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Ireland's National Forest Inventory 2022

Main Findings

Ireland's National Forest Inventory 2022 – Main Findings

Covering the fourth National Forest Inventory, 2020 to 2022

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Acknowledgements

The Department of Agriculture, Food and the Marine would like to express its appreciation to all those involved in the completion of the NFI. Sincere thanks are due to all landowners for facilitating access to their lands during the course of the NFI data collection.

Spatial Data

Corrections

- The text presented on page 10 was updated to correct a mis-classification, where one NFI plot was excluded from Deforestation in error. As a result the area that went from forest to non-forest has increased from 4,791 to 5,196 ha (28 February 2023).
- The deadwood carbon stock type was recalculated after an error was detected in the calculation process which resulted in the deadwood changing from 3.0 million tonnes of carbon to 2.5 million tonnes post correction. (31 March 2023).
- The area thinned and clearfelled was recalculated to correct for a mis-classification, where 13 NFI plots were assigned incorrect felling interventions (16 June 2023).

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List of Abbreviations

CI	Confidence Interval
Dbh	Diameter at breast height
FAWS	Forest Available for Wood Supply
FPM	Fresh-water Pearl Mussel
HLNA	Higher Likelihood Nesting Areas
IFER	Institute of Forest Ecosystem Research
NFI	National Forest Inventory
NHA	National Heritage Area
pNHA	Proposed National Heritage Area
OLL	Other Long-Lived Species
OSL	Other Short-lived species
SAC	Special Area of Conservation
SFM	Sustainable Forest Management
SPA	Special Protection Area

1 KEY FINDINGS

This section summaries the ten key findings of the fourth National Forest Inventory completed in 2022:

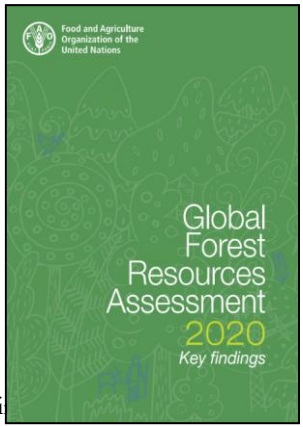
- The national forest estate is still expanding and has now reached 11.6% of the total land area, with a wide variety of forest types present. The total forest area has increased from 697,842 hectares (ha) in 2006 to 808,848 ha in 2022. The increase in area is a result of afforestation and natural development of semi-natural forests. Between 2006 and 2022 semi-natural forests are responsible for one-third (33.1%) of the new forest areas captured.
- For the first time over half (411,484 ha or 50.9%) of forests are in private ownership and 397,364 ha (49.1%) in public ownership. The share of private forests in the national forest estate has increased by over 7.9% since 2006.
- Leitrim is the county with the highest percentage of forest cover (20.1%), while Cork has the largest forest area (92,471 ha).
- Broadleaf tree species account for nearly one-third (30.6%) of the stocked forest area while conifer species are the dominant species present (69.4%). The share of broadleaf species nationally increased by 5.9% between 2006 and 2022.
- The age-profile of forests is increasing with 39.6% of stocked forests being less than 20 years of age and 30.4% between the ages of 21 and 30 years.
- The total growing stock volume of Irish forests is estimated to be over 142 million m^3, an increase of over 25.5 million m^3 since 2017. Gross annual volume increment between 2017 and 2022 was 10 million m^3 per year, while the mean annual standing volume felled within this period was 4.1 million m^3 per year.
- Since 2017, 40,043 ha of forests were thinned for the first time, which is a positive for wood mobilisation. The area thinned between 2017 and 2022 has increased by 10% while the area clearfelled has decreased by 35% over the same period.
- Forests play an important role in mitigating climate change by sequestering and storing atmospheric carbon dioxide. The results indicate that the national forest estate is an important sink for carbon, at 323.0 million tonnes of carbon.
- Irish forests are a rich resource of biodiversity providing important and abundant habitats for many species. Nearly one-third of Ireland's forests have four or more tree species present. Also, large quantities of deadwood are present within the forest, with 10.2 million m^3 of deadwood present.
- Overall, the forest estate appears healthy. While nearly two-thirds (63.2%) of stocked forest areas displayed signs of forest damage present, the severity of the damage was primarily low to moderate. Damage caused by animals, competing vegetation, exposure and nutrient deficiency were the most common damage.

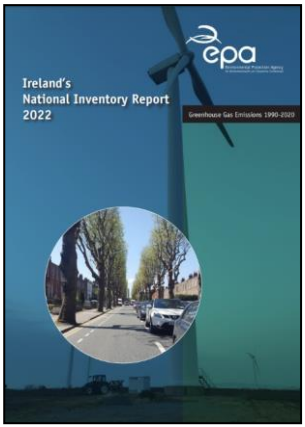
2 INTRODUCTION

The purpose of the NFI is to record and assess the extent and nature of Ireland's forests, both public and private, in a timely, accurate and reproducible manner. Reliable, current and consistent information is required to inform domestic forest policy, to support forest research and fulfil national and international reporting commitments.

Between 2004 and 2006 the Forest Service carried out the first NFI of Ireland's forests, with results published in 2007. The 2006 NFI was the first purely statistical approach to forest inventory undertaken in Ireland to provide an assessment of growing stock in both the public and private national forest estates.

In order to assess changes in the state of Ireland's forests over time, Ireland's NFI was designed using permanent sample plots which facilitated a repeat measurement programme. This robust reporting strategy was adopted to provide credible information to address strategic objectives and reporting commitments (Figure 1). The fieldwork for the fourth NFI began in February 2020 and was completed in March 2022.





Ireland has actively participated in work on harmonisation which has been led by the European National Forest Inventory Network (ENFIN), of which we are a member. The network has been active in COST Action initiatives (E43 and FP1001), a H2020 funded project (DIABOLO) and Framework Contracts with the Joint Research Centre.

The NFI provides information to monitor Sustainable Forest Management (SFM) and data to support forest policy, specifically in relation to:

- Growing stock;
- Harvesting;
- Increment;
- Carbon;
- Forest area;
- Species composition;
- Forest biodiversity; and
- Forest health and vitality.

This document presents a compact and comprehensive overview of the results of the fourth NFI cycle along with a comparison of results with the three previous NFIs. Two other NFI publications are available, namely:

- NFI Field Procedures and Methodology;
- NFI Results.

Both documents are available at: https://www.gov.ie/en/publication/823b8-irelands-national-forest-inventory/.

3 Survey Methods

The NFI involved a detailed survey of permanent forest sample plots based on a randomised systematic grid sample design (Figure 2). A grid density of 2km x 2km provided sufficient forest plots to achieve a national estimate of volume with a precision of ± 5%, at the 95% confidence level. This grid density equated to 17,423 points nationally, each representing approximately 400 hectares (ha). Each circular NFI sample plot measures 25.24 metres (m) in diameter, comprising 500 m², and is permanent in nature to allow future re-sampling as required.

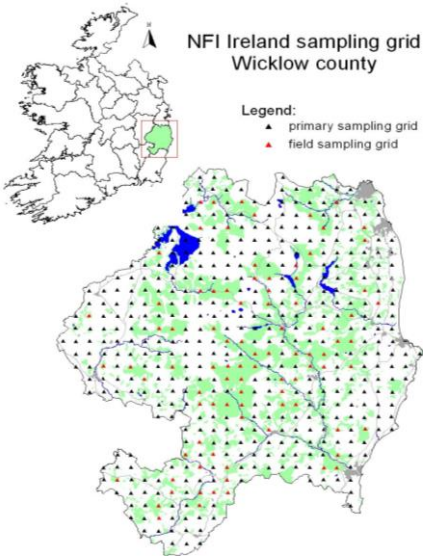


Figure 2. NFI grid design.

An initial desk study was carried out to identify land-use type, including forest areas, at each of the sample points using aerial photos and existing digital maps of forests (Figure 3). As the grid is permanent, it allows for the re-assessment of these primary sample points at future dates, to monitor forest land-use change e.g. afforestation.

Figure 3. Aerial photo interpretation.

In the field survey at each sample plot a variety of primary attributes were assessed, from the tree top to the soil underneath. For example, information was collected on tree growth and development, the diversity of plant species and soil type.

The underlying technology used in the NFI, Field-Map, consisted of an integrated system of hardware and software developed by the Institute of Forest Ecosystem Research Ltd (IFER). It allowed for the preparation of a NFI database, background maps, and plot generation. This in turn allowed for the creation of projects for field teams, which facilitated the field data collection process (Figure 4).

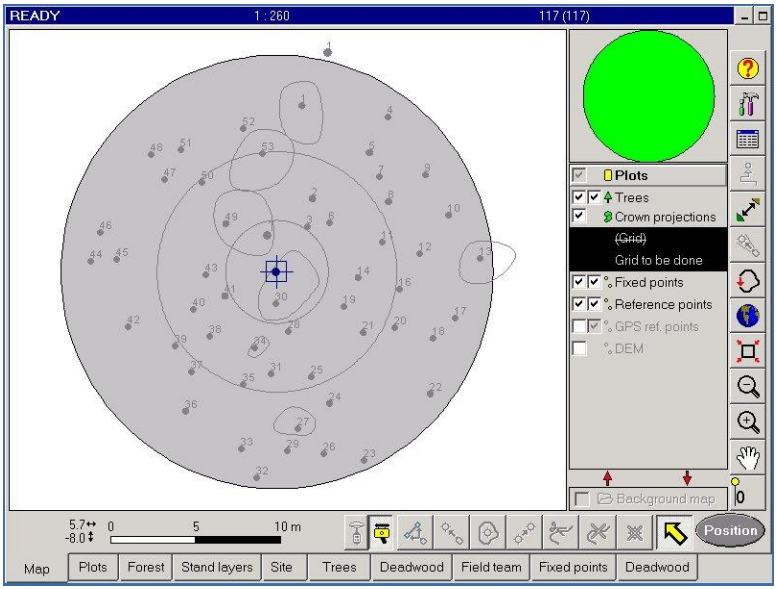


Figure 4. NFI field data collection software.

To carry out the field data collection, six professional foresters were recruited to work in teams of two. In total, 2,020 forest plots were assessed throughout the country in the 4th NFI, which includes 131 new forest plots due to the expansion of the forest estate. Training, field team support, validation and other quality control procedures were undertaken by two staff to ensure data quality and the smooth running of field operations.

Following the completion of field data collection work, primary data pre-processing and data analysis were completed. During data pre-processing the validity of the data was checked and data values were amended where necessary. Secondary variables, such as volume increment, were also calculated. Forest attributes (e.g. ownership) are used to classify evaluated variables (e.g. area) through the calculation of statistics (e.g. totals and/or means).

4 INTERPRETATION OF RESULTS

The analysis and results generation for the fourth NFI cycle were undertaken in 2022 by the Forestry Inspectorate, in close collaboration with the IFER. During this fourth NFI, all forest sample plots were re-assessed which not only provided current estimates for forest attributes but also allowed direct comparison with the previous NFI results.

4.1 PRESENTATION OF RESULTS

The analysis software (Field-Map Inventory Analyst) produces standardised tables and charts for reporting purposes. As errors are associated with all forms of sampling, most tables detail the calculated statistics with associated confidence intervals (α=0.05). The confidence interval quantifies the sampling uncertainty of a measurement by specifying the range of values within which the true value for the whole population lies. As a 95% confidence interval is used for the NFI analysis, there is a 95% probability that the true value for the population lies within the range of values. Only sampling error is included in the confidence interval, modelling errors (e.g. volume estimation) and measurement errors (e.g. Dbh data) are not incorporated in the confidence intervals. Sub-totals are provided where a variable is classified by more than one attribute. The proportion of the variable in each classifier class is also included. Interpretation of the results is aided by the use of charts and graphs.

4.2 ACCURACY OF RESULTS

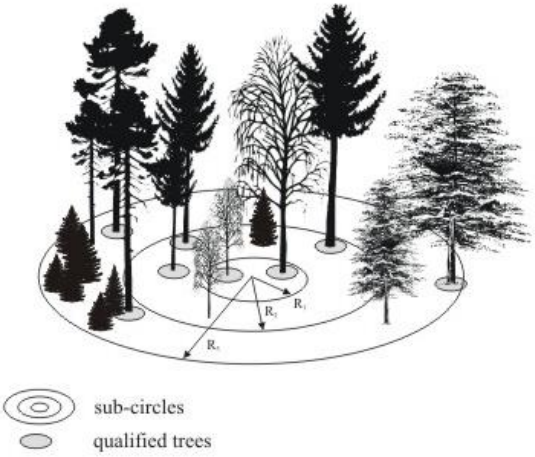
The confidence interval quantifies the uncertainty in measurement by specifying the range of values within which the true value for the whole population lies.

Attributes that occur less frequently tend to have lower levels of accuracy. The problem can be exacerbated through classification. Classification by small geographic areas, results in higher error margins for those areas e.g. small counties. For example the mean annual volume increment per ha for Co. Dublin is 11.2 m^3 $\pm$ 5.6 m^3, while the figure for Co. Cork is 14.7 m^3 $\pm$ 2.1 m^3. As Co. Dublin has a much smaller area of forest than Co. Cork, far fewer sample plots contribute to the result for Co. Dublin. In turn fewer plots result in a larger error margin.

Assessment of the NFI results should always be done in conjunction with the evaluation of the confidence interval presented with the statistic, which indicates the reliability of the results. This document provides an overview of the main findings. For more detailed statistics, including confidence intervals, please refer to the more comprehensive publication; *Ireland's National Forest Inventory 2022 – Results*.

4.3 Species Composition

Careful consideration is needed in the interpretation of stocked areas of individual species presented, since many forests contain an intimate mixture of species. The total stocked area of a given species therefore does not represent distinct areas of land covered by pure stands of the species, but represent the sum of shares of areas of mixed forest apportioned to it.



	R_1	R_2	R_3
Sub-circle radius (m)	4	7	12.62
Sub-circle area (m^2)	28.3	153.9	500
Threshold Dbh (mm)	70	120	200

Figure 5. Plot design.

Since the NFI uses a plot design that incorporates concentric circles, not all trees present on the plot were assessed (Figure 5). Tree data on the inner sub-circles was expanded over the entire plot by weighting individual tree data by the respective concentric circle size. This expansion assumes that what is observed in the inner sub-circles for smaller Dbh trees can be replicated over the whole plot.

In order to enable area related calculations, such as species composition, a procedure for the calculation of the so-called representative area of a tree is used. The area of each inventory plot was distributed among the trees proportionate to their size, with larger trees allocated larger areas. The sum of all the individual tree representative areas within the plot is equal to the total plot area of 0.05 ha. These tree representative areas are used to scale up from plot to national species composition estimates.

4.4 Forest Area

Forest area statistics are presented in three different ways in the results. As it is not possible to collect the same level of information on every plot (e.g. species) the total forest area is not always presented. For example, forest open area plots will have no trees present, resulting in no species composition data for this plot. As a result, there are three main types of forest area presented in the NFI (Figure 6):

1. Total Forest Area, 808,848 ha. - Encompasses all forest land.
2. Forest area, 720,748 ha - Excludes forest open area.

3. Stocked forest area, 713,152 ha - Excludes forest open area and temporarily unstocked areas.

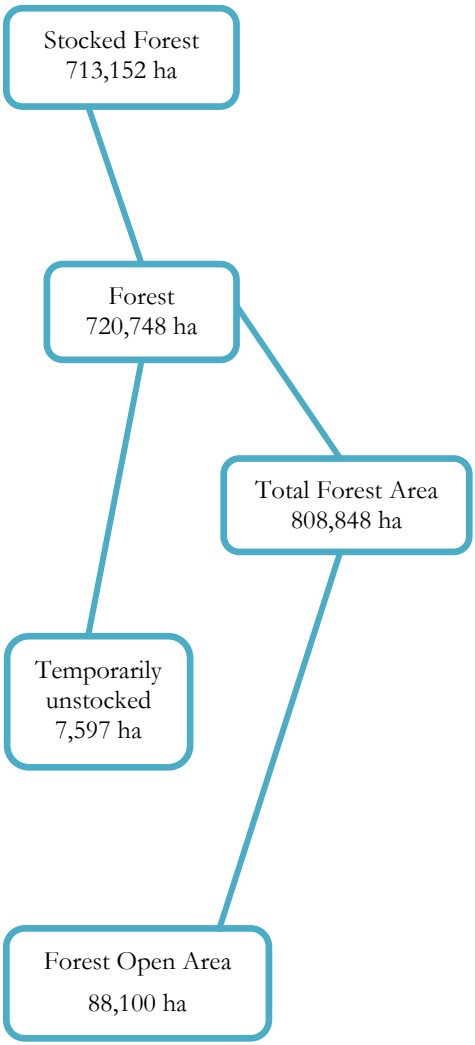


Figure 6. Forest area (ha) types reported in the NFI.

5 RESULTS

5.1 SUMMARY

The 2006 NFI was the first statistical and multi-resource inventory carried out on the national forest estate. In order to assess changes in the forest estate over time repeated assessments are required. The second NFI was completed in 2012, the third in 2017 and now the fourth in 2022. On all occasions multi-resource information was recorded including information on forest area and species composition, growing stock (m^3), biodiversity, health, and carbon content; for the entire national forest estate. The repeated NFI cycles have provided results on aspects such as forest area change, volume increment and latest felling volume estimates. This facilitates the assessment of changes in the state of Ireland's forests over time.

The forest estate is still expanding and has now reached 11.6% of the total land area, with a wide variety of forest types present. The total forest area has increased from 697,842 ha in 2006 to 808,848 ha in 2022. Between 2017 and 2022 the forest area has increased by 38,828 ha due to afforestation and natural development of semi-natural forests.

For the first time, over half (411,484 ha or 50.9%) of forests are in private ownership and 397,364 ha (49.1%) in public ownership. The share of private forests in the national forest estate has increased by 7.9% since 2006. Leitrim is the county with the highest percentage of forest cover (20.1%), while Cork has the largest forest area (92,471 ha).

Conifer species are the dominant species present, representing 69.4% of the stocked forest area while broadleaved species accounted for 30.6% of the area. The share of broadleaf species in the national forest estate has increased by 5.9% between 2006 and 2022. The age-profile of the forest estate is increasing with 39.6% of the stocked forest estate is less than 20 years of age and 30.4% between the ages of 21 and 30 years.

The total growing stock volume of Irish forests is estimated to be over 142 million m^3, an increase of over 25.5 million m^3 since 2017. The private forests share of the total growing stock volume has increased from 44.4% in 2012 to 49.1% in 2017. The total growing stock volume consists mostly of spruce and pine species however there is a significant quantity of growing stock present in older broadleaf forests.

The balance between gross increment and fellings is an important indicator as it describes the sustainability of wood production over time, the current availability of wood and the potential for the future. Gross annual volume increment between 2017 and 2022 was 10 million m^3 per year. The mean annual standing volume felled within this period was 4.1 million m^3 per year. Less than half (41.3%) of the gross annual increment was felled between 2017 and 2022.

In terms of the thinning status, 18.3% of forests have been thinned at least once. Less than half (40.3%) of forests are juvenile (i.e. at a maturity stage where they could not be thinned) and a further 17% was also deemed not suitable for thinning as it was classified as semi-natural or low stocking. One quarter (24.4%) of forests are

categorised as "no thin", which in theory is defined by the forest maturity stage where it could be thinned but has not been thinned due to a variety of factors such as high windthrow risk, economic factors, owner intentions or thinning may be imminent.

Forests play an important role in mitigating climate change by sequestering and storing atmospheric carbon dioxide. The NFI results indicate that the national forest estate is an important and expanding sink for carbon, at 323.0 million tonnes of carbon.

There is an important biodiversity resource within Irish forests, with many non-tree plant species and lichens frequent across the forest estate. Over half (59.9%) of the forest area has vegetation coverage of greater than 90%, excluding the tree species present. There are significant proportions of open areas and areas with natural regeneration present, the latter particularly so in the older private forest estate. Over three quarters (77%) of Ireland's forests have two or more tree species present. Large quantities of deadwood are present within the forest, with over 10.2 million m^3 of deadwood present as stumps, standing or lying deadwood.

Overall, the forest estate appears healthy. While nearly two-thirds (63.2%) of stocked forest areas displayed signs of forest damage, the severity of the damage was low. Abiotic damage was recorded on 46.9% of the forest area and biotic damage was recorded on 36.2% of the forest area. Damage caused by animals (e.g. browsing by deer) was the most common type of biotic damage, followed by vegetation and harvesting operations. In terms of abiotic damage, climatic factors (e.g. windthrow) were the most common type of damage, followed by nutrient deficiency and anthropogenic factors.

The majority (61.6%) of forests occur on mineral soils, with the remaining 38.4% on peats. Nearly one-quarter (30.7%) of all forests are growing on highly productive gley soils while 41.9% of Private (grant aided) forests occur on these soils, reflecting forestry's move onto more productive soils since the mid to late 1980's. Over the last 40 years, the afforestation of peats has decrease significantly.

An overview of the main results for the fourth NFI cycle are presented in Table 1, along with results from the previous three NFIs.

Table 1. Overview of the main NFI results 2006-2022.

	2006	**2012**	**2017**	**2022**
Total Forest Area (ha)	697,842	731,652	770,020	808,848
Mean Basal Area (m^2/ha)	20.2	25.3	27.5	29.8
Mean Growing stock (m^3/ha)	112	148	170	200
Growing stock (million m^3)	71.9	97.5	116.5	142.0
Gross Increment Volume (mill. m^3 yr^{-1})	not available	7.69	8.53	10.0
Gross Fell Volume (mill. m^3 yr^{-1})		3.62	4.90	4.1

5.2 Land-use Type Change

Aerial photo interpretation of all 17,423 grid points was carried for each of the four NFI cycles, with the primary aim of identifying forest plots. Other land-use types were also recorded allowing for trend analysis in land usage over time. Much higher quality aerial photos became available from 2012 onward, leading to some significant shifts in land-use types over time and more accurate results.

The total forest area has increased from 697,842 ha in 2006 to 808,848ha (Table 2). Between 2017 and 2022 the overall forest area increased by 38,828 ha which comprises newly afforested areas and new semi-natural forests. During the same time (2017 and 2022) period, 5,196 ha went from forest to non-forest, which included deforestation and forest areas that were misclassified in earlier cycles. In terms of tree cover; Other Wooded Land (OWL) has increased from 68,136 ha to 107,792 ha and the area of hedgerows has decreased from 273,144 ha to 267,509 ha.

In the fourth cycle, "Bare Rock" and "Quarry" were removed from the classification. "Bare rock" was removed as it was typically found in association with either "Sea & coastal complex" or "Bog & Heath". The "Quarry" category was removed as it was small in terms of area and it also proved difficult to accurately classify. These have mainly been reclassified as "Bog & Heath" or "Other Wooded Land".

Table 2. Land use and land use change (2012-2022).

Land-use type	2012		2017		2022	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Forest	731,652	10.5	770,020	11.0	808,848	11.6
Other Wooded Land	47,681	0.7	68,136	1.0	107,792	1.5
Hedgerow	271,912	3.9	273,144	3.9	267,509	3.8
Scrub	82,606	1.2	not available		not available	
Bare Rock	73,684	1.1	74,481	1.1	not available	
Bog and Heath	916,415	13.1	975,193	14.0	1,020,507	14.6
Built Land (Rural)	128,854	1.8	139,245	2.0	137,280	2.0
Built Land (Urban)	70,599	1.0	71,716	1.0	70,118	1.0
Crop & cultivated land	352,262	5.0	347,651	5.0	345,917	5.0
Cutaway Peat (Domestic)	101,760	1.5	97,756	1.4	85,746	1.2
Cutaway Peat (Industrial)	67,715	1.0	63,295	0.9	58,489	0.8
Grassland	3,725,092	53.4	3,665,613	52.4	3,617,993	51.9
Green Space (Rural)	84,562	1.2	89,337	1.3	108,169	1.6
Green Space (Urban)	28,026	0.4	27,202	0.4	29,609	0.4
Quarry	12,019	0.2	12,031	0.2	not available	
Road (Paved)	92,103	1.3	97,307	1.4	102,943	1.5
Track (Unpaved)	22,812	0.3	32,419	0.5	32,812	0.5
Water Body	144,376	2.1	146,766	2.1	149,572	2.1
Sea & Coastal Complex	21,980	0.3	24,799	0.4	32,807	0.5
Total	6,976,112	100	6,976,112	100	6,976,112	100

5.3 Forest Area

Forest is defined as land with a minimum area of 0.1 ha, a minimum width of 20 m, trees higher than 5 m and a canopy cover of more than 20% within the forest boundary, or trees able to reach these thresholds *in situ*.

In 2022, the area of forest in Ireland was 808,848 ha or 11.6% of the land area excluding inland water bodies (Table 3). Between 2017 and 2022 the forest area has increased by 38,828 ha as a result of afforestation and the further encroachment of semi-natural forests. These semi-natural forest are predominantly broadleaf and have come about due to change in management such as the cessation of industrial peat extraction.

Co. Cork has the highest share of national forest area at 92,471 ha or 11.4% of the total forest estate (Figure 8). A map of forest cover in Ireland is presented in Figure 7.

Table 3. Total forest area

	2012		2017		2022	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Forest	731,652	10.5	770,020	11.0	808,848	11.6
Non-forest	6,244,460	89.5	6,206,092	89.0	6,167,264	88.4
Total	6,976,112	100	6,976,112	100	6,976,112	100

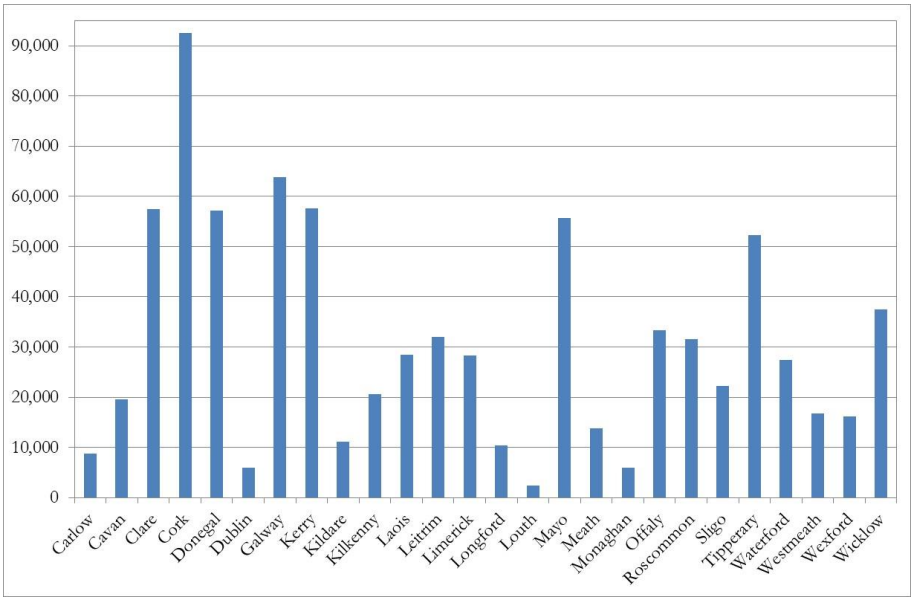


Figure 7. Total forest area (ha) by county.

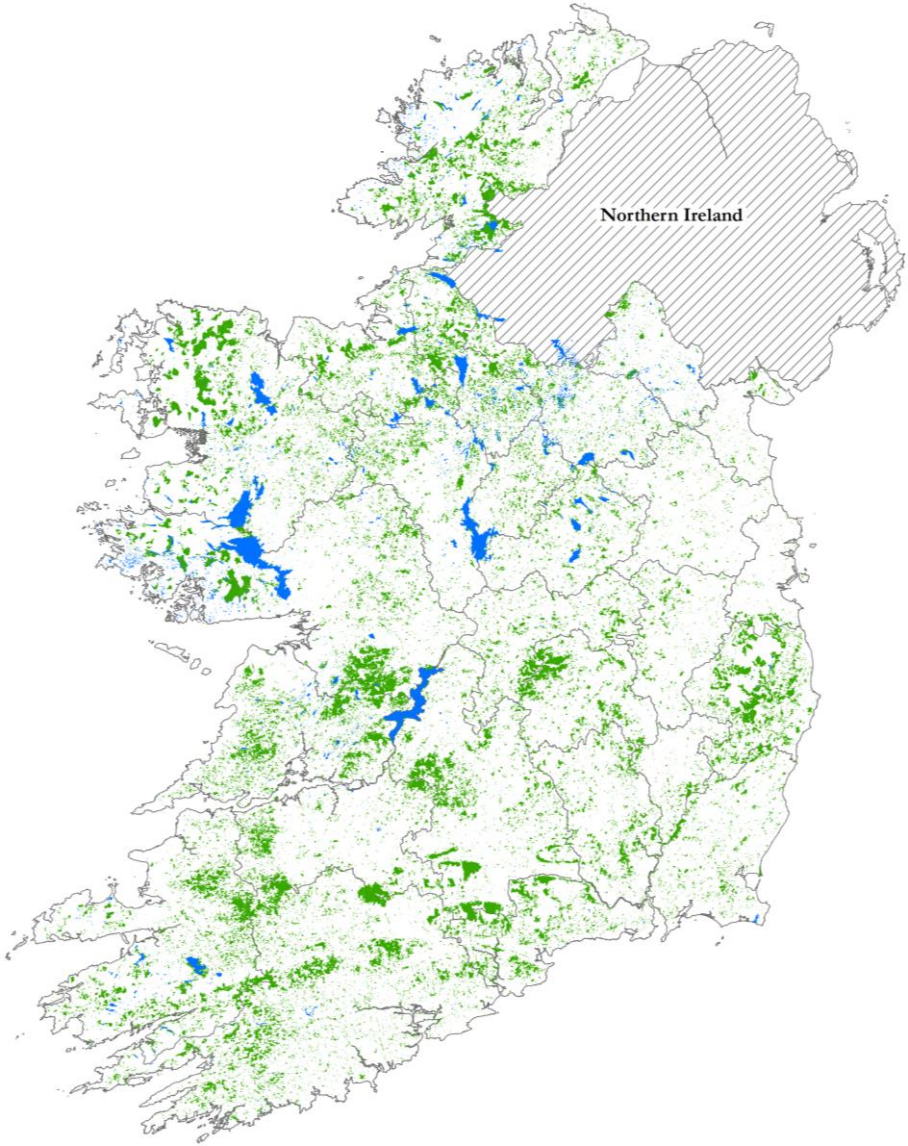


Figure 8. Map of forest cover in Ireland, 2022.

Since the NFI commenced in 2006, three subsequent cycles have been completed at 5 to 6 year intervals. Over this time period and at each NFI cycle the level of forest cover has increased by approximately 0.5% on each occasion. Given that the annual rate of afforestation has been declining over this same time period, it is hard to envisage how this is happening.

In Figure 9 below the total forest area increase is presented and classified by establishment type, which describes the land type on which the forest was established and how the forest was established (i.e. artificially or naturally). Both afforestation and reforestation involve the direct planting of trees and are referred to as planted forest in Figure 9, whereas semi-natural forests established by natural regeneration.

The total area increase is presented for the three time-periods and it is clear to see the significant contribution that semi-natural forests are making to the overall increase in forest cover. Between 2006 and 2022 semi-natural forests are responsible for one-third (33.1%) of the new forest areas captured.

These semi-natural forest are predominantly broadleaf and have come about due to a change in land management such as the cessation of industrial peat extraction and the extensification of agricultural activity in some areas.

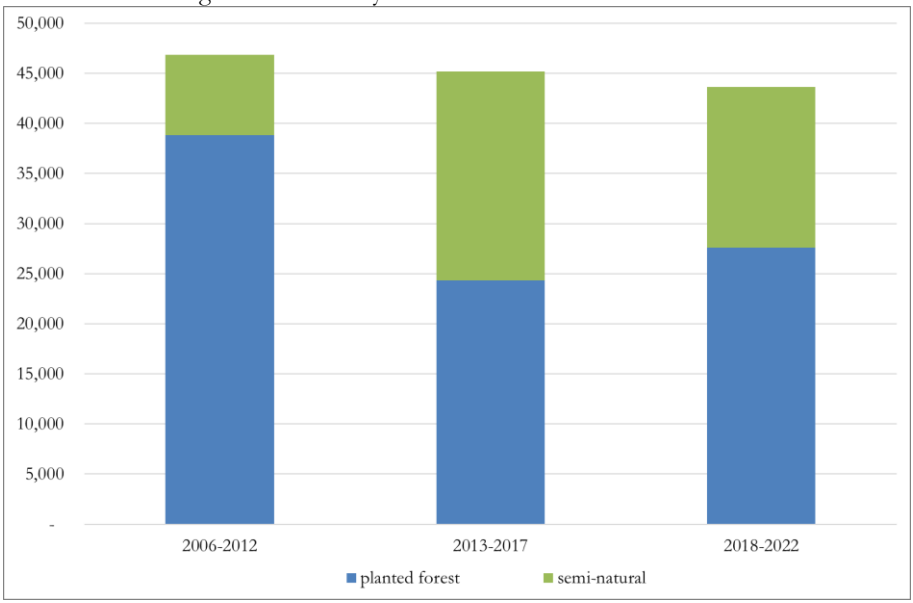


Figure 9. Total forest area (ha) increase from 2006-2022 by establishment type.[1]

[1] Please note that the total forest area increase is presented which does not consider deforestation and forest areas that were misclassified in earlier cycles. Also, the afforestation area presented will not correspond directly with the official afforestation statistics due to the sampling methodology used by the NFI.

In terms of forest cover as a proportion of the total county land area, Co. Leitrim has the highest forest cover at 20.1% (Figure 10).

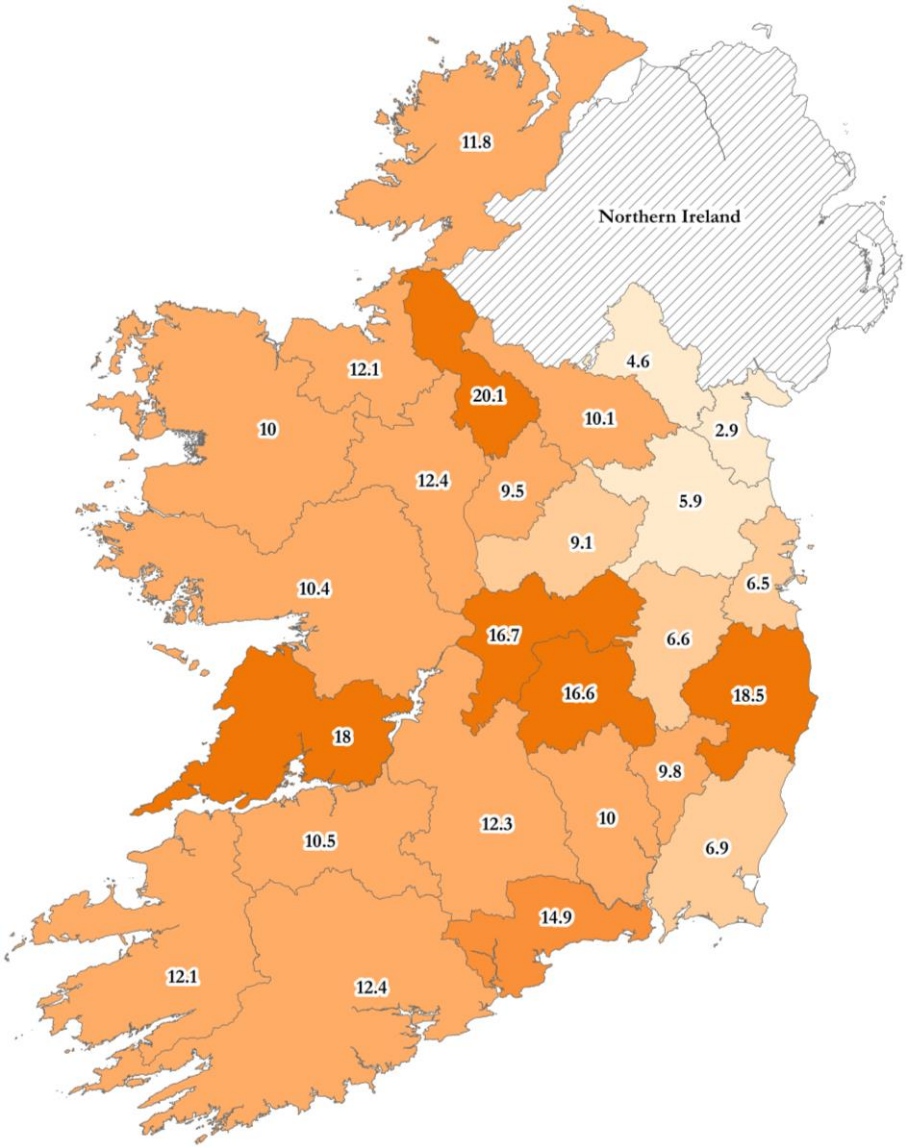


Figure 10. Percentage of forest cover in each county.

Counties with the highest forest area are primarily distributed along the western and south-western seaboards (Figure 11).

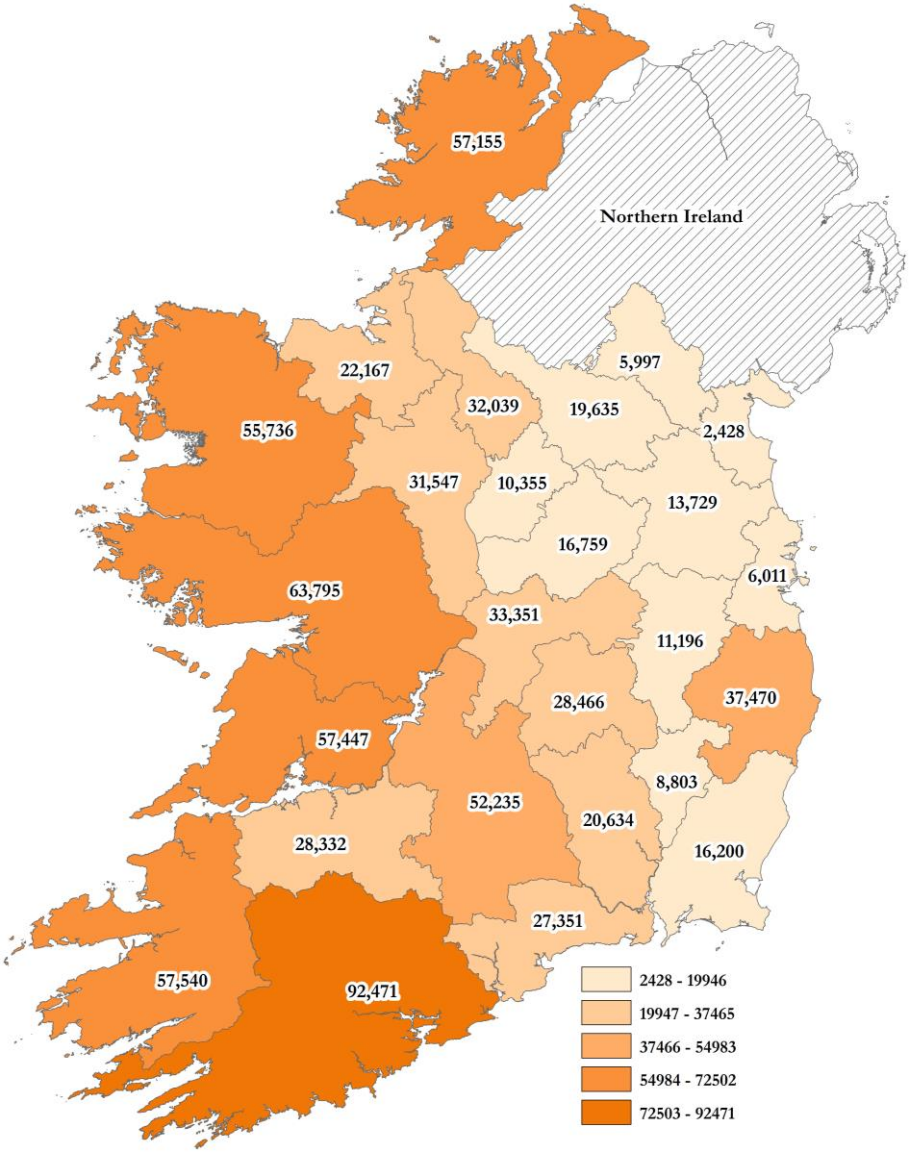


Figure 11. Total forest area per county (ha).

5.3.1 Forest Open Area

Forest open areas (e.g. firebreaks) are integral to the forest and constitute 10.9% of the total forest area (Figure 12). The Private (grant aided) estate has 14.3% forest open area, compared to 9.4% in the Public forest. As the majority of the private estate has yet to be roaded, the forest open area differential between the two ownership types will continue to increase over time.

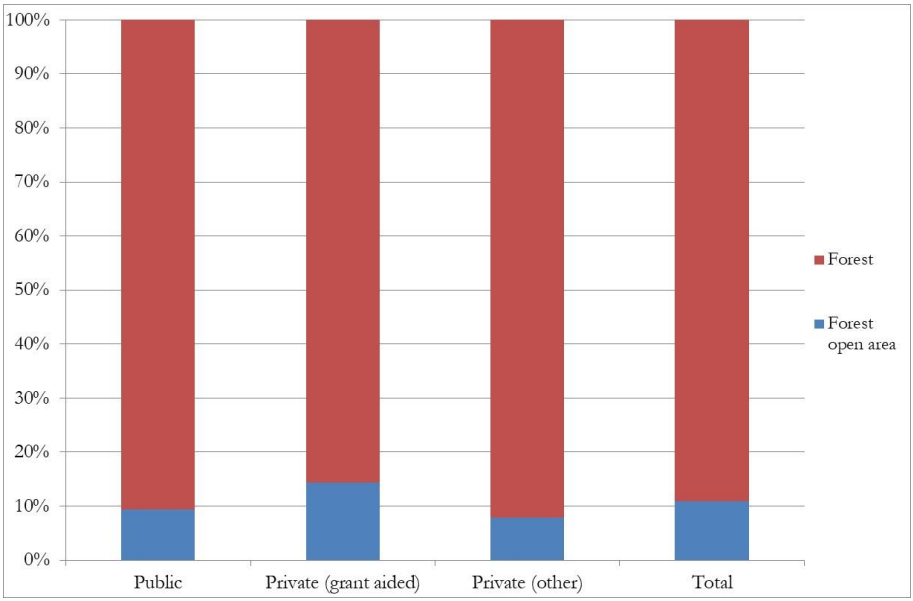


Figure 12. Proportion of forest open area in the total forest area by ownership.

5.3.2 Forest Ownership

Forest ownership refers to land ownership, with over half (411,484ha or 50.9%) of forests now in private ownership and 397,364ha (49.1%) in public ownership (Table 4 and Figure 13). The private forest estate is in effect comprised of two distinct forest types; the older non grant aided forests, referred to as Private (other), and the younger grant aided forests categorised as Private (grant aided), planted post 1980. The percent of private forests in the national forest estate has increased by 7.9% since 2006.

Table 4. Total forest area by ownership

Ownership	2012		2017		2022	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
public	389,356	53.2	391,358	50.8	397,364	49.1
private (grant aided)	248,554	34	268,100	34.8	288,497	35.7
private (other)	93,742	12.8	110,563	14.4	122,987	15.2
Total	731,652	100	770,020	100	808,848	100

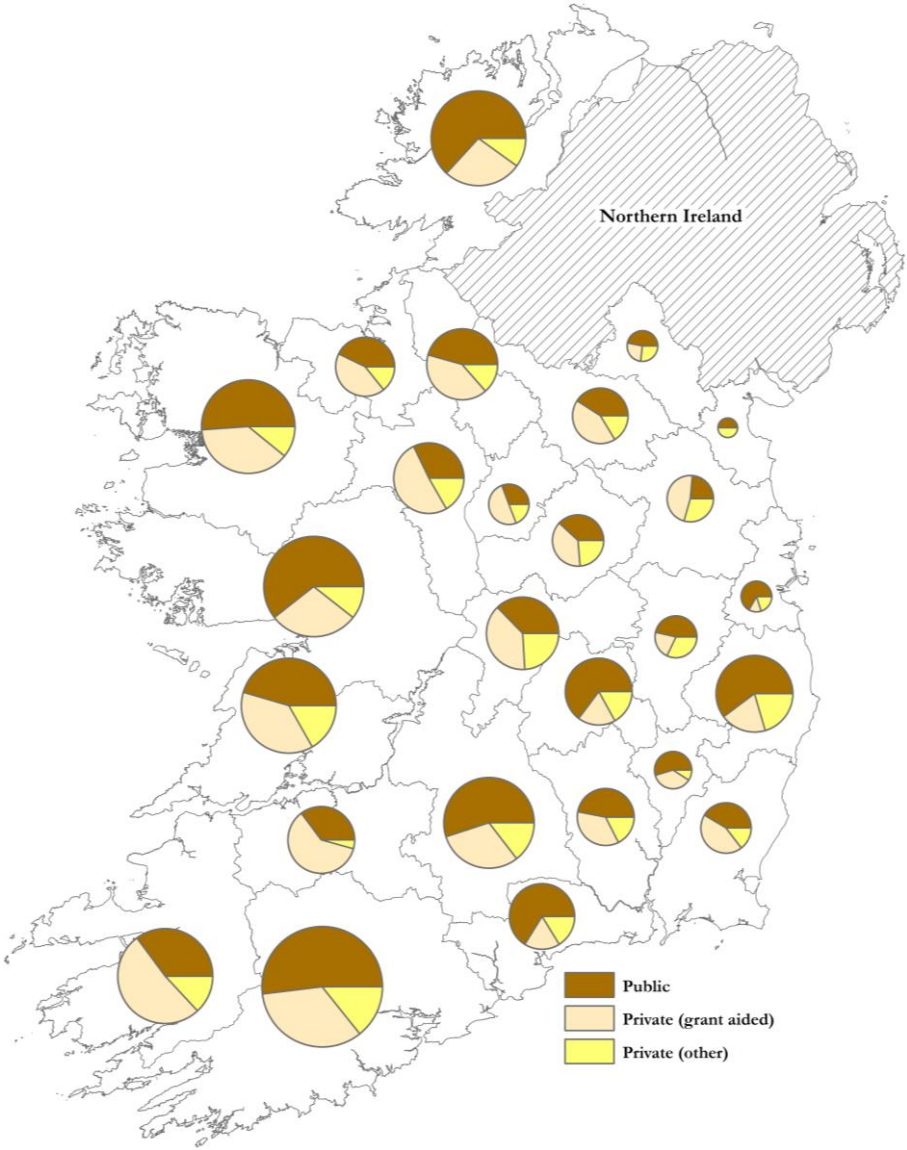


Figure 13. Proportion of national forest cover by county and ownership.

5.3.3 Availability of Wood for Supply

The classification of Forest Available for Wood Supply (FAWS) describes the relative importance of the national forest estate in terms of timber supply. The majority (74.3%) of forests in Ireland have no restrictions on timber supply (Figure 14). A small portion (0.7%) of the estate is considered not available due to the National Parks and Nature Reserves designations.

A significant portion (25%) of the national forest estate is considered unlikely to contribute to wood supply (Figure 14). Three-quarters (75.2%) of the Private (other) estate is classified as unlikely to contribute to wood supply, primarily due to the presence of semi-natural broadleaf forests which are unlikely to be harvested due to poor timber quality.

The factors considered when assessing availability of wood for supply are detailed in Figure 15. Factors relating to site constraints, physical productivity or wood quality are the most significant limitations.

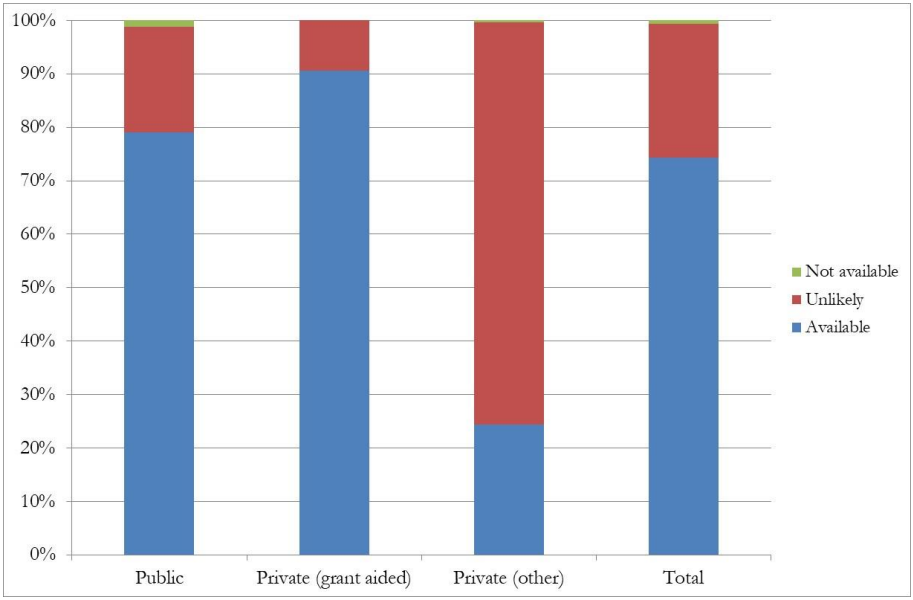


Figure 14. Proportion of the stocked forest area by ownership and Forest Available for Wood Supply.

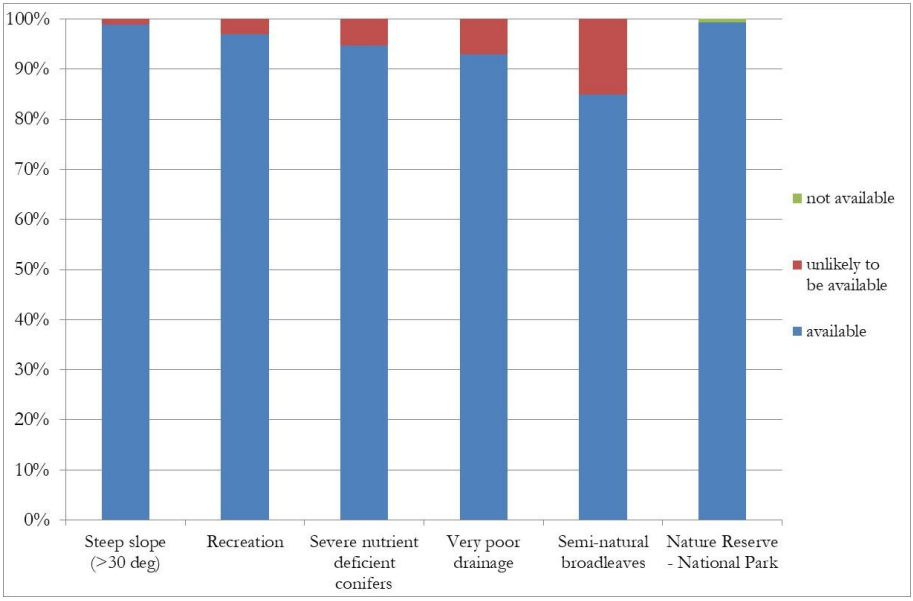


Figure 15. Proportion of the stocked forest area by Availability of Wood Supply and Availability Restriction Class.

5.4 Species Composition

The portion of the forest estate that has tree cover or is available for planting is 720,748 ha. At any one time a portion of this will be temporarily un-stocked due to events such as felling or fire. The removal of these temporarily unstocked areas leaves 713,152 ha with tree cover present.

Conifer species are the dominant species present, representing 69.4% of the stocked forest area while broadleaved species accounted for 30.6% of the area. (Figure 16 & 17). The share of broadleaf species in the national forest estate has increased by 5.9% since 2006. The increase in the proportion of broadleaf species is due to afforestation, reforestation and the encroachment of semi-natural broadleaf forests.

The main tree species is Sitka spruce occupying 360,854 ha or 50.6% of the area (Figure 17). Other pines, composed primarily of lodgepole pine, accounted for 8.8%. The most common broadleaf species present were Other short living broadleaves[2] (OSL), which includes species such as willow and hazel, representing 8.9% of the area. Birch is the next most common broadleaf species occupying 8.1% of the area.

[2] OLL Broadleaves are Other Long Living broadleaves e.g. Sweet chestnut, Holly, and Lime. OSL are Other Short Living broadleaves e.g. Willow & Hazel.

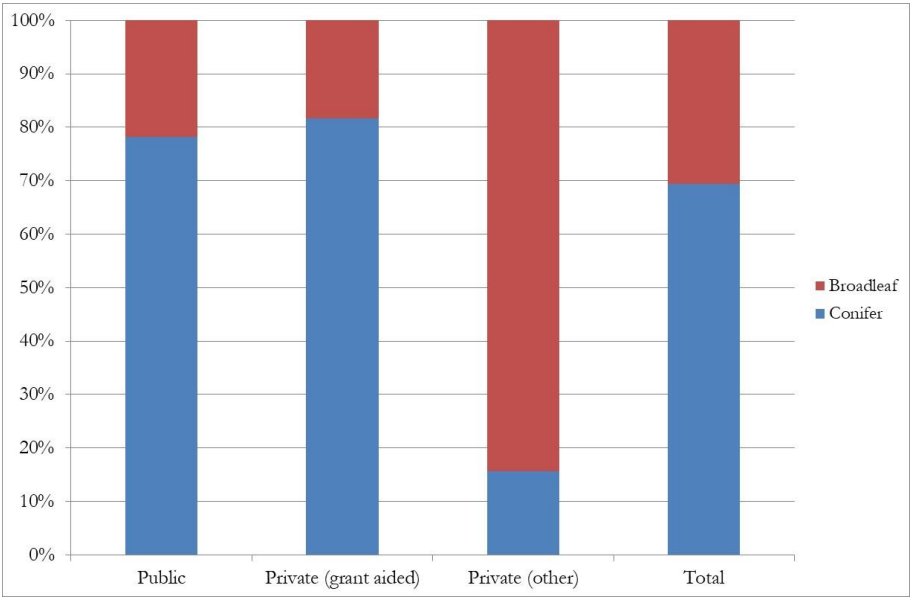


Figure 16. Proportion of the stocked forest area by ownership and species group.

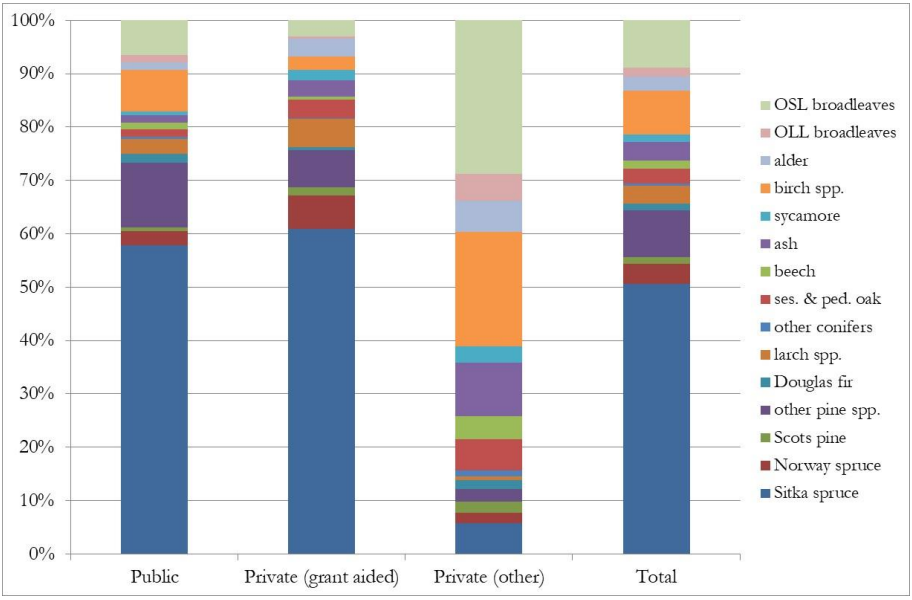


Figure 17. Proportion of the stocked forest area by ownership and species group.

The proportion of the stocked forest area by county and species group is detailed in Figure 18.

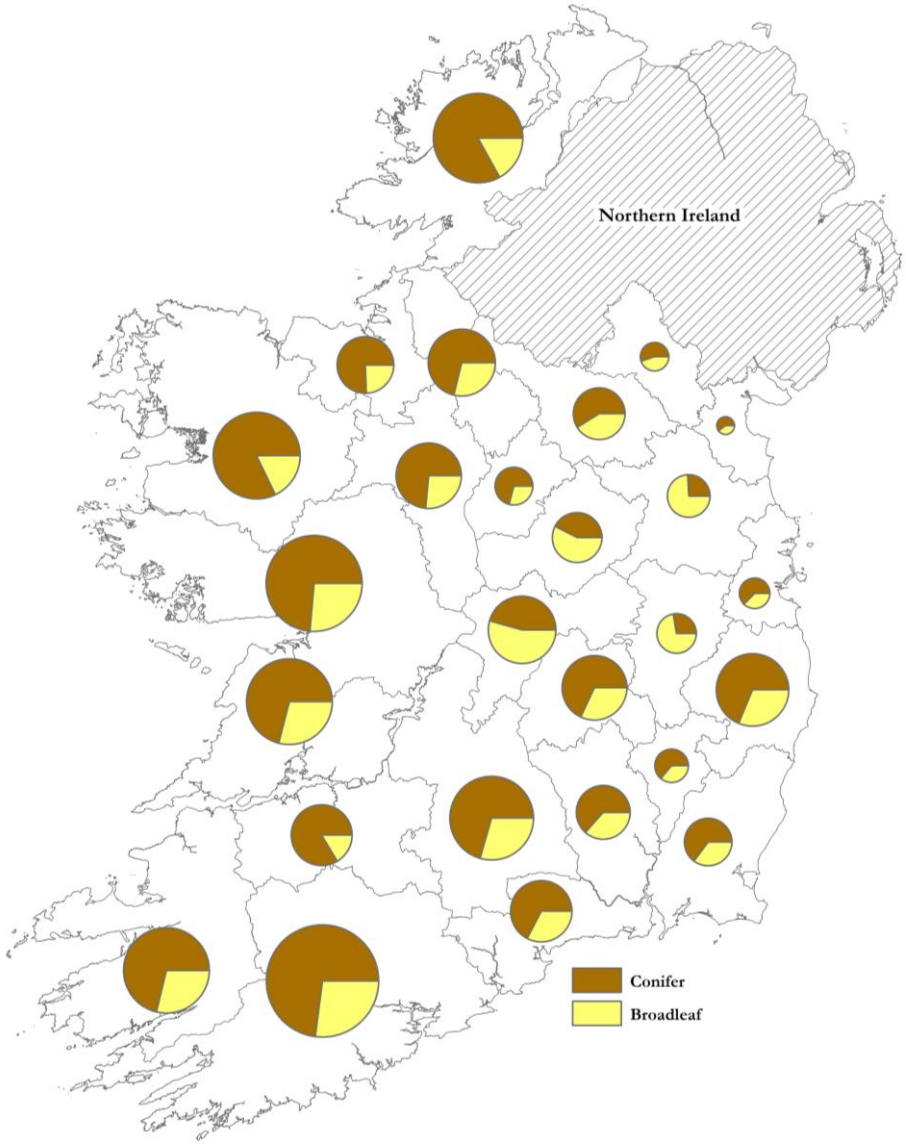


Figure 18. Proportion of the stocked forest area by county and species group.

5.4.1 Age Class

The age of a forest is described as the number of growing seasons since initial planting or natural regeneration. Nearly one-third (30.4%) of the stocked forest estate is between 21 and 30 years of age (Figure 19). The Private (grant aided) forests are predominantly less than 30 years old. However, the reduction in afforestation in recent years is apparent in the 1-10 year age-class begin smaller than the 11-20 year age class.

The age profile of the Public estate is relatively uniform from 1-40 years, except for the 21-30 year category. Private (other) forests are also evenly distributed across the range of age classes with a dominance in the 51 years plus category, reflecting their partial composition of the areas of long-term retention in the older private estates.

In general, there is a higher proportion of broadleaves in young forests due to higher levels of broadleaf afforestation over recent decades and natural regeneration (Figure 20).

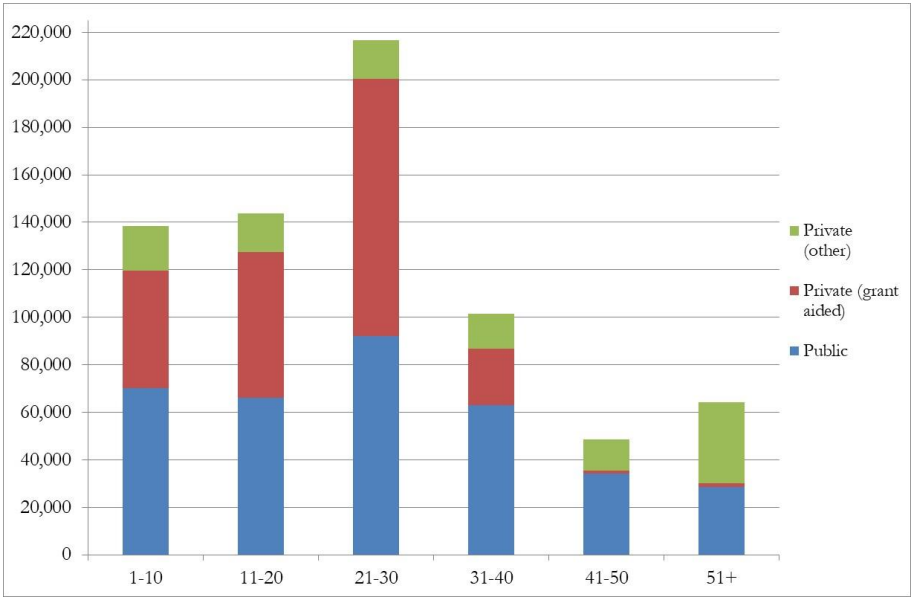


Figure 19. The stocked forest area by age class and ownership.

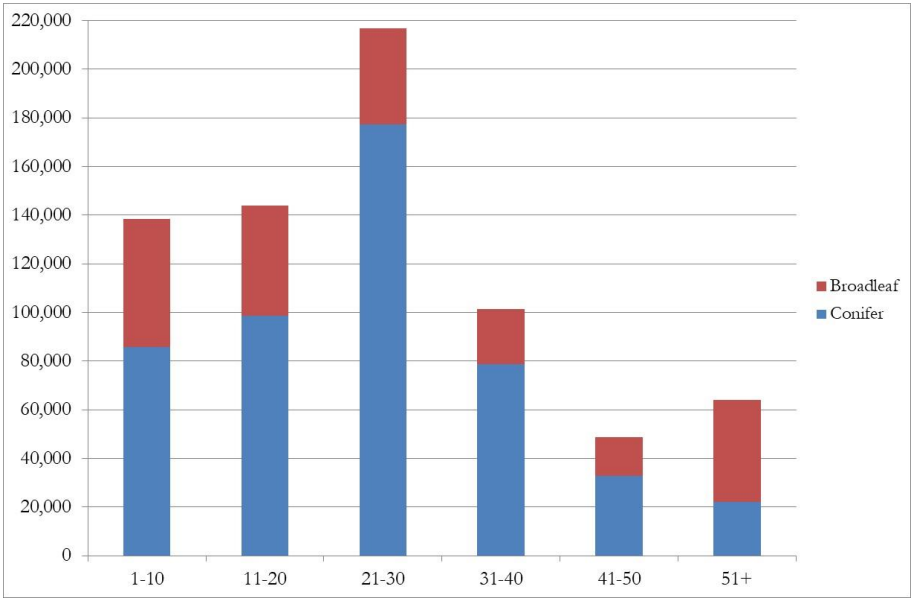


Figure 20. Total stocked forest area by age class and species group.

5.5 Forest Classification

5.5.1 European Forest Type

European forest type applies a broad species class at forest level, as opposed to the broadleaf/conifer classification presented in the previous section which is derived from tree species class. Almost two-thirds (64.1%) of the stocked forest area is composed of forests with conifer species predominating (Figure 21), which is a reduction of 1.6% since 2017. The Private (other) forests are composed of forests with broadleaf species predominating.

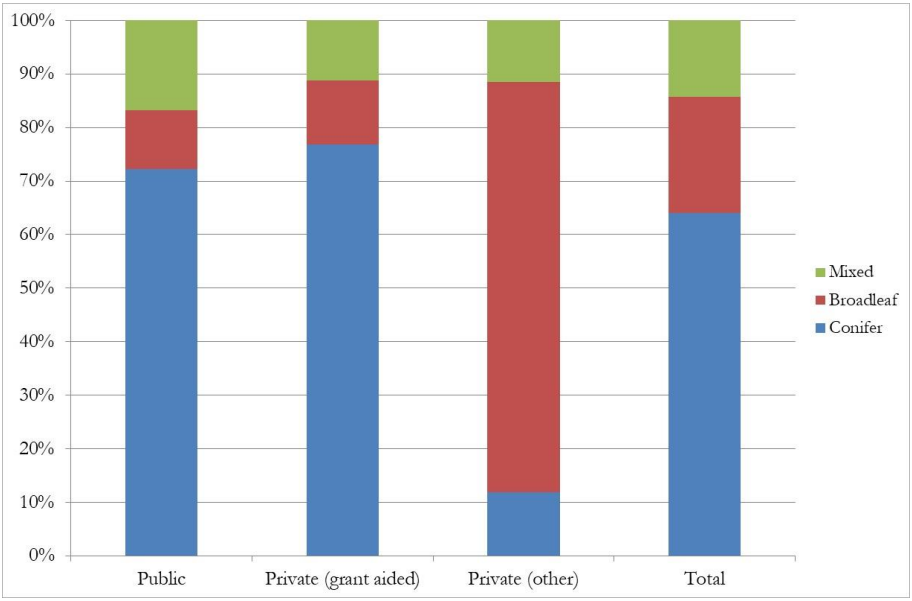


Figure 21. Proportion of the stocked forest area by European forest type and ownership.

5.5.2 Nativeness

A number of different native forest types are found across Ireland, each influenced by soil type, climate and other physical factors. Native tree species are trees that have arrived and inhabited an area naturally, without deliberate assistance by man. For NFI purposes the species list of natives trees recorded is primarily based on the list of species eligible for inclusion in Ireland's Native Woodland Scheme[3].

Native and mixed forests comprise 33.9% of Ireland's forests (Figure 22), which is an increase of 2.2% on 2017. Native tree species predominate in Private (other) forests while non-native tree species predominate in both Private (grant aided) and public forests.

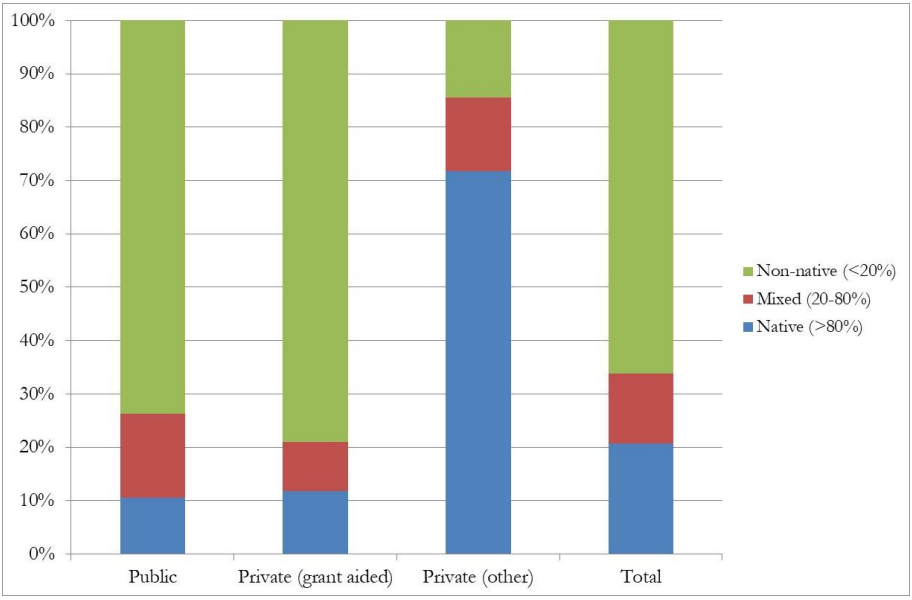


Figure 22. Proportion of total stocked forest by nativeness by ownership.

[3]Anon., 2008. Native Woodland Scheme Manual. Forest Service, Department of Agriculture, Food and the Marine, Johnstown Castle Estate, Co. Wexford, Ireland.

5.5.3 Establishment Type

Afforestation is the establishment of forest through planting and/or deliberate seeding on land that, until then, was under a different land use. Afforestation dominates as the main method by which forests have become regenerated with 55.2% of forests established in this way (Figure 23). Reforestation is the re-establishment of forest through planting and/or deliberate seeding on land classified as forest, comprises 29.7% of forests.

Semi-natural forests, which are forests established by natural regeneration, occupy 15.1% of forests. Private (grant aided) forests are almost entirely established as afforestation reflecting their contemporary nature since 1980. A large proportion (68.9%) of semi-natural forests occupy the Private (other) forests while Public forests have the largest share (53.8%) of reforestation.

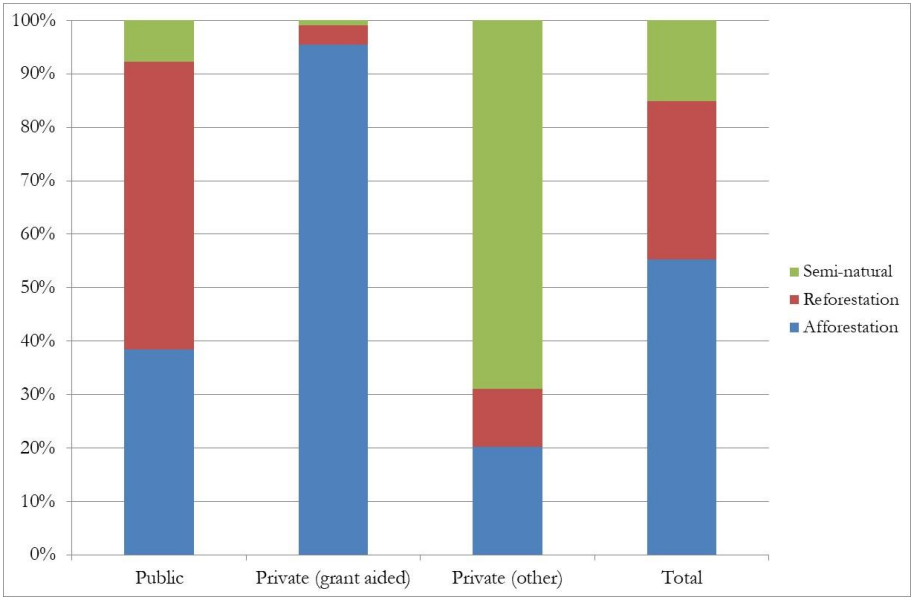


Figure 23. Proportion of total stocked forest by establishment type and ownership.

5.5.4 Development Stage

Development stage categorises the maturity classes of the forest estate. The stages range from young post establishment forests to over-mature forests along with multi-storied forests.

Overall, the high proportion of small-pole, pole stage and high forests that is present, indicates a maturing of the forest estate that has reached or is at harvesting stage (Figure 24). Multi-storied forests comprise the largest element (60.7%) of Private (other) forests while the Public forests display a relatively high proportion (17.3%) of the high forest area.

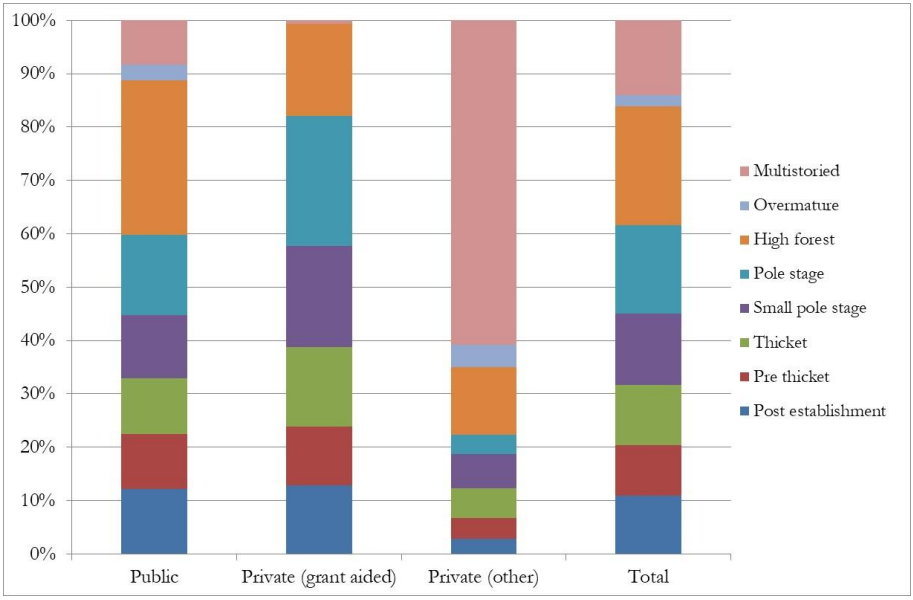


Figure 24. Proportion of the stocked forest by development stage by ownership.

5.5.5 Thin Status

Thin status describes the extent of thinning operations or absence of thinning operations in the national forest estate.

In terms of the thinning status, 18.3% of forests in the current rotation have been thinned at least once. Less than half (40.3%) of forests are juvenile (i.e. at a development stage where they could not be thinned) and a further 17% was also deemed not suitable for thinning as it was classified as undeveloped (i.e. semi-natural forest or forest with a low stocking).

One quarter (24.4%) of forests are categorised as "no thin" (Figure 25). "No thin" is defined as the forest being at a development stage where it could be thinned in theory (taking into account species, height, basal area and stocking), but has not been thinned due to a variety of factors such as high windthrow risk, economic factors/considerations; or thinning may be imminent. Apart from the limiting factors described, these "no thin" forests generally offer the best potential for thinning.

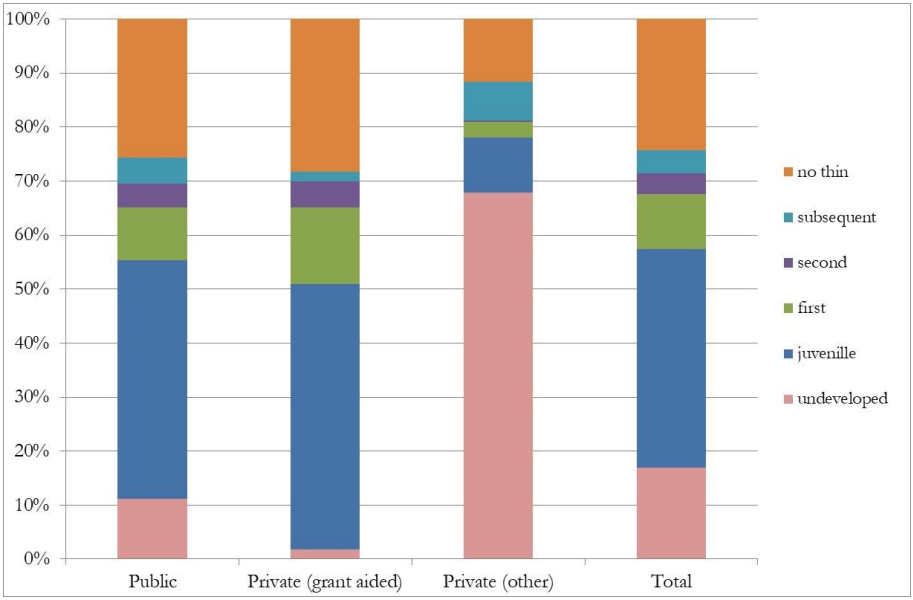


Figure 25. Proportion of the stocked forest by thin status and ownership.

5.6 Site Conditions

5.6.1 Soil Type

The majority (61.6%) of forests occur on mineral soils, with the remaining 38.4% on peats (Figure 26). Almost one-third (30.7%) of all forests are growing on highly productive gley soils, with 41.9% of Private (grant aided) forests occurring on these soils, reflecting forestry's move onto more productive soils since the mid to late 1980's.

Over the last 40 years, fewer forests are being afforested on peat (Figure 27). The proportion of minerotrophic peat being afforested has remained relatively static overtime, largely as a result of the afforestation of land that was reclaimed for agriculture. Afforestation of ombrotrophic peat is declining, reflecting a shift away from the unenclosed land type.

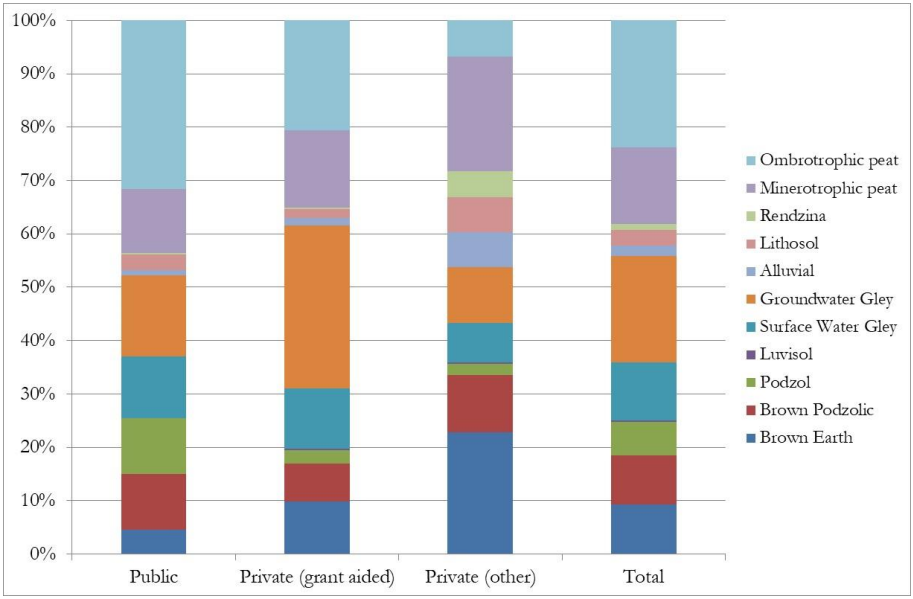


Figure 26. Proportion of the stocked forest by soil group by ownership.

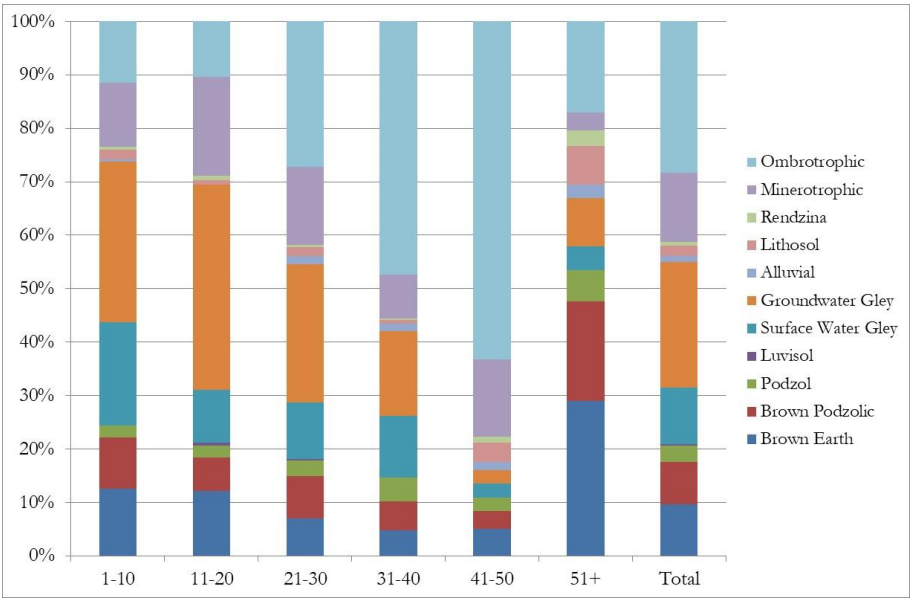


Figure 27. Proportion of total afforested area by age class (10 year) and soil group.

5.6.2 Environmental Designations

There are a number of environmental designations[4] that affect forest management but do not significantly restrict timber harvesting. Nearly half (48.2%) of the forest area had one or more environmental designation (Figure 28).

Nine environmental designations are included with some having greater affects than others in terms of restricting forest management operations (Figure 29). The increase in hen harrier SPA designations has resulted in considerable areas being designated since 2006. Restrictions on the timing of felling, in relation to the protection of Hen Harriers, occurs within the Higher Likelihood Nesting Areas (HLNA), which include 4.4% of the total forest area.

[4] Designations include: Special Area of Conservation (SAC); Special Protection Area (SPA); National Heritage Area (NHA); Fresh Water Pearl Mussel (FPM); Nature Reserve; National Park; Fisheries Sensitive, Acid Sensitive and Hen Harrier Higher Likelihood Nesting Area (HLNA).

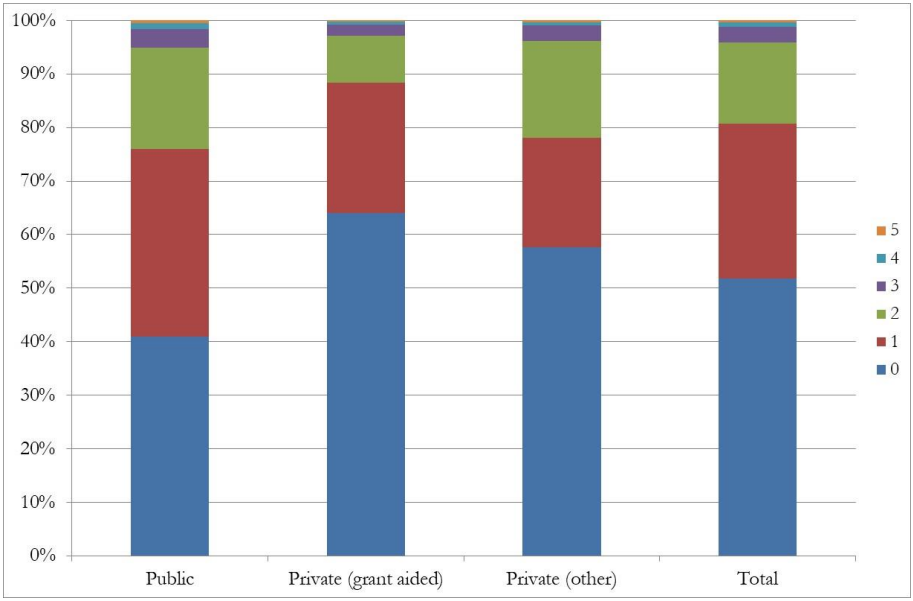


Figure 28. Proportion of total forest area by ownership and number of environmental designations.

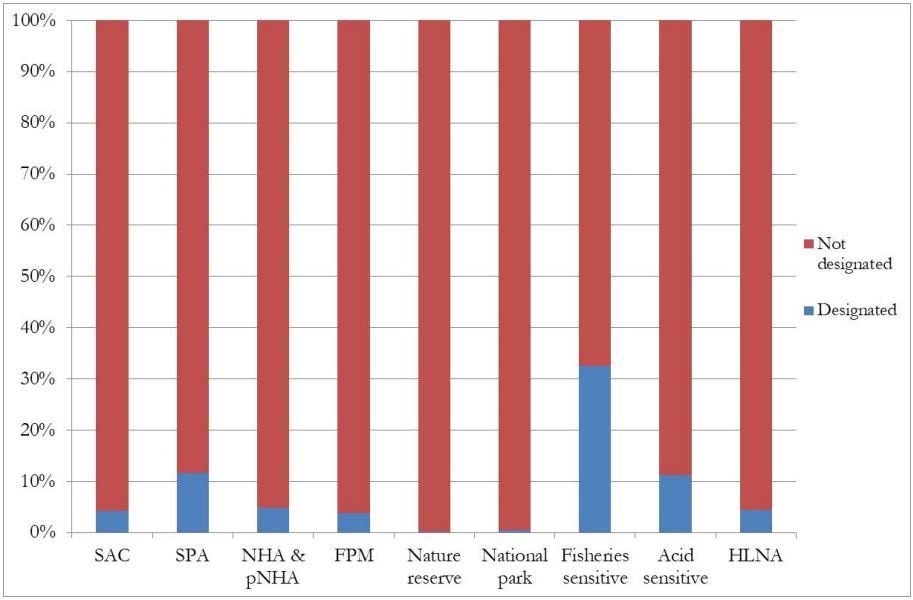


Figure 29. Total forest area by environmental designations.

5.7 Growing Stock Volume and Basal Area

5.7.1 Basal Area

In forest management, Basal area is the term used to define the area of a given section of land that is occupied by the cross-section of tree stems at height of 1.3 m from the tree base. The average basal area for all Irish forests is 29.8 m^2 per ha. The Private (grant aided) estate basal area increased from 27.1 m^2 per ha to 31.2 m^2 per ha between 2017 and 2022, due to the high growth phase of these forests and the low levels of harvesting (Table 5).

Table 5. Basal area (m^2/ha) by ownership (2006 to 2022).

Ownership	2006	2012	2017	2022
Public	24.1	27.0	27.1	29.4
Private (grant aided)	10.7	21.2	27.1	31.2
Private (other)	26.3	29.6	27.8	27.6
Total	20.2	25.3	27.5	29.8

5.7.2 Growing Stock Volume

The total standing growing stock volume is estimated to be over 142 million m^3, an increase of 25.5 million m^3 on the 2017 volume. The mean growing stock per hectare for the forest areas is 200 m^3. The gap between public and private forest growing stock volume has closed in considerably since 2012, with the private sector share expanding from 38% in 2012 to 49% in 2017 (Table 6).

Table 6. Growing stock (1000's m^3) by ownership (2012 to 2022).

Ownership	2012		2017		2022	
	1000's m^3	%	1000's m^3	%	1000's m^3	%
Public	60,405	62	64,783	55.6	72,340	50.9
Private (grant aided)	21,824	22.4	34,090	29.3	49,527	34.9
Private (other)	15,247	15.6	17,651	15.1	20,179	14.2
Total	97,476	100	116,525	100	142,046	100

In terms of broad species groups, 81.1% of growing stock volume refers to conifer species, while 18.9% is contained in broadleaf species. Sitka spruce contains 60.2% of the growing stock, followed by other pines at 8.3% (Figure 30). Counties in the west of Ireland have the highest proportion of growing stock, with Co. Cork having the highest volume at 16.5 million m^3 (Figure 31 and 32).

Note:

The difference in growing stock between time periods does not represent the total increment, as the increment of trees which have been felled or have died during the reference period are not included. See Section 5.8.1 for details on gross volume increment.

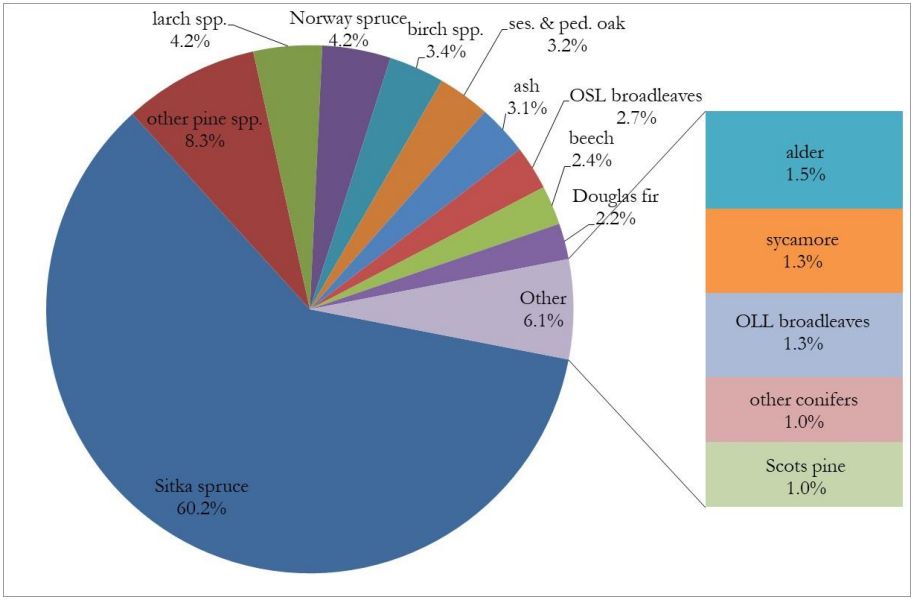


Figure 30. Proportion of growing stock (m^3) by species group.

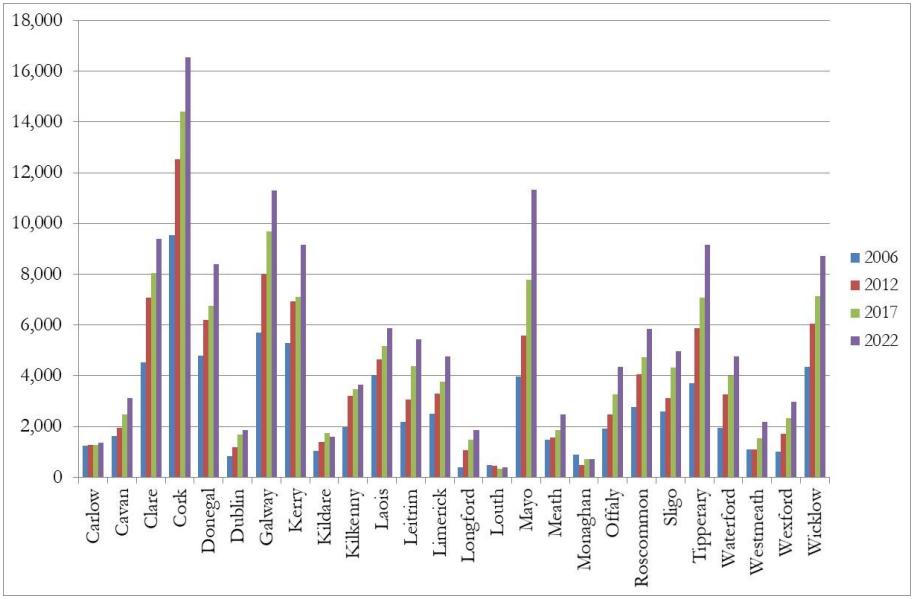


Figure 31. Total growing stock (1,000's m^3) by county (2006 to 2022).

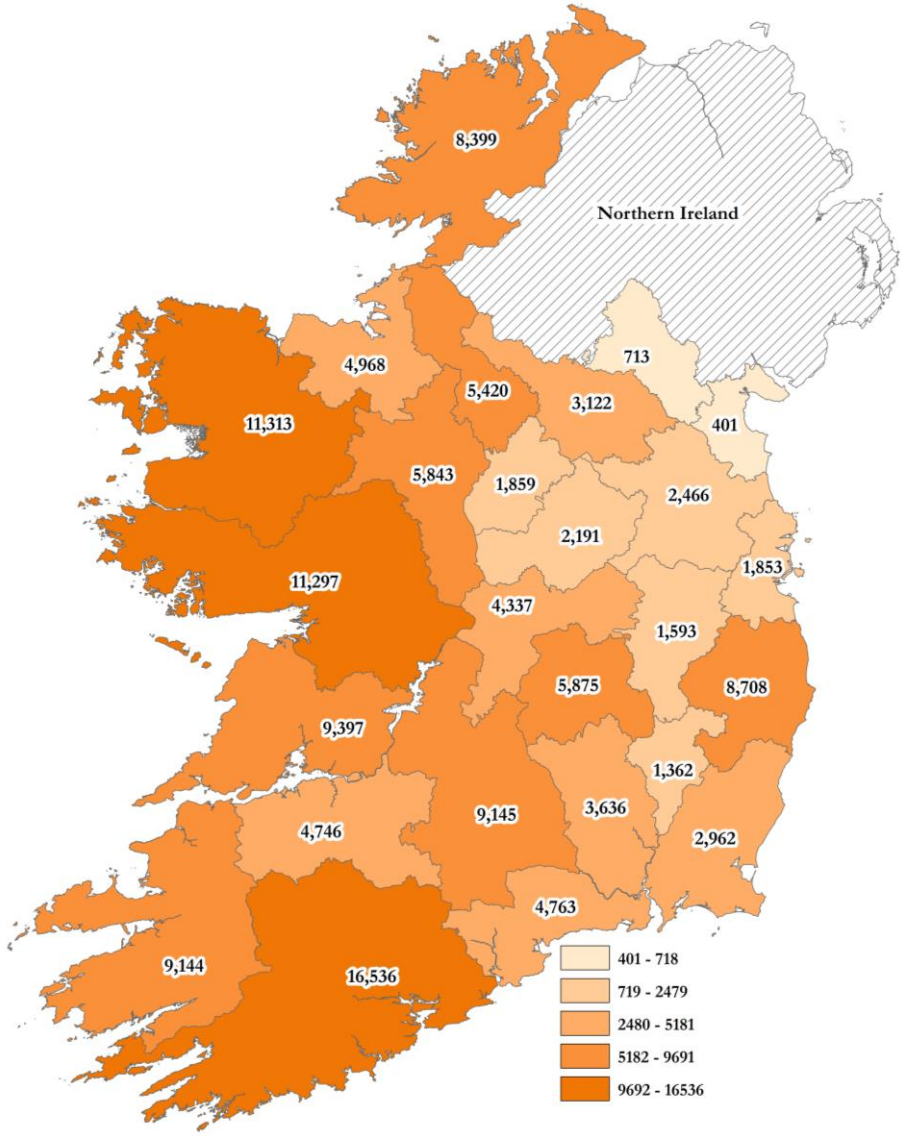


Figure 32. Distribution of growing stock volume (1,000's m^3) by county.

5.8 INCREMENT AND FELLINGS

The balance between increment and fellings is an important indicator of SFM in a country as it describes the sustainability of wood production over time, the current availability of wood and the potential for the future. The completion of four NFI cycles creates a time-series to assess forest increment and felling in Ireland for the entire forest estate since 2006.

5.8.1 Gross Volume Increment

Gross volume increment is defined as the volume growth on trees ≥7 cm Dbh and includes the increment of trees which have been felled or have died during the reference period.

Gross annual volume increment between 2017 and 2022 was 10 million m³ per year. Almost half (49.7%) of the increment occurred in the Public forest estate (Table 7). The counties with most significant growing stock increment are distributed on the western and south western seaboards (Figure 33).

Table 7. Gross annual volume increment by ownership (2006 to 2022).

Ownership	2006-2012		2013-2017		2017-2022	
	1000's m³	% Total	1000's m³	% Total	1000's m³	% Total
Public	4,702	61.2	4,656	54.6	4,985	49.7
Private (grant aided)	2,392	31.1	3,373	39.5	4,349	43.4
Private (other)	591	7.7	503	5.9	691	6.9
Total	7,685	100	8,532	100	10,025	100

Sitka spruce dominates the volume increment in terms of species groups comprising 70.4 % of the annual volume increment followed by other pines at 6.6 % (Figure 34).

The mean net annual increment is 13.9 m³/ha/year in the stocked forest estate. Public forests average 14 m³/ha/year and Private (grant aided) 17.6 m³/ha/year, with Private (other) significantly lower at 6 m³/ha/year (Figure 35). The differences are due to a combination of age, species composition and soil type.

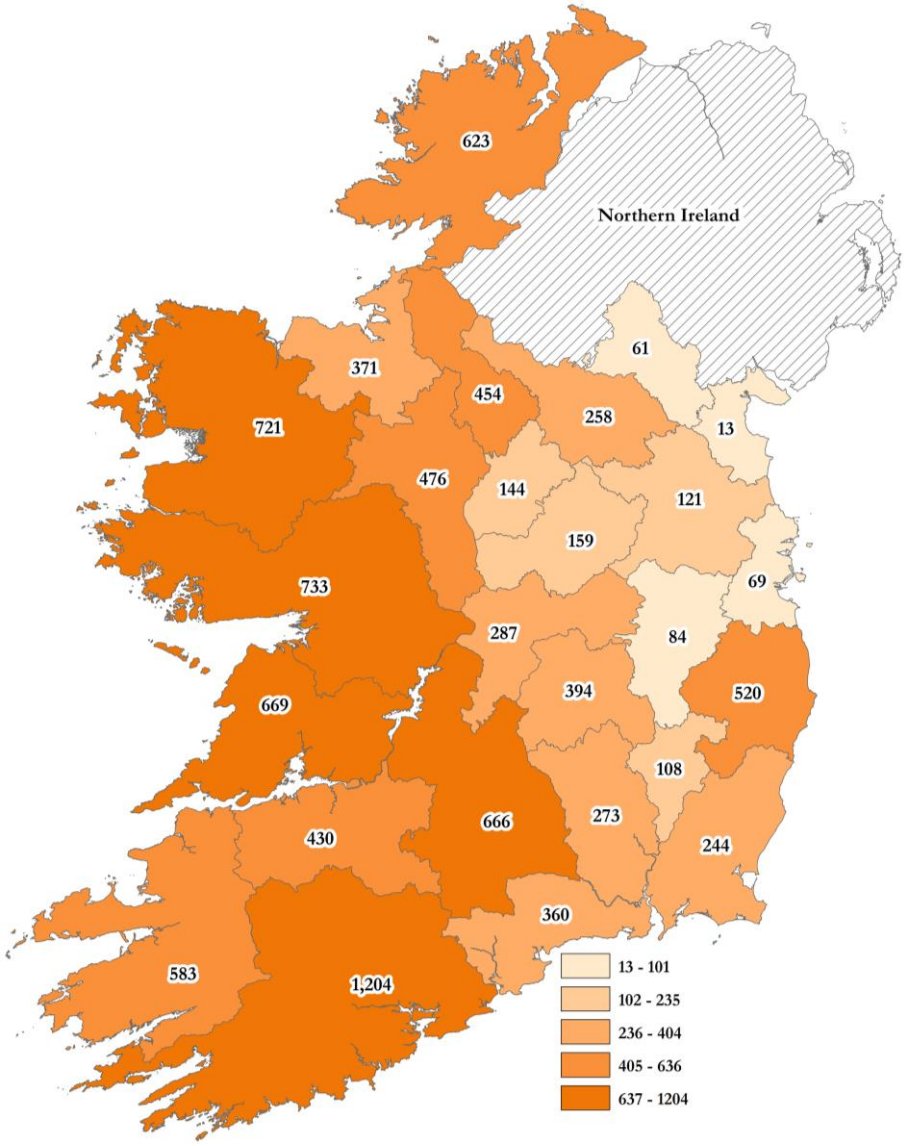


Figure 33. Distribution of gross annual volume increment (1,000's m^3) by county.

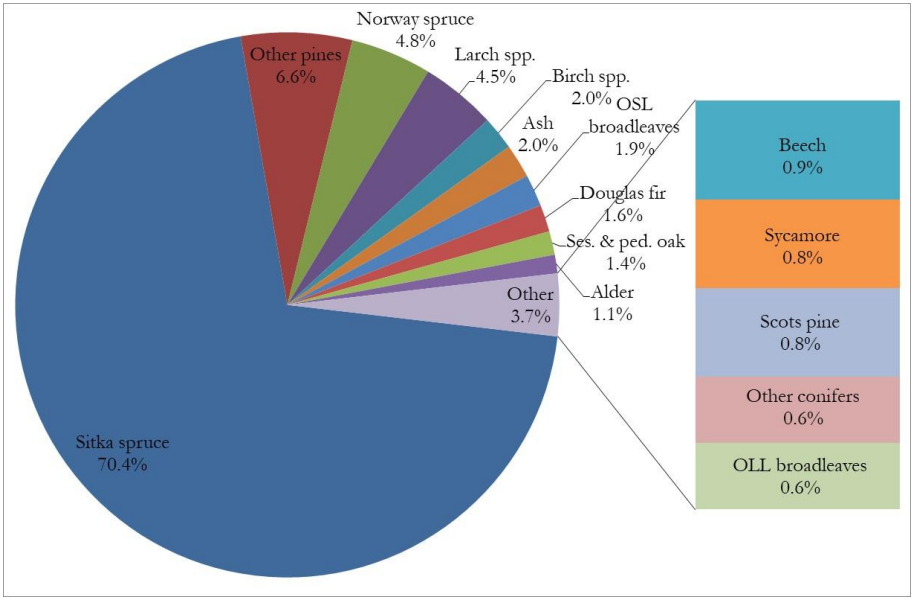


Figure 34. Gross volume annual increment by species group.

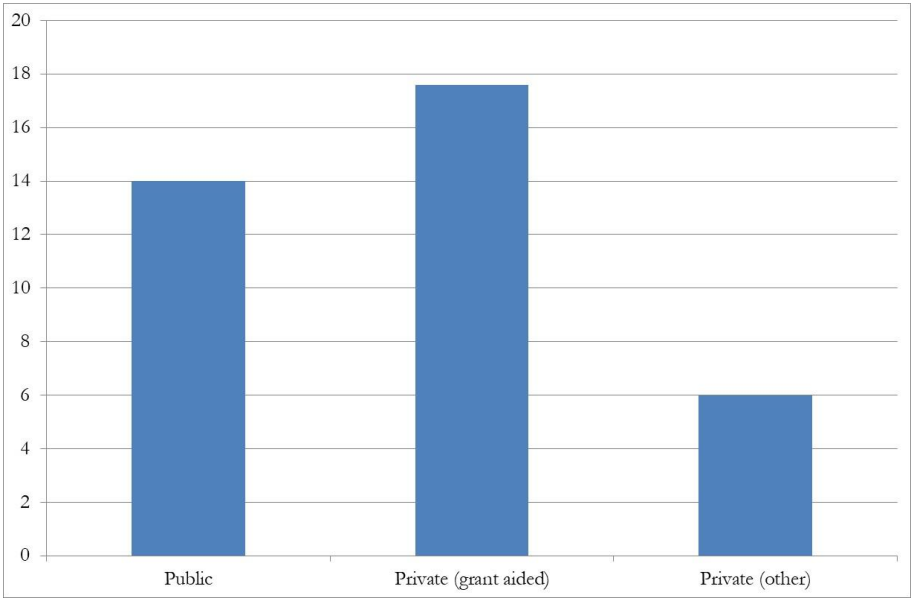


Figure 35. Mean net annual volume increment per hectare by ownership (m^3/ha/year).

The county with the highest mean annual volume increment is Limerick at 17.9 m³/ha/year (Figure 36). Low increment levels result from one or more of the following factors; high proportion of broadleaves, very young forest and low productivity sites.

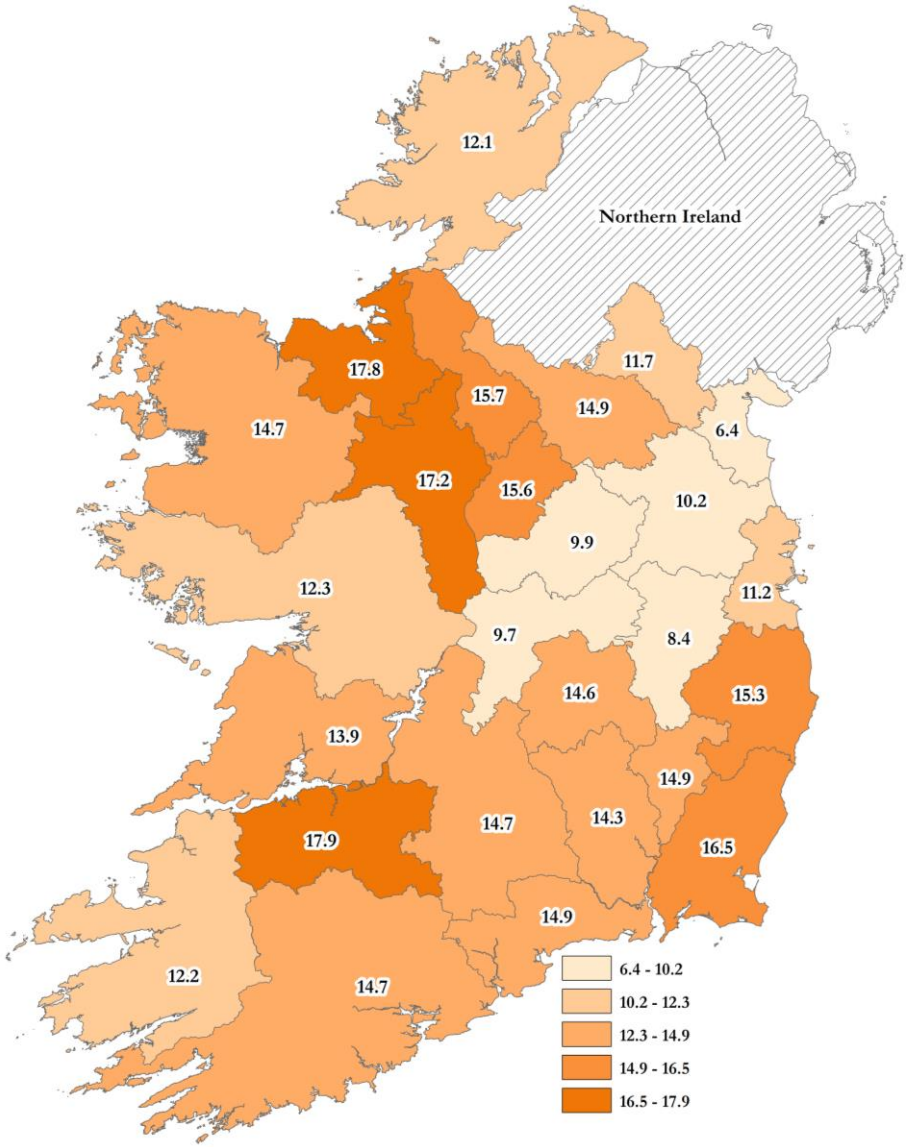


Figure 36. Mean net annual volume increment per hectare per county (m³/ha/year).

5.8.2 Fellings

The extent of felling interventions that occurred within the forest between NFI cycles is detailed in Table 8. It is important to note that the timespan within each cycle differs; 5.95 years (2006-2012), 4.66 years (2013-2017) and 4.46 years (2017-2022), which means any change in the later period is more significant in real terms. The area clearfelled has decreased significantly by 14,810 ha. Also, first thinning area has increased between 2017 and 2022, which is a positive trend for wood mobilisation.

Table 8. Forest area (ha) by felling intervention (2006-2022).

Felling intervention	2006-2012		2013-2017		2017-2022	
	Area	%	Area	%	Area	%
no intervention	561,471	85.8	582,598	84.8	624,246	86.5
first thinning	34,441	5.3	36,446	5.3	40,043	5.6
second thinning	7,618	1.2	16,841	2.4	18,012	2.5
subsequent thinning	14,412	2.2	9,616	1.4	11,234	1.6
clearfell	36,038	5.5	42,023	6.1	27,213	3.8
Total	653,980	100	687,525	100	720,748	100

The mean annual standing volume felled between 2017 and 2022 is 4.1 million m^3 per year (Table 9), which represents less than half (41%) of the gross annual increment. The volume felled between 2017-2022 showed a decrease of 0.77 million m^3 over the period 2012-2017. Fell volumes are concentrated in Public forests which accounted for 71.5% of mean annual volume felled between 2017 and 2022.

Table 9. Mean annual volumes felled by ownership (2006-2022).

Ownership	2006-2012		2013-2017		2017-2022	
	1000's m^3	% Total	1000's m^3	% Total	1000's m^3	% Total
Public	3,152	87.1	3,780	77.2	2,951	71.5
Private (grant aided)	208	5.8	792	16.2	937	22.7
Private(other)	256	7.1	324	6.6	239	5.8
Total	3,616	100	4,896	100	4,127	100

The estimate of mean annual standing volume felled between 2017 and 2022 from the NFI is close to the published estimates from the CSO Wood Removal Survey[5]. For the period 2017-2021, the annual average roundwood harvest is estimated to be 3.95 million m^3. The primary difference between these two estimates is the NFI volume estimate is standing in the forest, whereas the CSO estimate represents the roundwood sold by forest owners. This methodological difference is represented by the losses associated with harvesting, which could range from 5 to 25% depending on the type of forest being harvested.

[5] CSO, 2022. Forest Wood Removals 2021.

Clearfelling - the felling of a continuous block of trees - is the dominant harvest type for all ownership groups, accounting for 64.9% of the fell volume in the national forest estate (Figure 37).

First thinning accounts for 20.6% of the fell volume, and is particularly prevelant in the Private (grant aided) forests representing 43.7% of the volume felled.

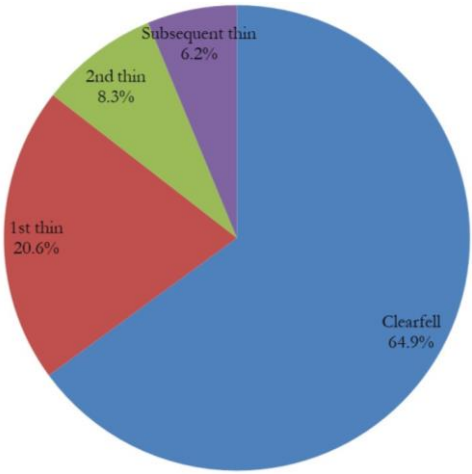


Figure 37. Fell volume by harvest type.

In terms of broad species categories 96.2% of the mean annual volume felled comes from coniferous species (Figure 38). Sitka spruce accounted for 78.6% of the share of the mean annual felled volume, followed by others pines at 6.8% and Norway spruce comprising 5.3%.

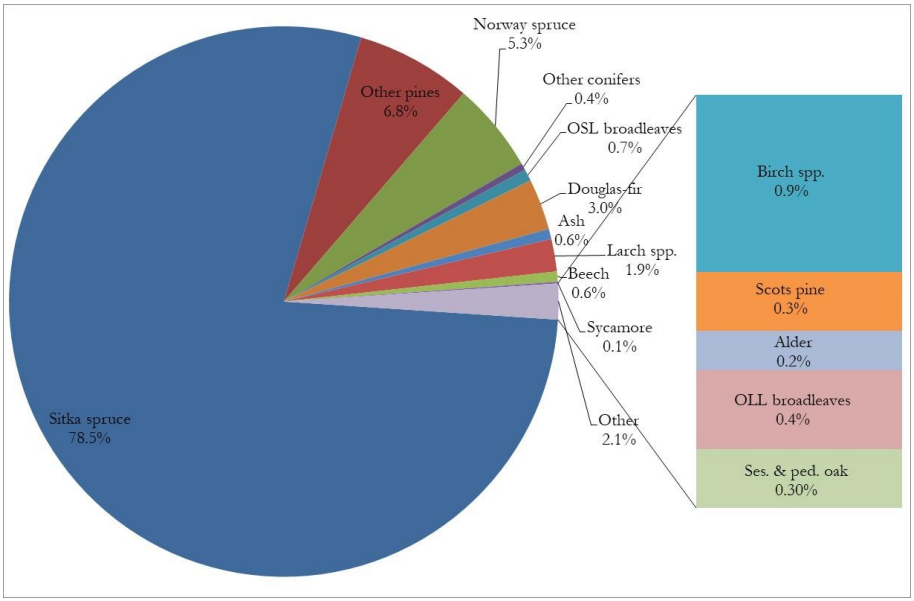


Figure 38. Proportion of total fell volume by species group.

5.8.3 Fell Mean Tree Volume

The mean tree volume of felled trees in Irish forests is 0.33 m³. The felled mean tree, according to harvest type, ranges from 0.24 m³ in first thinning operations to 0.48 m³ at clearfell (Table 10).

Table 10. Fell mean tree volume by harvest type.

Harvest Type	1st thin	2nd thin	Subsequent thin	Clearfell	All
Tree Volume (m³)	0.24	0.27	0.44	0.48	0.33

In terms of mean tree volume size, nearly half (48%) of the total clearfell volume comes from trees 0.5 m³ or less. In 1st thinning, 65.1% of the volume comes from trees that are 0.24 m³ or less (Figure 39).

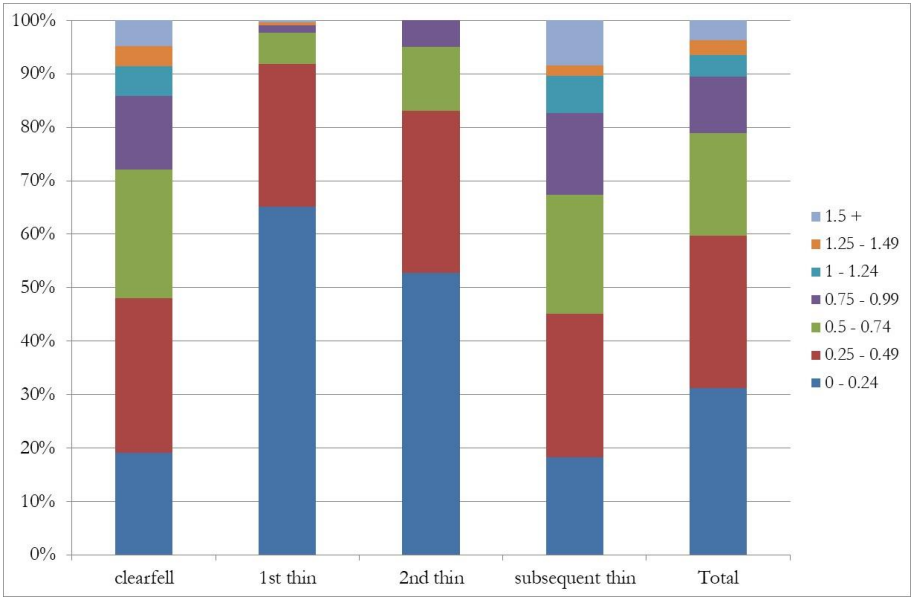


Figure 39. Mean annual standing volume (m³) felled by harvest type and mean tree volume (m³) class.

5.9 Forest Carbon

Forests play an important role in mitigating climate change by sequestering and storing atmospheric carbon dioxide (CO_2). Sequestration is the net removal of CO_2 from the atmosphere, and storage in plant biomass, deadwood and harvested wood product pools (Figure 40). CO_2 is taken up during photosynthesis and stored as biomass. Some carbon is released back into the atmosphere due to autotrophic respiration and from the forest deadwood, litter and soils pool due to decomposition. Sustainably managed forests are a net absorber of carbon. However, unmanaged and degrading forests eventually become a net emitter of carbon back into the atmosphere. Large emissions can also occur during catastrophic disturbance events, such as fires, storms and windthrow. About half of carbon in harvested timber is stored in wood products (HWPs) but these carbon stores are eventually released back into the atmosphere unless it is recycled or used for bioenergy. Use of wood for bioenergy replaces fossil fuel use and reduces overall emissions. Fossil fuel emissions can also be reduced by substituting energy intensive materials with wood products (i.e. product substitution).

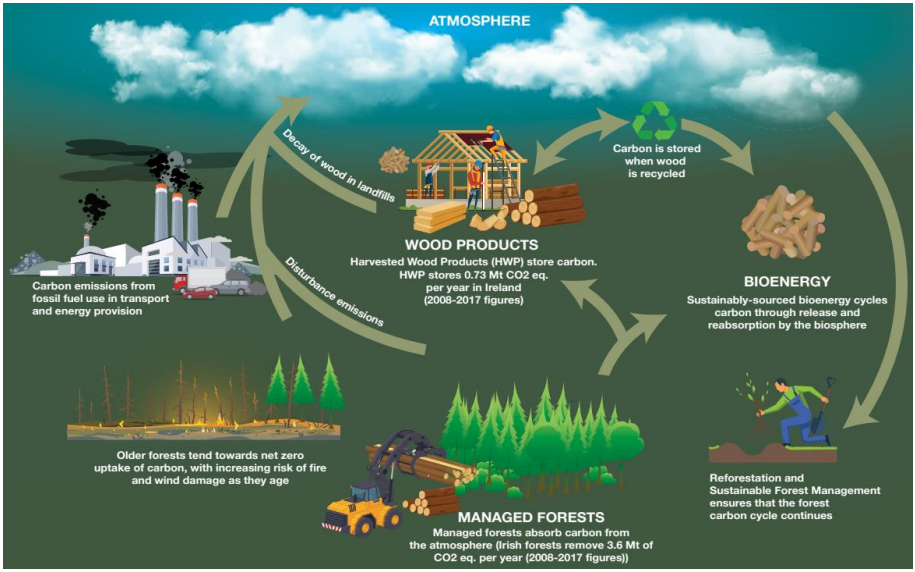


Figure 40. The role of forests and harvest wood products in the carbon cycle.

5.9.1 NFI Carbon Stocks

The amount of carbon (C) present in forests (i.e. the C stock) provides an estimate of the total accumulation of C to a specific point in time. The NFI measures C stocks in the forest pool, which include aboveground biomass (stems, leaves and branches), belowground biomass (Stumps and roots to a minimum diameter of 5 mm), litter (fallen needles/leaves and branches >7cm diameter), deadwood (harvest residue, dead trees) and soils.

The estimates of C stock for each plot were calculated using some of the reporting methodology that has been developed for the United Nations Framework Convention on Climate Change (UNFCCC). Changes incorpoarted into the methodology to more accurately estimate the grennhouse gas balance for Ireland, are also adopted for NFI estimates of carbon stocks in biomass, deadwood, litter and soils pools. Changes include; updated tree biomass equations, deadwood classification systems and associated C stock values for soil, and a new method to calculate litter stocks.

The NFI based estimates of C stocks in litter and soils are based on different methodologies than those applied to the inventory submissions to the UNFCCC. In particular, soil and litter stock are calculated using reference soil stocks and litter depth measurements. In contrast the UNFCCC inventory submission calculations use a tier 3 models which estimate fluxes (gains and losses on C) in 24 component pools. The UNFCCC inventory estimates of organic soil C stock changes are based on emission factors not measured in the NFI protocol. In addition, different methodologies have been used to calculate NFI C stock in the past and the stratified plot sampling protocol was updated in 2012. Therefore, it is not appropriate to use this information to assess carbon stock changes in litter and soil pools in particular. The information supplied by the Environmental Protection Agency as part of Ireland's submission to the UNFCCC provides information on carbon stock changes based on information from the NFI (Duffy *et al.*, 2022[6]).

The results presented in Table 11 show the forest C stock in the five different pools. The carbon stock in forest soils is the dominant component, accounting for 78% of the carbon stock in the forest estate in 2022. Biomass C pools represent a small proportion of the total C stock, but these are subject to the largest variation from year to year due to harvesting and disturbance events (e.g. fires and windthrow). Total living tree biomass (Aboveground and Belowground) amounts to 20.1% of the total carbon stock, while deadwood, including logs, stumps and standing dead trees along with litter constitutes the remaining 1.9%.

Table 11. Forest Carbon stock 2006 - 2022.

Carbon Stock	2006		2012		2017		2022	
	Million tonnes	% Total	Million tonnes	% Total	Million tonnes	% Total	Million tonnes	% Total
Aboveground	30.6	8.9	39.7	10.4	45.6	14.6	52.6	16.3
Belowground	6.7	1.9	8.8	2.3	10.3	3.3	12.3	3.8
Deadwood	1.2	0.4	2.5	0.6	2.1	0.7	2.5	0.8
Litter	2.5	0.7	6.3	1.6	7.1	2.3	3.6	1.1
Soil	304.9	88.1	323.7	85.1	246.6	79.1	252.1	78.0
Total	345.9	100	381.0	100	311.7	100	323.0	100

[6] Duffy, P. Black, K., Fahey, D., Hyde, B., Kehoe, A., Monaghan, S., Murphy, J., Ryan, A.M.. and Ponzi, J. 2022. National inventory report greenhouse gas emissions 1990 – 2020 Reported to the United Nations Framework Convention On Climate Change, EPA, Dublin.

The carbon stock in the living tree biomass was 64.8 million tonnes in 2022, with Sitka spruce and 'other pine' species the predominant contributors (55.6%) (Figure 41). From an ownership perspective, the Public, Private (grant aided) and Private (other) forest estates account for 51%, 35% and 14% respectively of the carbon stock in the living tree biomass (Figure 42).

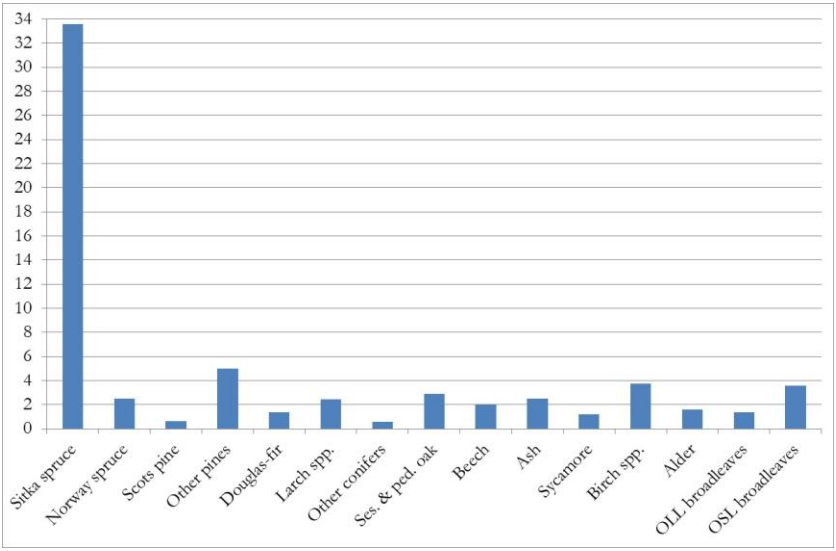


Figure 41. Total living tree carbon stock (Million tonnes) by species group (2022).

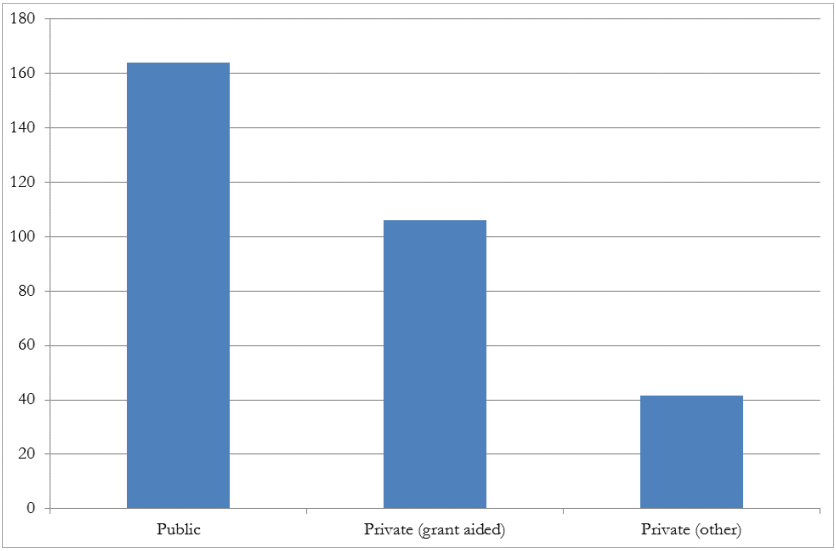


Figure 42. Total carbon stock (Million tonnes) by ownership type (2022).

5.10 Health and Vitality

The NFI is the only systematic national assessment of forest damage in Irish forests. Information is collected on forest damage at the individual tree and plot level**.** Forest health and vitality is affected by both abiotic (e.g. wind) and biotic (e.g. deer) factors. The types of forest damage recorded are those which are most common or cause most damage to Ireland's forests.

5.10.1 Forest Damage

In the NFI, damage to forest health is considered to be an alteration of the normal growth pattern of the trees. This definition therefore encompasses a wide range of factors, some of which would not have been traditionally considered as damage agents (e.g. nutrition).

Over one-third (36.8%) of stocked forest areas have no forest damage present (Figure 43). Abiotic damage was recorded on 194,727 ha or 27% of the forest area and biotic damage was recorded on 117,305 ha or 16.3% of the forest area. Both abiotic damage and biotic damage was recorded on 143,433 ha or 19.9% of the forest area.

While nearly two-thirds of stocked forest area displayed signs of forest damage present, the following sub-sections will show that the overall severity of the damage was low.

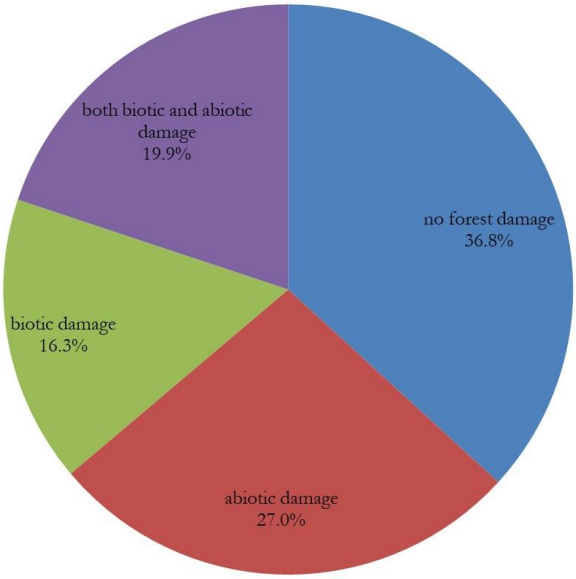


Figure 43. Damage presence in Ireland's forest estate.

5.10.2 Biotic

Biotic damage was recorded on 260,738 ha or 36.2% of the forest area. Damage caused by animals (e.g. browsing by deer) was the most common type of biotic damage, followed by vegetation competition and harvesting operations (Figure 44).

Phytophthora ramorum was first detected in Japanese larch in 2010 and the first detection of ash dieback in Ireland was in 2012. Ash dieback is now widespread and was noted to be present at 34,395 ha of forests visited. *Phytophthora ramorum* was noted on only one NFI sample plot. The systematic nature of NFI sampling grid is not conducive to accurately report on small areas statistics such as *Phytophthora ramorum*. Targeted surveys by the Forestry Inspectorate provide more accurate information on the extent of diseases that impact small areas.

Note that forest areas may have more than one type of biotic damage present. Therefore, double counting will occur if the forest area associated with each damage agent is added together.

In terms of damage severity, 21.5% of the areas with biotic damage present display high or critical levels of damage (Figure 45). This indicates that the damage agent has critically impacted tree growth and the damage agent is expected to kill trees in the future. The majority (78.5%) of forests with biotic damage have low or moderate levels of damage.

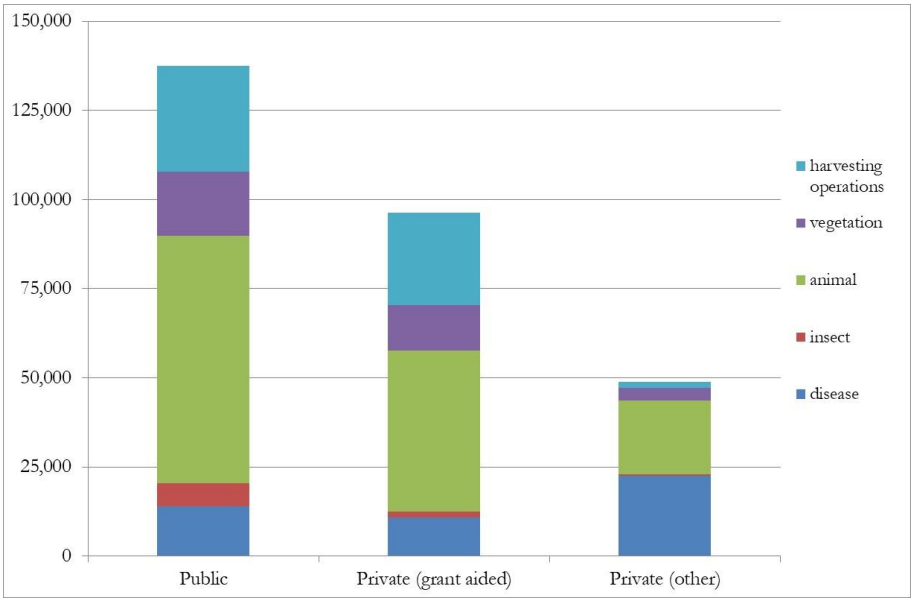


Figure 44. Overview of forest area (ha) by ownership effected by biotic damage agent.

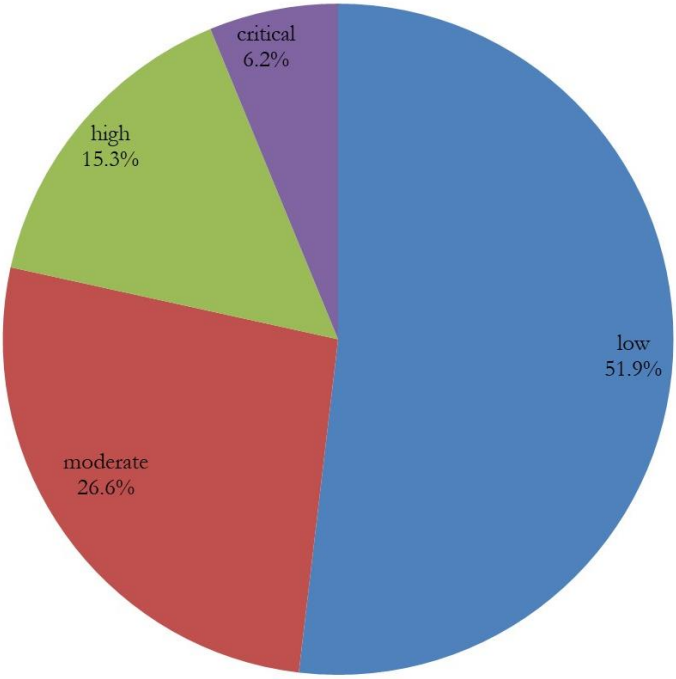


Figure 45. Severity of biotic damage.

5.10.3 Abiotic

Abiotic damage was recorded on 338,160 ha or 46.9% of the forest area. Damage caused by climatic factors (e.g. exposure) was the most common type of damage, followed by nutrient deficiency and anthropogenic factors (Figure 46).

Note that forest areas may have more than one type of biotic damage present (Figure 46). Therefore, double counting will occur if the forest area associated with each damage agent is added together.

In terms of damage severity, 15.7% of the areas with abiotic damage present display high or critical levels of damage (Figure 47). The majority (84.3%) of forests with abiotic damage have low or moderate levels of damage.

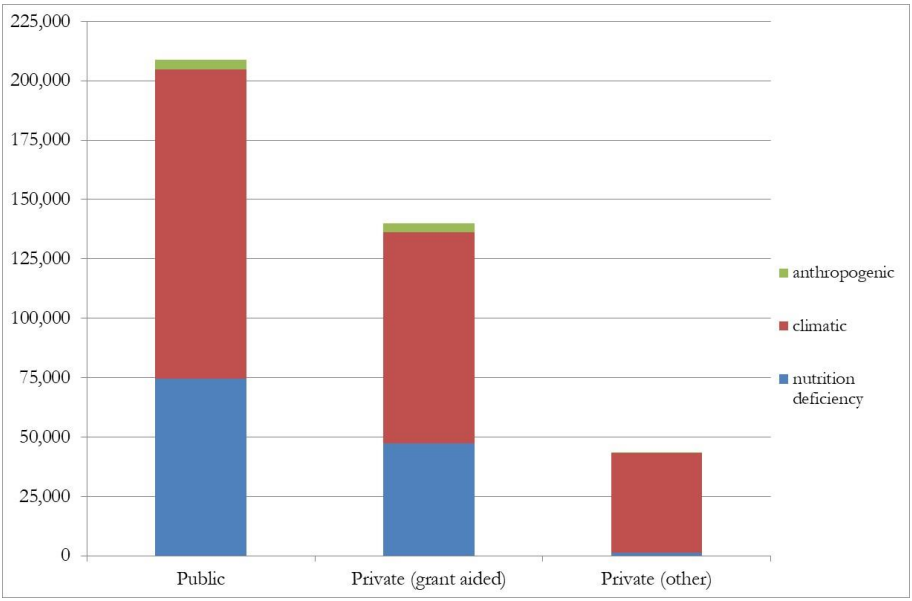


Figure 46. Overview of forest area effected by abiotic damage by ownership (ha).

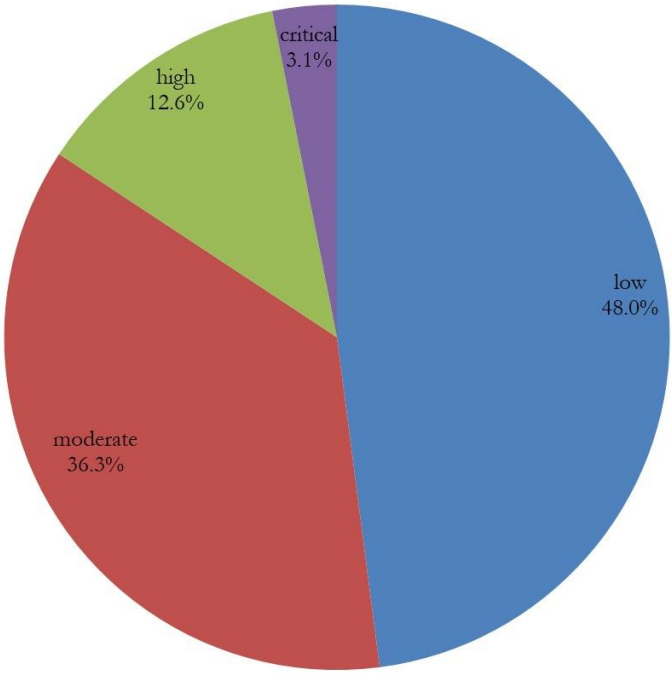


Figure 47. Severity of abiotic damage.

5.11 Diversity and Deadwood

Ireland, positioned at mid-latitudes, is warmed by the Gulf Stream and experiences a very favourable climate promoting plant growth and diversity.

5.11.1 Tree Diversity

Tree species diversity in our forests enhances the appearance of the landscape, creates wildlife habitats, protects forest health and provides a variety of timbers that can be used in a wide range of end uses.

The range of tree species in Irish forests is influenced by inherent site characteristics. Given the significant proportion (38.4%) of the national forest estate growing on peats, there are limitations on the range of tree species that can be grown.

Over three quarters (77%) of Ireland's forests have two or more tree species present (Figure 48). In terms of tree diversity, the most diverse cohort of Ireland's forests are the Private (other) category, comprising of at least four or more tree species in 60.1% of the area.

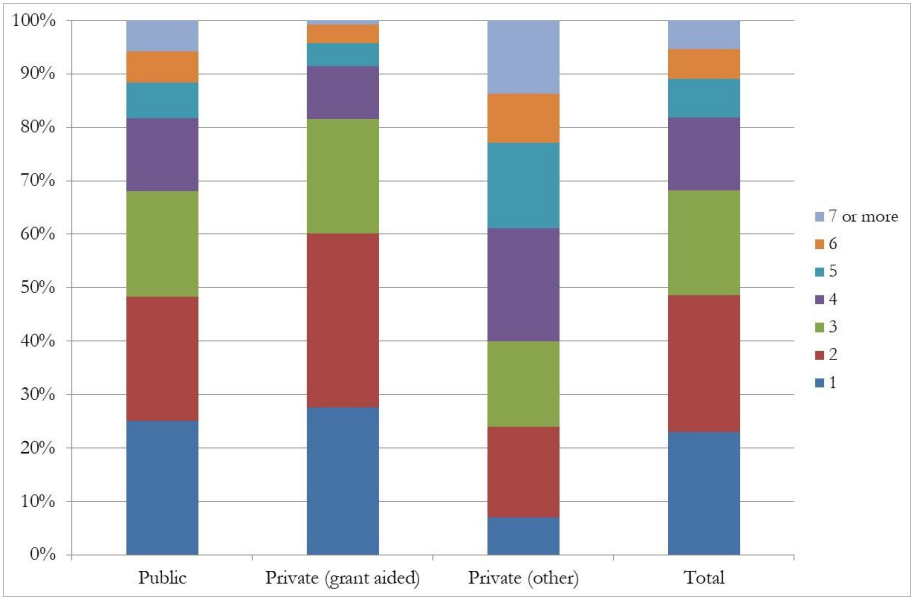


Figure 48. Proportion of the forest area by ownership and number of tree species.

5.11.2 Plant Diversity

The assessment of plant diversity is an important indicator which can be used in the monitoring of SFM. The structure and range of the vegetation present will also be indicative of the insect diversity.

Over half (59.9%) of the forest area has vegetation coverage of greater than 90%, excluding the tree species present. The Private (other) cohort contains the most diversity with 85% of the area having nearly a vegetation coverage of greater than 75% (Figure 49).

The range of plant species in Irish forests is influenced by the inherent site characteristics and the type of forest present. No plant species were found on 4.3% of the stocked forest area. The majority (86.2%) of the stocked forest has between 1 and 15 different plant species present. The remaining 9.5% has 16 or more different plant species present (Figure 50).

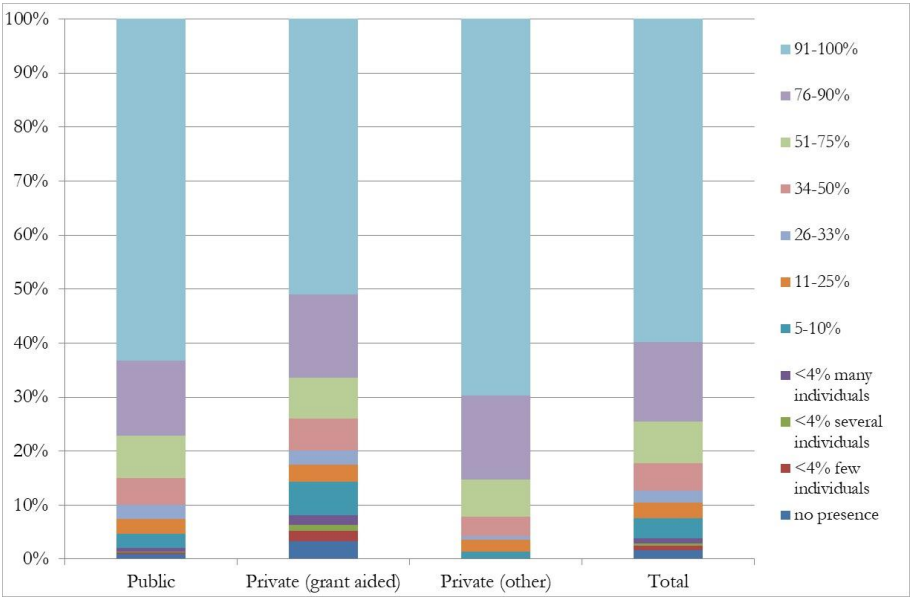


Figure 49. Proportion of the forest area by ownership and occurrence of vegetation cover.

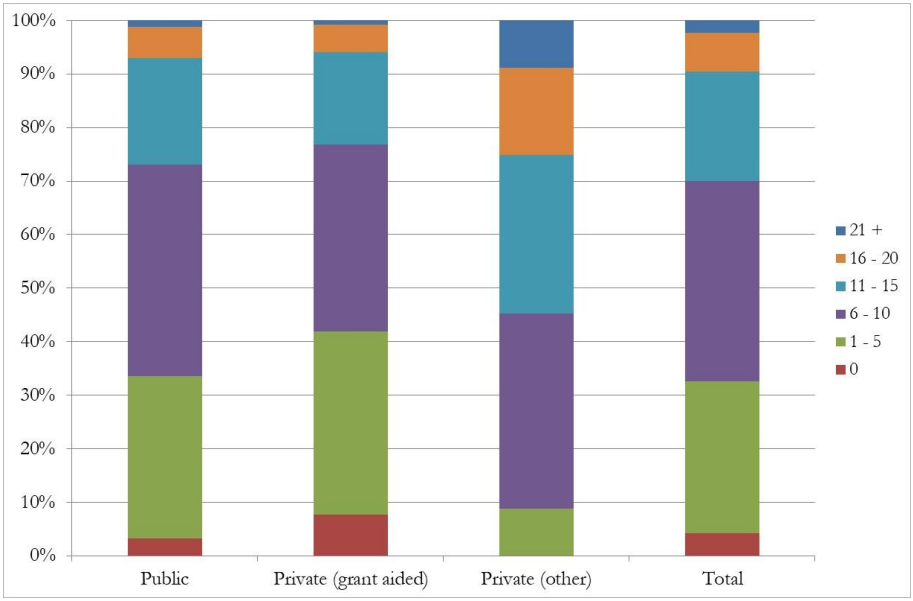


Figure 50. Proportion of forest area by ownership and number of plant species.

5.11.3 Deadwood

Large woody material contains very significant stores of carbon and energy and is the foundation of an important forest food web. This large material usually decays more slowly and therefore provides a steady input of energy and longer-lasting structures for the ecosystem. Deadwood also provides habitat for plants, animals and insects and a source of nutrients for soil development.

There are 10.2 million m^3 of deadwood in the forest estate. Stump and standing deadwood account for 77.3% of all deadwood with the remaining lying on the forest floor (Figure 51).

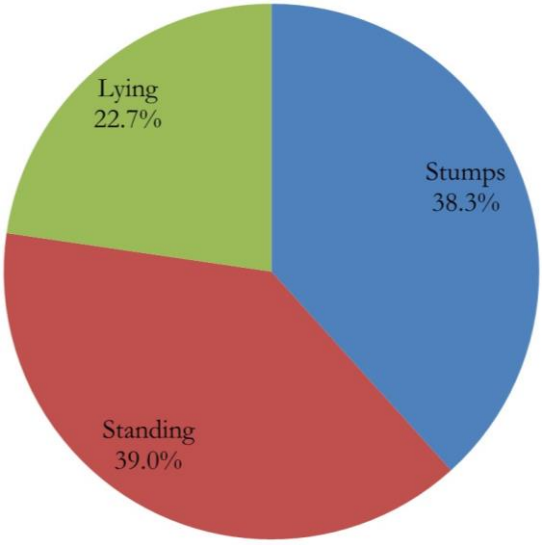


Figure 51. Proportion of deadwood volume by deadwood type.

The Public forest estate has the majority (71.8%) of the deadwood, due primarily to the relatively high level of harvesting occuring in these forests (Figure 52). As the Private (grant aided) estate is only entering the production phase, deadwood amounts are lower.

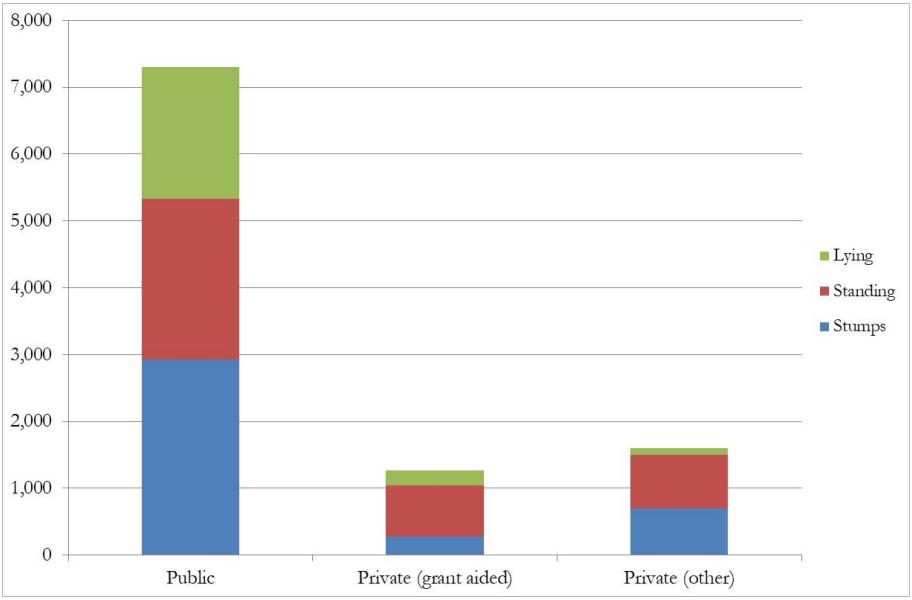


Figure 52. Total deadwood volume by ownership (1,000's m^3).

Glossary

Age	The number of growing seasons since initial planting or natural regeneration.
Afforestation	Establishment of forest through planting and/or deliberate seeding on land that, until then, was under a different land use, implies a transformation of land use form non-forest to forest.
Basal Area	The cross-sectional area of a tree measured at 1.3 m from the ground, or the sum of the basal areas of trees in a specified area, expressed in m^2.
Broadleaves	Trees with broad, flat leaves, e.g. oak, ash, beech and sycamore. Growth is not in whorls but almost always diffusely branched. Usually deciduous.
Carbon pool	A system with the capacity to accumulate or release carbon, expressed in mass units (tonnes C).
Clearfell	A continuous block of trees that have been felled.
Conifers	Trees which bear cones and have needle-like leaves. They are usually, but not always, evergreen.
Confidence Interval	The confidence interval quantifies the uncertainty in measurement by specifying the range of values within which the true value for the whole population lies. As a 95% confidence interval is used for the NFI analyses, there is a 95% probability that the true value for the population lies within the range of values.
Diameter at breast height (Dbh)	The Dbh of a tree is the stem diameter at 1.3 m from ground level.
Forest	Forest is defined as land with a minimum area of 0.1 ha, a minimum width of 20 m, trees higher than 5 m and a canopy cover of more than 20% within the forest boundary, or trees able to reach these thresholds *in situ*.
Gross Annual Volume Increment	Mean annual volume of tree increment over the period 2006-2012 of trees ≥7 cm Dbh. Includes the increment of trees which have been felled or have died during the reference period.
Growing stock volume	The overbark volume of living trees (Dbh≥7 cm) from stump to 7 cm top diameter.
High forest	A forest that has a high proportion of sawlog approaching or at normal rotation length.
Multistoried forest	Forest with trees present at various stages of development, i.e. height.
Native species	Species that have arrived and inhabited an area naturally, without deliberate assistance by man. For trees in Ireland usually taken to mean those present after post-glacial

	recolonisation and before historic times. For NFI purposes the species list of natives trees recorded is based on the list of species eligible for inclusion in Ireland's Native Woodland Scheme.
Ownership	Specifies land ownership.
Overmature forest	A forest retained beyond its normal rotation length, resulting in the presence of large trees.
Pole stage	A forest at a stage where it could be thinned or in the early stages of thinning.
Post establishment stage	A recently established forest that is not at free growing stage.
Pre-thicket stage	The forest is established, but the green branches are not yet touching.
Private (grant aided)	Private afforested land which was or is in receipt of grant and/or premium over the period 1980 to present.
Private (other)	Private forest land which was not established with grant aid since 1980. This category includes estate planting and natural succession land.
Public	Forest land owned by the Irish State e.g. Coillte, National Parks and Wildlife Service, Bord na Mona.
Semi-natural woodland	Forests established by natural regeneration, i.e. greater than 80% of the tree species regenerated naturally
Sustainable Forest Management (SFM)	Sustainable Forest Management as a central principle of Irish forest policy, whereby forests are managed to provide economic, social and environmental benefits on a sustainable basis for both current and future generations.
Small pole stage	Forest where the canopy has fully closed and the lower branches are dead.
Thicket stage	Forest where the canopy has closed but the lower branches are mainly green.
Thinning	Periodic removal of trees in a stand which are competing with those better trees which are expected to form the final crop. The object is to benefit the final crop trees, and to get income from the thinnings before they die.

Notes:

Notes:

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