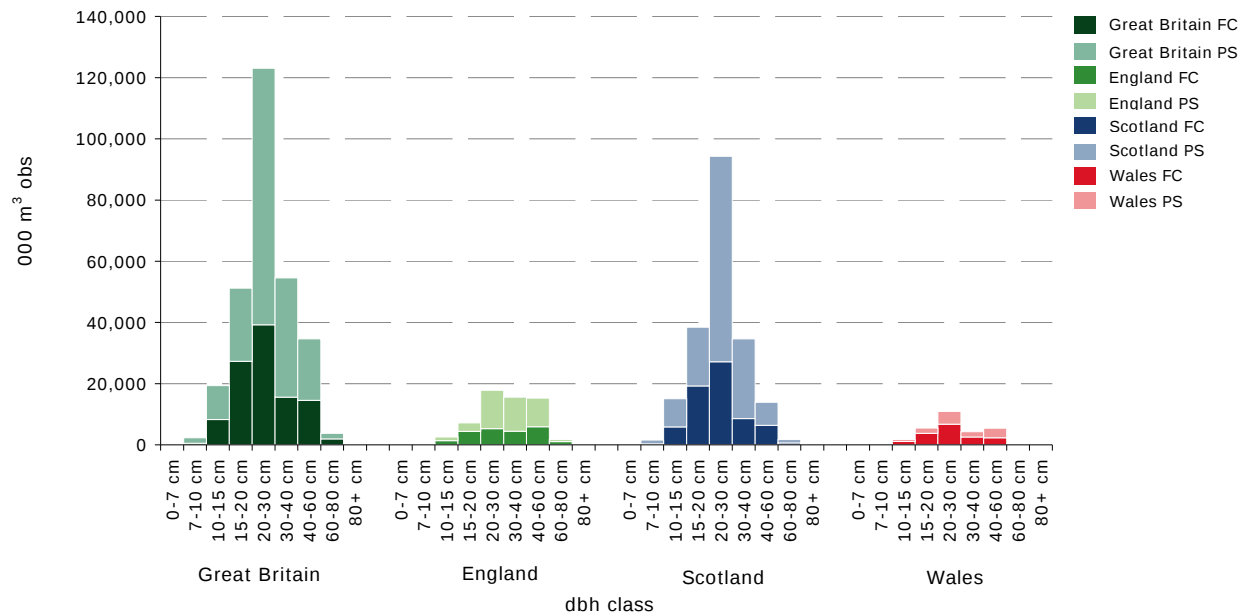
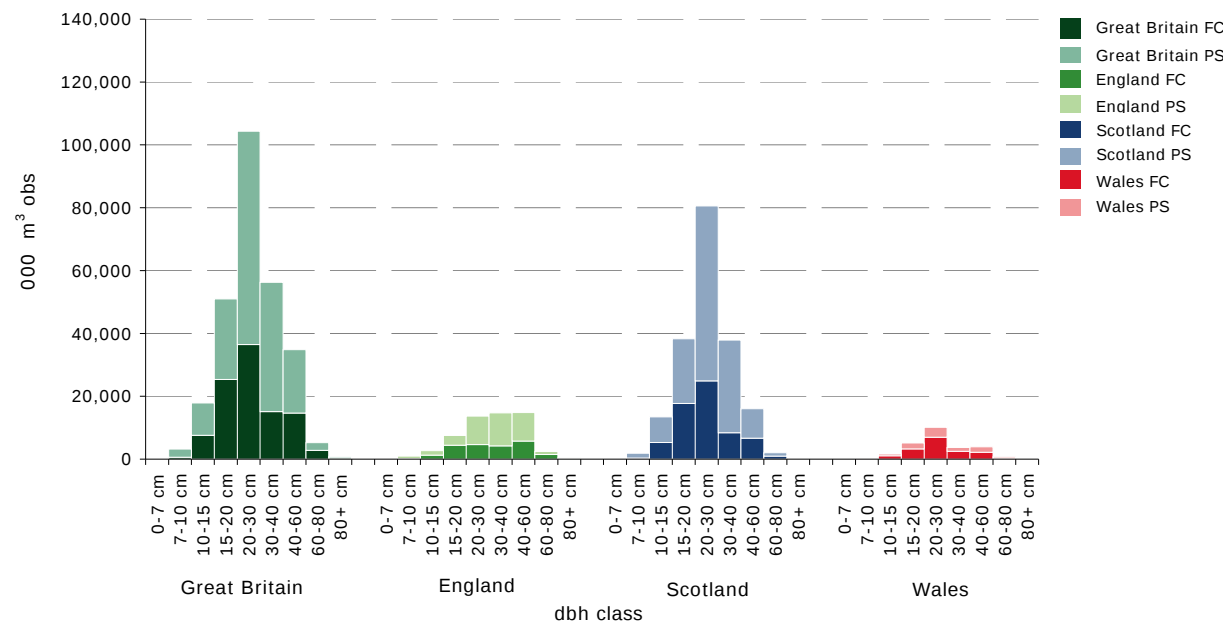
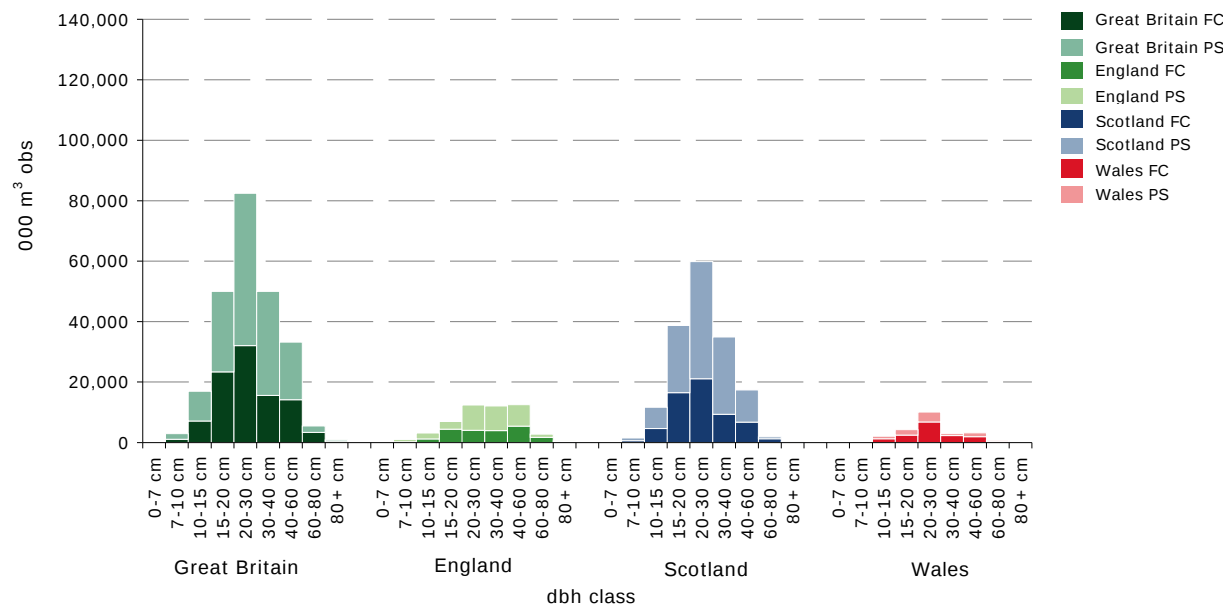


Figure 12. Forecasts of standing volume within mean stand DBH ranges in 2027.



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Figure 13. Forecasts of standing volume within mean stand DBH ranges in 2032.



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Figures 15 and 16 and Tables 7 and 8 are broken down by NFI countries and regions, which are shown in Figure 14.

Figure 14. Map of National Forest Inventory countries and regions.



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Table 7. 25-year forecast of average annual standing volume by region.

Forecast period	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
North West England				
2012-16	2,698	4,245	11	6,943
2017-21	2,638	4,378	12	7,015
2022-26	2,579	4,188	11	6,767
2027-31	2,467	3,463	13	5,930
2032-36	2,432	2,830	12	5,262
North East England				
2012-16	6,148	5,987	10	12,135
2017-21	5,516	5,739	10	11,256
2022-26	5,306	5,614	11	10,920
2027-31	5,212	4,861	12	10,073
2032-36	5,232	4,181	12	9,413
Yorkshire and the Humber				
2012-16	2,259	4,662	8	6,920
2017-21	2,364	4,400	8	6,764
2022-26	2,316	3,916	9	6,232
2027-31	2,259	3,212	9	5,470
2032-36	2,255	2,801	9	5,056
East Midlands				
2012-16	1,818	1,946	8	3,765
2017-21	1,799	1,924	8	3,723
2022-26	1,733	1,676	9	3,409
2027-31	1,685	1,448	9	3,133
2032-36	1,608	1,226	9	2,833
East England				
2012-16	3,250	4,016	10	7,265
2017-21	3,321	4,012	11	7,333
2022-26	3,260	3,841	12	7,101
2027-31	3,133	3,540	12	6,673
2032-36	2,923	2,976	13	5,899
South East England and London				
2012-16	2,319	8,750	6	11,070
2017-21	2,252	8,391	6	10,643
2022-26	2,198	7,361	7	9,559
2027-31	2,130	6,268	8	8,397
2032-36	2,040	5,041	10	7,082
South West England				
2012-16	3,095	7,667	8	10,762
2017-21	3,047	6,920	9	9,967
2022-26	3,022	6,227	9	9,248
2027-31	2,950	5,797	9	8,747
2032-36	2,897	5,797	9	8,695
West Midlands				
2012-16	1,802	4,353	15	6,155
2017-21	1,938	4,329	15	6,267
2022-26	1,903	3,563	17	5,466
2027-31	1,799	3,593	19	5,392
2032-36	1,734	3,291	20	5,025

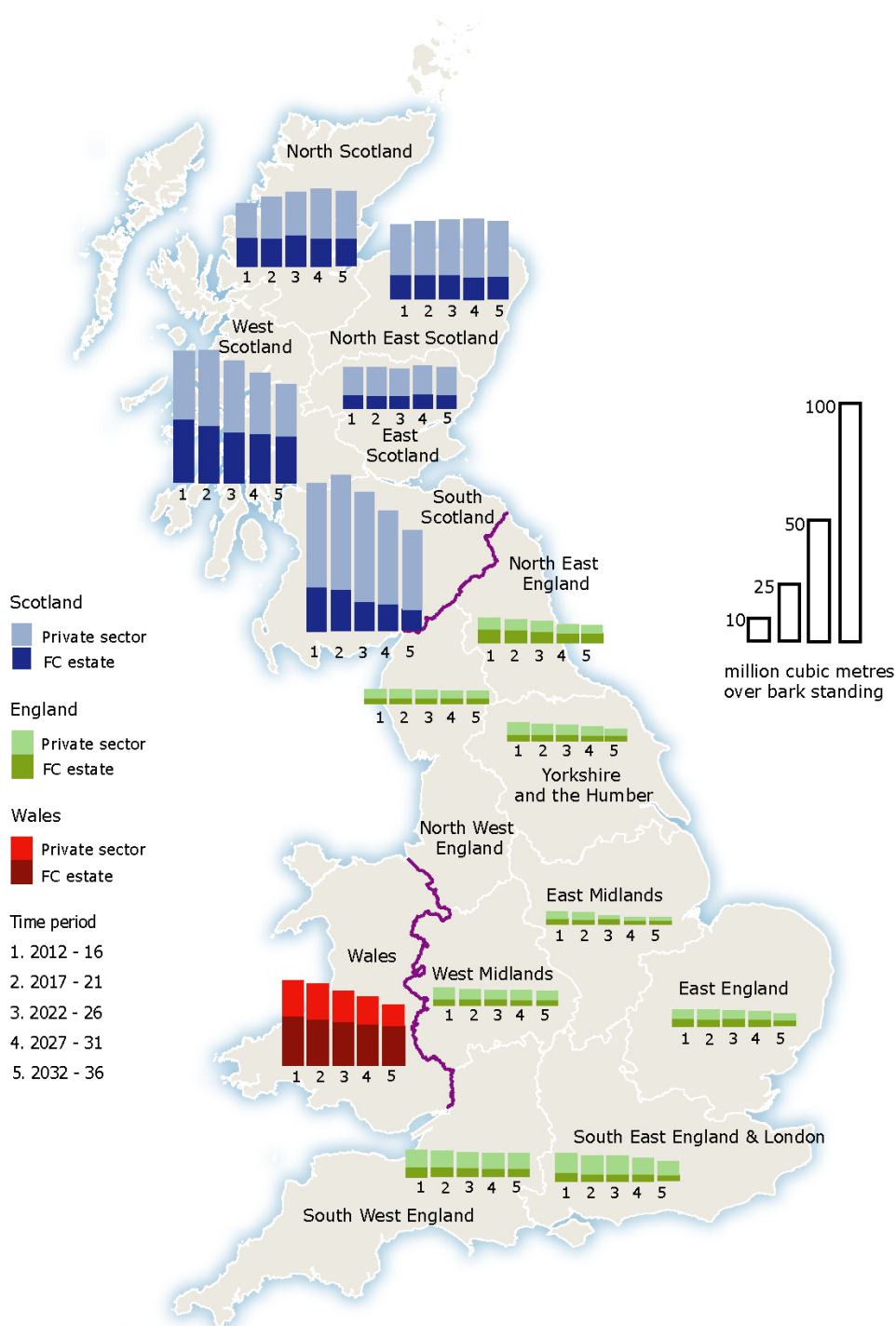
Forecast period	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
North Scotland				
2012-16	11,079	14,871	6	25,950
2017-21	11,080	16,325	6	27,405
2022-26	11,151	18,425	6	29,576
2027-31	10,972	19,000	6	29,971
2032-36	10,029	17,777	6	27,806
North East Scotland				
2012-16	9,368	20,144	5	29,512
2017-21	9,476	21,565	5	31,041
2022-26	9,434	21,631	5	31,064
2027-31	9,267	22,040	5	31,307
2032-36	9,273	21,587	5	30,860
East Scotland				
2012-16	5,092	12,039	6	17,131
2017-21	5,310	12,034	6	17,344
2022-26	5,387	11,729	6	17,117
2027-31	5,482	12,277	7	17,759
2032-36	5,454	12,003	8	17,457
South Scotland				
2012-16	21,920	43,615	4	65,535
2017-21	19,735	47,995	4	67,731
2022-26	17,796	46,365	4	64,161
2027-31	16,011	38,619	5	54,630
2032-36	15,072	31,492	5	46,564
West Scotland				
2012-16	25,777	28,542	5	54,319
2017-21	24,081	30,946	5	55,027
2022-26	22,757	28,970	5	51,727
2027-31	20,690	26,717	5	47,408
2032-36	19,096	20,445	6	39,541

Forecast period	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
Wales				
2012-16	18,195	14,391	7	32,585
2017-21	17,338	12,834	8	30,172
2022-26	16,624	10,962	9	27,587
2027-31	16,429	8,885	10	25,314
2032-36	15,364	7,725	10	23,089

Figures 15 and 16 illustrate the forecast distribution of standing coniferous volume over time within GB by region and then by country. A large proportion of the standing current and future volume is in Scotland, in the North East and South of England, and in Wales.

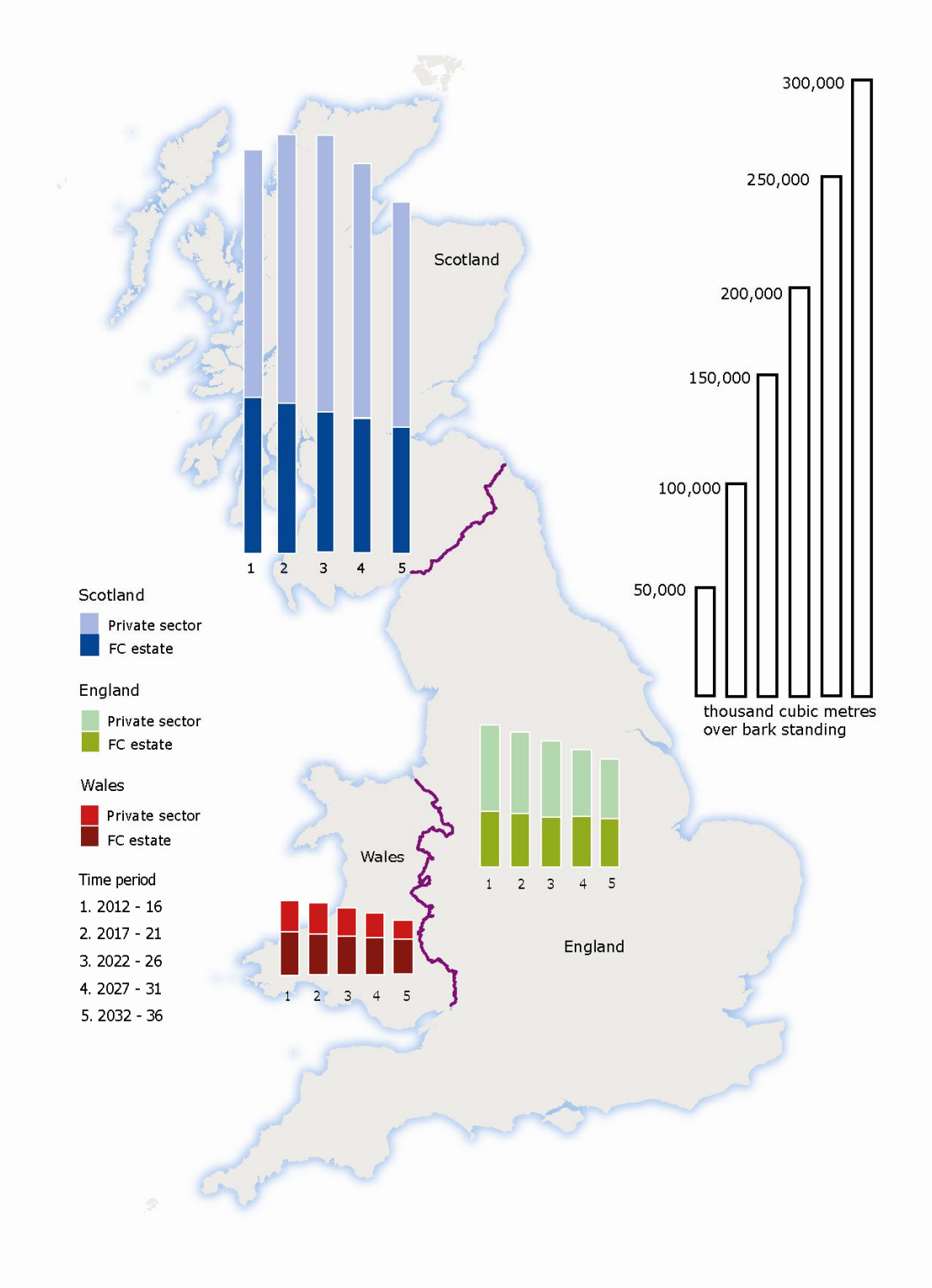
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Figure 15. Map of forecast of average annual standing volume per region by time period.



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Figure 16. Map of forecast of average annual standing volume per country by time period



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Table 8. 25-year forecast of average annual increment by region.

Forecast period	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
North West England				
2012-16	142	227	10	369
2017-21	134	221	10	355
2022-26	124	230	9	354
2027-31	119	216	9	335
2032-36	120	207	10	327
North East England				
2012-16	304	305	9	609
2017-21	292	299	10	591
2022-26	280	280	10	560
2027-31	277	256	10	533
2032-36	286	236	11	522
Yorkshire and the Humber				
2012-16	123	220	7	343
2017-21	115	199	7	313
2022-26	104	191	7	295
2027-31	97	180	7	277
2032-36	95	174	7	269
East Midlands				
2012-16	81	103	7	185
2017-21	73	90	7	164
2022-26	65	78	7	143
2027-31	61	71	7	132
2032-36	57	67	7	124
East England				
2012-16	197	218	10	415
2017-21	175	195	10	370
2022-26	146	179	11	325
2027-31	126	166	11	291
2032-36	112	156	11	269
South East England and London				
2012-16	103	449	5	552
2017-21	93	398	6	491
2022-26	84	360	7	444
2027-31	78	330	8	408
2032-36	75	307	8	382
South West England				
2012-16	168	397	7	565
2017-21	152	358	8	511
2022-26	139	369	8	509
2027-31	130	410	7	541
2032-36	126	410	7	536
West Midlands				
2012-16	106	216	14	322
2017-21	103	206	16	308
2022-26	94	197	16	291
2027-31	86	208	15	294
2032-36	84	216	14	300

Forecast period	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
North Scotland				
2012-16	490	918	5	1,408
2017-21	440	960	5	1,400
2022-26	403	943	5	1,346
2027-31	375	887	5	1,262
2032-36	347	820	6	1,167
North East Scotland				
2012-16	410	1,062	5	1,472
2017-21	397	1,162	4	1,559
2022-26	374	1,225	4	1,599
2027-31	355	1,270	4	1,625
2032-36	348	1,282	4	1,630
East Scotland				
2012-16	230	713	5	943
2017-21	212	711	6	923
2022-26	188	712	6	900
2027-31	173	723	6	896
2032-36	161	705	6	866
South Scotland				
2012-16	1,174	2,540	3	3,714
2017-21	1,035	2,657	3	3,692
2022-26	936	2,562	3	3,498
2027-31	899	2,296	4	3,195
2032-36	930	2,062	4	2,993
West Scotland				
2012-16	1,139	1,594	4	2,733
2017-21	1,007	1,586	4	2,592
2022-26	898	1,428	4	2,325
2027-31	829	1,245	4	2,073
2032-36	821	1,031	5	1,852

Forecast period	FC	Private sector		Total
	volume (000 m ³ obs)	volume (000 m ³ obs)	SE%	volume (000 m ³ obs)
Wales				
2012-16	861	731	6	1,592
2017-21	832	636	7	1,468
2022-26	810	563	7	1,374
2027-31	810	514	8	1,324
2032-36	774	535	8	1,309

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Figures 17 and 18 bring standing volume, increment and production together, for comparative purposes.

Figure 17. Relationship between 25-year forecast of standing volume, net increment and potential production for the FC estate.

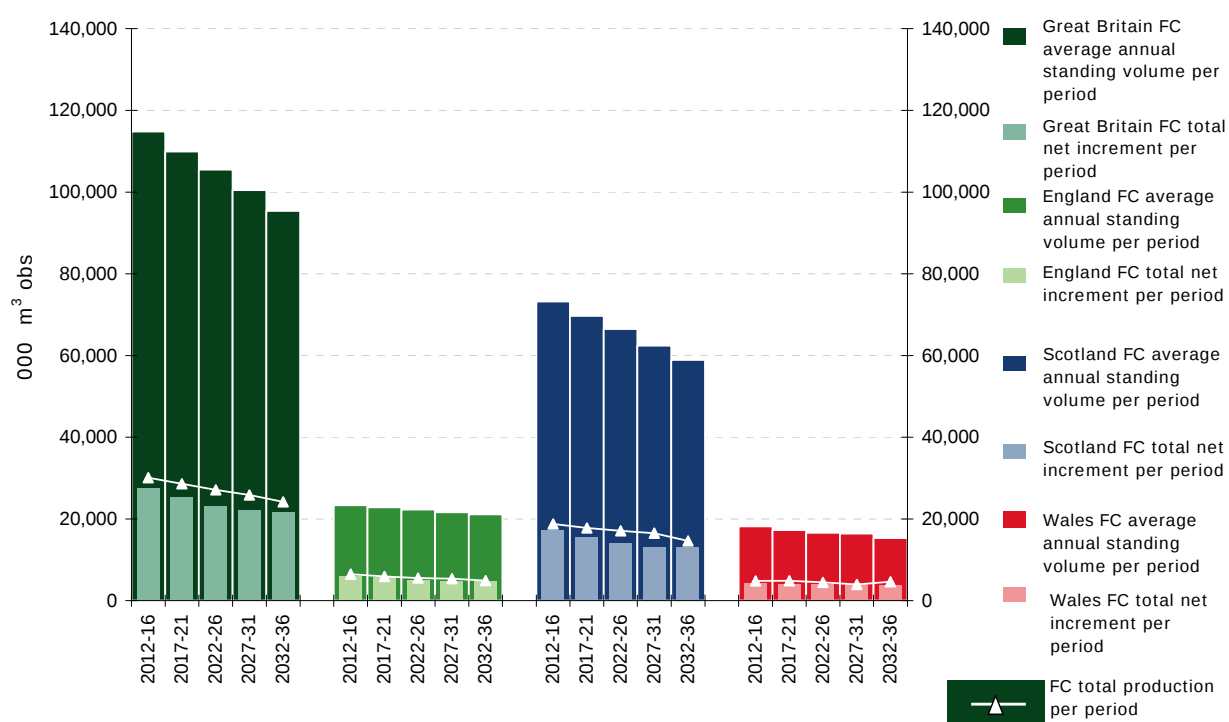
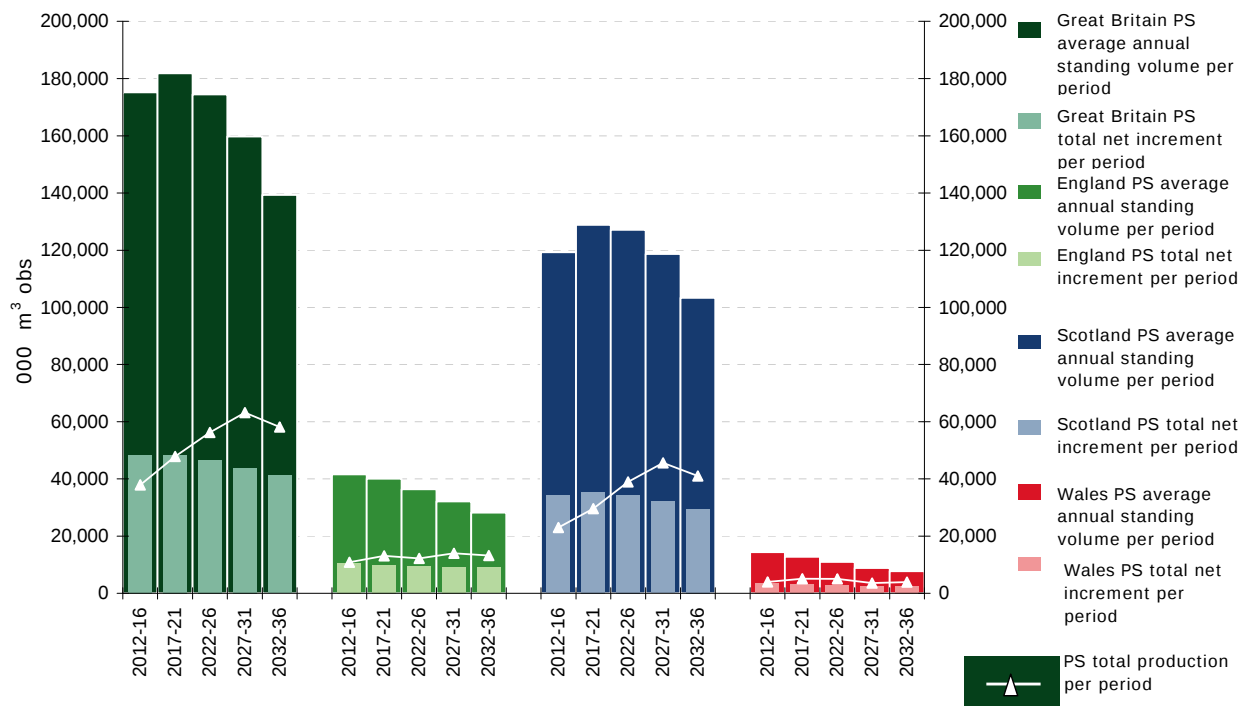


Figure 17 broadly indicates the relationship between standing volume, increment and forecast level of production for the FC estate. The illustrated results reflect the relationships defined within the situations covered by, for example, harvesting, currently clearfell land, restocking, over due timber and land sales that are set out in the methodology. The Forestry Commission projections of standing volume and increment assume the application of any existing management plans within areas set as 'non forecastable' with the SCDB, whilst the production totals exclude these. This assumption will slightly increase the forecast decline in FC standing volume in relation to the forecast harvest levels and increment.

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Figure 18 Relationship between 25-year forecast of standing volume, net increment and potential production for the Private sector estate.



What the results tell us

The total average annual standing coniferous volume in the FC estate in GB is estimated to be 115 million m³ for the period 2012–16 and is forecast to decrease to 95 million m³ by the period 2032–36. This forecast decrease in standing volume of 20 million m³ over the next 25 years is as a result of the projected harvesting rates exceeding forecast increment rates during the period. The management plans forecast for the FC estate predicts an average of 5.5 million m³ per annum of timber production for the next 25 years (2012 to 2036), while net increment or growth is expected to be an average of around 4.8 million m³ per annum over the period. Net increment starts at an average of 5.6 million m³ per annum in the 2012–16 period and decreases to an average of 4.3 million m³ per annum in the 2032–36 period. This is contingent upon the assumption of the current thinning and felling plans being applied. As some of the countries are in the process of regulating production, with the introduction of production caps and yield regulation, if this trend continues actual standing volumes will remain higher. Also the forecast assumes the application of any existing management plans within areas set as ‘non forecastable’* with the SCDB, whilst the production totals exclude these. This assumption will slightly increase the decline in FC standing volume in relation to the forecast harvest levels and increment.

The total average annual standing coniferous volume in the Private sector estate in GB is estimated to be 175 million m³ for the period 2012–16 (excluding overdue timber volume, which is assumed to be felled in the first period). This then rises to 182 million m³ in the second period before declining continuously to 139 million m³ in the final period. This increase in the second period only occurs in Scotland, which offsets a decrease in England and Wales. If the Private sector estate manages its woodlands to maximise timber volume production over the long term, the timber availability forecast predicts that it would produce an average of 10.5 million m³ per annum of coniferous timber from its estate for the next 25 years. Average net increment would be 9.0 million m³ per annum over the period, starting at 9.7 million m³ per annum in the period 2012–16, and declining to 8.2 million m³ per annum by the period 2032–36. As projected rates of harvest exceed forecast rates of net increment, standing volume would be expected to decrease by 36 million m³ over the course of the next 25 years. This assessment is based upon a statistical survey of forests (the NFI) and has a standard error of 2% across the periods, contingent upon management assumptions being realised. However, Private sector owners have a wide range of objectives and factors that drive the management of their resource, and these may vary over time. Consequently, all participants in this sector are unlikely to consistently manage their

* Forestry Commission allocates some areas of woodland within the SCDB as non-forecastable. This removes these areas from the production forecast. Reasons for this may be the absence of roads for extraction or for conservation purposes such as Natural Reserves.

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estates throughout the forecast period with the objective of maximising long-term volume production, so production and the associated impact on standing volumes are expected to vary from this forecast.

The total average annual standing coniferous volume in all woodlands in GB is currently estimated to be 290 million m³ for the period 2012–16 (excluding overdue timber). This is expected to rise to an average of 292 million m³ by 2017–21 and to then decrease to an average of 235 million m³ by the period 2032–36, a reduction over the full forecast period of 55 million m³. This overall decrease in standing volume is a result of the projected harvesting rates exceeding forecast net increment rates during the period. Harvesting rates are forecast to be an average of 16.5 million m³ per annum over the period, while annual net increment decreases and is expected to average around 13.9 million m³ per annum. The degree to which these forecasts are realised is dependent upon actual levels of future harvesting and when this harvest occurs. These in turn depend upon actual future harvesting strategies in the Forestry Commission and Private sector estates. For example if none of the overdue timber found in the NFI survey was harvested over the forecast period (46 million m³) the decline would only be 9 million m³.

These volumes, especially for the Private sector, are generally much higher than any earlier unpublished forecasts of standing volume and increment. They are also higher than what could have been inferred from related published information such as the National Inventory of Woodlands and Trees or previous timber availability forecasts.

The main reason why this increase has occurred is that at the starting point of the forecast, the 2011 estimate of current standing coniferous volume in Private sector forests is higher than earlier estimates. The last estimate published by the Forestry Commission before April 2012 was 25 years ago (Locke, G.M.L. (1987). *Census of Woodland and Trees 1979–82*, Forestry Commission Bulletin 63). Initial analysis shows that much of the difference between this and the 2011 estimate is due to a genuine increase in woodland area between 1980 and 2011, arising from new planting. However, this cannot account for all the difference and some difference must be due to measurement error in the 1980 survey. Additionally, a 2010 estimate of standing volume was published in the *2010 Global Forest Resources Assessment* (2010) by the Food and Agriculture Organisation of the United Nations. Again this showed there to be less standing volume than is currently estimated by the NFI. Analysis of the input data has shown that this is due to three main factors:

1. Area: There is 5.4% more conifer woodland in GB than previously thought.
2. Yield classes: Private sector estate yield class for conifers has been observed to be higher than previously estimated.

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3. Standing volumes: Standing volumes per hectare are higher than those used in previous estimates. The current estimates are based on direct measurement whereas previous estimates were based on the outputs of growth models.

These factors combined have driven up the baseline or starting point of the standing volume and increment forecast. They are discussed in more detail in the *UK 25-Year Forecast of Softwood Availability Statistical Analysis* report.

The 2011 Private sector estimates and forecasts are based upon the largest mensuration exercise ever undertaken in GB and this should give confidence in the levels of reported timber in the GB forests today and how these forests will grow over time. The sampling standard errors of estimates of standing volume at GB level resulting from this exercise are typically around 2%.

However, the forecasts are based upon assumptions about harvesting practice in the Private sector estate and variation in harvesting practice from these assumptions will result in variation in future standing volume and increment from the estimates presented. Nevertheless, under the majority of harvesting scenarios applied, standing volumes decrease over the period. From this result it may be inferred that it is probable that this will happen and is the expected trend.

The principal factor that determines the evolution of standing coniferous volume over the next 25 years is the current age profile, which is mostly determined by when the forests in GB were established. Many of the forests came about as the result of substantial planting programmes in the decades following the First and, particularly, the Second World Wars. This has resulted in an uneven tree age profile within GB forests, countries and regions. As the trees follow their natural 'life cycle', with trees gaining more volume as they grow and mature, the age profile will largely determine the evolution of standing coniferous volumes. The timing of thinnings and fellings, and the nature and extent of replanting and regeneration on felled sites, will also significantly impact upon this underlying trend.

Indeed, the assertion that age profiles predominantly determine standing volumes relies upon the assumption that stands are clearfelled at some point, whether later or sooner. Yet if this assumption is removed and whether felling is undertaken or not comes into question, it is seen that the decision to fell has the most significant impact upon standing volumes overall. For example, if a proportion of stands were never felled and there was a consequent 12% reduction in harvesting throughout the forecast period, that would leave the level of standing volume stable.

As the forest estate established during these booms in planting matures, is harvested and is subsequently replaced with younger crops of a lower standing volume and

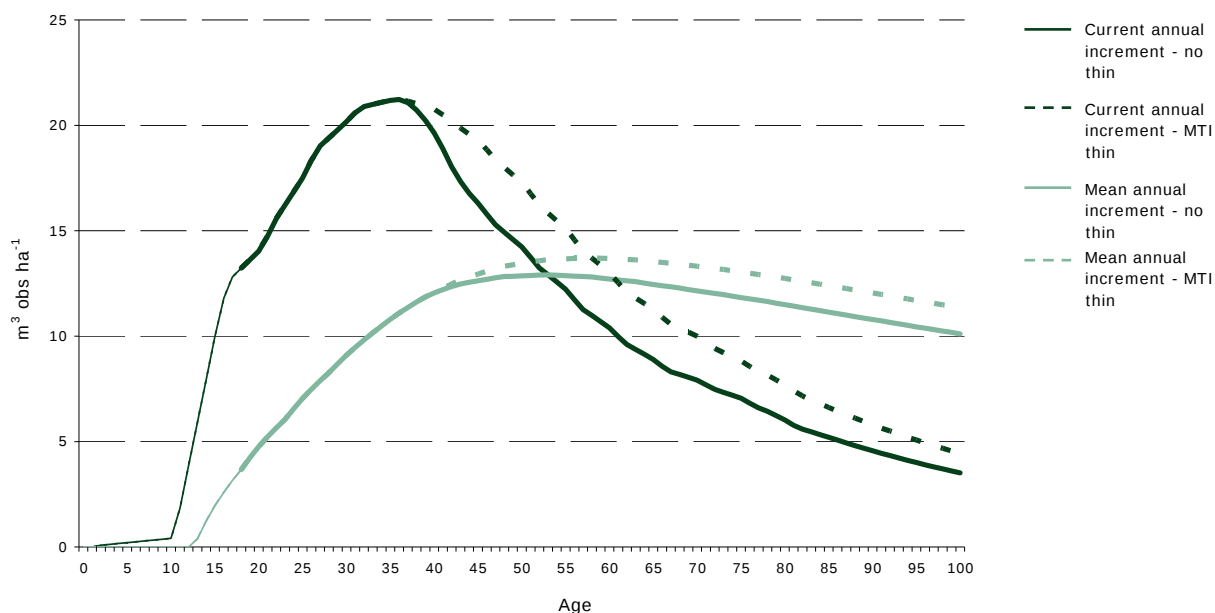
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increment, standing volume and increment will reduce over the forecast period. Due to the age profile of the forest, felling activity is projected to be particularly strong during the middle periods of the forecast. The forecast also assumes a two-year 'fallow' period between the crops being felled and replanted, which further depresses overall standing volumes, particularly in periods of high felling activity.

With regard to the forecasts of increment, younger trees have lower rates of annual increment than mature trees and thus felling and replanting depresses overall annual increment as well as standing volume. The fallow period further suppresses average annual increment as no increment is achieved in this period. However, as these younger crops reach pole stage and maturity in the periods after 2036, they would be expected to have elevated increment, which will also lead to an elevated standing volume beyond the forecast's time horizon.

Figure 19 illustrates this relationship between tree age and rate of increment, with younger crops (0 to 20 years) having lower annual increment than more mature crops. The figure is based upon yield class 14 Sitka spruce, the predominant coniferous stand type. Other species and yield classes differ in their detail, but generally show similar patterns in the evolution of increment with age.

Figure 19. Increment and age.



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The NFI has found that there is currently more standing coniferous volume in Private sector estate forests than previously estimated and that these will gain more increment than would have been previously anticipated. This has implications on the future levels of potential production from the Private sector. If stands are managed to maximise productivity and are felled at age of maximum MAI then the increases in standing volume and increment will feed through to increases in the amount of available timber. Private sector stands are, on average, a little younger than those of the FC estate (whose production is on the decrease) and therefore Private sector stands have 'further to go' in terms of maturing and gaining standing volume and increment and their rise in potential production is still ahead. Hence, Private sector standing volume and increment are forecast to increase in the short term, then decrease as they are then felled and follow the same cycle as the FC estate at a later stage. Currently most stands are between the ages of 20 to 40 years, and through the forecast period they grow older, with the average moving to 40 to 60 years. These stands are then forecast to be felled, which has the effect of reducing the average age of the stock. Similar trends can be seen in the stand average DBH increasing from 20–30 cm DBH on average to 30–40 cm DBH, then declining again. These trends vary between the countries, with Scotland having much the largest standing volume and younger crops on average, thus dominating the GB picture. In England and Wales the age profile is older and there is a broader base in tree ages. This results in flatter profiles in the evolution of standing volume compared to Scotland.

Conclusions

These forecasts predict that within the coniferous forest resource of Great Britain (GB), over the next 25 years, under a wide range of harvesting scenarios, there will be an overall decrease in coniferous standing volumes and net annual increment. This is primarily because rates of harvesting are predicted to increase and these rates exceed those of increment. There are other possible harvesting scenarios and outcomes for production, standing volume and increment, but these on the whole do not alter the overall declining trend, but they do decrease or increase it. This trend occurs as the levels and rates of standing volume and increment are primarily set by the underlying age class structure of the growing stock of GB and the assumption to fell stands at some point in time, which drives the overall trend. If, for example a relatively small proportion of woodland owners chose not to fell at all, then standing volume could remain static, or if a higher proportion chose not to fell, standing volume could increase.

Why age class structure is such a large determinant in setting the levels of total standing volume and increment within GB is due to GB's history of creating a man-made forest resource over a relatively short period of time. This has created an uneven age class structure, which determines the evolution of standing volumes and increment. This occurs because, after planting, the trees follow their natural 'life cycle', with trees gaining more volume as they grow and mature. Thus, if most of the trees were planted in a short period, as they were in GB, then most will also mature in a short period, driving standing volumes upward. Because GB experienced a large increase in planting after the Second World War, it has experienced an equivalent increase in standing volume as those crops have matured. Because this increase in planting came to a relatively abrupt end in the late 1980s, the increases in standing volume resulting from the post-war planting boom are consequently forecast to decrease.

Harvesting rates impact upon this underlying trend, but they are only secondary to age class structure in determining standing volume when assuming some form of harvesting will occur. However, if it is assumed that no harvesting will occur, harvesting becomes the predominant factor. This is because stands that are not harvested will continue to contribute to standing volume over time and as a consequence a different picture of standing volume would evolve. This extreme scenario is unlikely to occur; however, it is possible that it may occur in some areas. When considering the amount of timber that is currently overdue for harvesting within Great Britain, it is conceivable that a proportion of stands may never be harvested. Indeed, if such trends of overdue timber were to continue or increase, and a large enough area of forest was never to be harvested, then standing volumes may not

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decrease overall. In such a case, overdue timber, its amount and its future treatment could possibly have a significant impact on future standing volumes.

In deriving this forecast, assumptions have also been made about how harvested forests are replanted in both the FC estate and the Private sector estate, with the forecasts assuming that they are replanted on a 'like-for-like' basis. Over a 25-year period the standing volumes associated with alternative replanting practices are likely to vary little between themselves and such differences will not greatly affect actual future standing coniferous volumes and net increments within the 25 year period of the forecast. However, longer-term forecasts of standing volume and its evolution within both sectors will depend directly upon future replanting and new planting practice. Consequently, there is a need for further study of such strategies.

This forecast also assumes no new planting of woodlands, but this may not represent future developments. Significant increases in new planting would noticeably alter the evolution of standing volume and increment within GB and could have the effect of creating a more stable profile of standing volume over time. Such future replanting and planting practice will be influenced by government policy and how this is implemented by the Forestry Commission, whether directly via the FC estate or through grant aid for the Private sector estate. Change in harvesting policy, management plans and land sales policy will also affect the amount of standing volume in both sectors of the GB forest estate.

The evolution of standing volume within GB is therefore heavily determined by when the forests were planted and this overall trend is in turn influenced significantly by projected rates of harvesting and replanting. These factors combined cause the forecast to show an attrition of standing volume over the forecast period. This pattern of increase and decrease is in contrast with forest resources which have a more evenly distributed age, as is found in many other countries. Such forests result in a more stable evolution of standing volume and increment.

Additionally, it should be noted that these forecasts are a limited examination of standing volume and increment over a 25-year time horizon, which represents only a fraction of the life cycle of the forests. If a 50 or 100-year time horizon were to be used in longer-term forecasts, a different perspective would result and this should also be considered when drawing conclusions on sustainability.

In the GB context, therefore, it is important that the age profile of the forest resource is taken into account as well as rates of harvest when drawing meaningful conclusions on sustainable forest management of the GB forest estate.

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The significant changes in standing volume and increment forecast within this report may instigate a new discourse on the projected levels of harvesting within GB and how this relates to standing volume in terms of sustainable forest management and a 'sustainable level of harvesting'. The problem that GB faces in working through any such discourse is that a sustainable level of harvest has not been defined for GB (or the UK) and it is likely, in the light of these reports, that such a definition may begin to be considered.

If any such judgements in quantifying sustainable harvesting practice were to be made in relation to standing volume, increment and removals, then these parameters would need to be assessed in light of the underlying age structure of GB forests. As the uneven patterns in age class structure in GB make it very important to consider not only total removals and total standing volume for GB, but also to consider standing volume per age class (see Table 5), and to compare and contrast these to removals per age class. This will help to take account of the unevenness of planting and tree ages in GB, which primarily dictate standing volume, removals and increment relationships and whether they should be viewed in a positive or negative light in relation to any definition of sustainable practice.

Future work

This report has built on the woodland area reports published in 2011 and the standing volume assessment published in April 2012 to give a forecast of standing volume and increment. Such information is an essential part of planning for sustainable forest management across a range of interests, including biodiversity and climate change considerations, in addition to the development of the forest products industry. Further work to assess the impacts of different restocking strategies upon standing volume is still to be undertaken, as is the need to look at the evolution of standing volume over longer periods. Potentially, further harvesting scenarios could also be developed.

Other reports to be published as part of the 2011 production forecast will examine and estimate biomass and carbon stocks in the GB forest resource. Similar reports for broadleaved woodlands will be published in 2013. These, in combination with the present reports, will provide a more complete view of standing volume within GB.

Further information

This report forms part of the NFI's GB 25-Year Forecast of Standing Coniferous Volume and Increment theme. The other individual theme titles are:

- GB 2011 Standing Coniferous Timber Volume
- UK 25-Year Forecast of Softwood Availability
- GB 25-Year Forecast of Coniferous Carbon Stocks
- GB 25-Year Forecast of Coniferous Biomass Stocks

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 used for the compilation of the tables and charts of this report are also available for use in [NFI Statistical Data](#).

[NFI Technical Documentation](#) for all forest volume themes:

- *NFI Growing Stock Calculations*
- *Forecast Types*
- *Restocking in the Forecast*
- *NFI Survey Manual*
- *NFI Mensuration Protocol*
- *NFI Map Protocol*
- *Technical Glossary*
- *Felling and Removals Forecast*
- *Tree Species*
- *Volume Increment Forecasts*
- *Growing Stock Volume Forecasts*
- *Growing Stock Volume Forecasts*
- *Volume Increment Forecasts*

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

Glossary

age class	A grouping of trees into specific age ranges, for classification purposes.
area (forest/woodland)	Forest and woodland area is divided into net forest area – the land actually covered by trees (in the NFI defined to the drip line of the canopy), and gross forest area – which includes both the area covered by trees and the open spaces (of less than 0.5 hectare) within the forest boundary (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 m 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 m), 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.

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	Forestry policy is devolved, with the exception of common issues that are 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.
growing stock	A term broadly referring to the standing resource of living trees at a point in time.
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	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.
management table thinning (MTT)	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. See thinning intensity.
maximising productivity	The management of woodland to maximise volume production by felling at age of maximum MAI thinning at MTT.
maximum MAI (MMAI)	The maximum value of mean annual increment for a forest stand as observed directly or estimated from Forestry Commission yield tables. Under UK conditions, maximum MAI is usually achieved after a number of decades. See mean annual increment. When implemented within the forecast the year of maximum MAI is utilised.
mean annual increment (MAI)	Mean annual increment is the average rate of cumulative volume production up to a given year, expressed in cubic metres per hectare per year. In even-aged stands it is calculated by dividing cumulative volume production by age.
mensuration	The study of the measurement of lengths, areas, volumes and related quantities. Forest mensuration is concerned with the measurement of trees, woodlands and forests, including standing and felled timber.
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 (NFI)	An inventory run by the Forestry Commission, set up in 2009, to provide a record of key information about GB forests and woodlands.
net increment	Net increment is defined as volume growth, inclusive of any harvested volumes, less loss due to natural mortality, including endemic windthrow.
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.
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.

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Private sector estate	Forests and woodlands in the UK not owned or managed by the Forestry Commission (GB) or the Forest Service in Northern Ireland. In the context of the NFI, '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 availability from the Forestry Commission (GB), the Forest Service in Northern Ireland, and potential softwood availability from the Private sector (UK).
restocking plan	A spatial and temporal plan covering replacement planting in harvested areas.
SCDB (sub-compartment database)	The SCDB is a record of all land managed by the Forestry Commission. Each stand of trees is represented spatially, together with information on individual stand characteristics (e.g. species, planting year, spacing and yield class) that is periodically updated. As new surveys of stands are conducted (e.g. for operational purposes), survey results are also recorded against the stands. In addition, the SCDB contains details of how the stands are being managed – in particular the planned frequency and type of thinning operations and a 'due date' for felling.
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).
stemwood	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 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.
thinning intensity	A measure of the 'lightness' or 'heaviness' of a thinning, generally expressed in terms of the amount of timber volume per hectare removed relative to the growth rate of a forest stand.
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

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	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. There are two types: • Endemic windthrow: damage caused by frequently recurring peak winds. Forest management practices worsen endemic damage when windward-facing boundaries are created or stands are excessively thinned. • Catastrophic windthrow: an infrequent occurrence associated with exceptionally strong winds where large areas/numbers of trees are thrown over.
year of maximum MAI	The year or age at which a stand achieves, or is estimated to achieve, maximum MAI. Felling and re-establishing the stand at this age will achieve the highest average production per annum. See maximum MAI, mean annual increment.
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.