

Forest Genetic Resources in Ireland

Authored by the National Consultative Committee on Forest Genetic Resources



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A report submitted by Ireland to the FAO State of the World's Forest Genetic Resources.

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Front cover: Oak (sessile) - dair (*Quercus petraea*), Ballygannon Wood, Rathdrum, Co Wicklow (planted about 1870)

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Foreword

Conserving and developing forest genetic resources is fundamental to forest policy, and in maintaining and building the comparative advantage that Ireland holds in growing wood fibre.

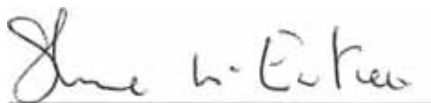
As well as providing the essential building block for the expansion of forest cover, forest genetic resources are key to the conservation and sustainable management of those small areas of native woodland that have survived to the present day. Indeed, for the national afforestation programme, native trees, such as ash and oak, are mostly sourced from selected Irish origins.

As well as the impact on the growth and development of planted forests, conservation of native forest genetic resources is of great importance in the protection of biodiversity.

This document on Ireland's forest genetic resources, compiled by officials of my Department, in collaboration with other departments and agencies, forms Ireland's input to the compilation of UN Food and Agriculture Organisation's first report on the *State of the World's Forest Genetic Resources*. The objective of the FAO report is to establish a consolidated global picture on the status and trends in forest genetic resources. The full report will be presented to the Commission on Genetic Resources for Food and Agriculture in 2013. In the meantime it is opportune to issue this document, as it provides a benchmark for the conservation and development of forest genetic resources in Ireland.

I welcome the report as it identifies priority species and those currently used and managed in Ireland, as well as providing information on the quantity of forest reproductive material traded. It provides information on *in-situ* and *ex-situ* gene conservation programmes, and an up-to-date account of the use and sustainable management of forest genetic resources.

The report also shows that there is a solid basis to forest genetic resources in Ireland, thanks in large part to the work and commitment of the Forest Service and a number of other state agencies and third-level institutions. The recent announcement of the award by this Department of €1.6 million for work on forest genetics to University College Dublin is a further indication of the commitment of government to the vital area of forest genetic resources.



Shane McEntee TD, Minister of State for Forestry

Department of Agriculture, Food and the Marine



Oak – dair (*Quercus petraea*) native oak woodland at the Glen of the Downs, Co Wicklow (winter 2012)

Section I

Executive summary

Centuries of over-exploitation and clearances for agriculture left Ireland with a forest cover of just over 1% of the total land area at the beginning of the twentieth century. A state funded afforestation programme, begun in the 1920s, has been continued to the present day. Today, after almost a century of afforestation, the forest area has increased to over 720,000 ha, more than 10% of the area of the Republic of Ireland. In the main this has been achieved through the planting of exotic conifers from north-west America, mostly on upland sites. These areas are generally not suitable for commercial broadleaved species.

By the early 1980s, there was a realisation of the need to widen the species base, as Sitka spruce (*Picea sitchensis*) constituted over 80% of the annual planting programme at that time. Policy changes resulted in a wider range of species being planted, both conifers and broadleaves, with in more recent years, greater emphasis being placed on native broadleaves such as alder, ash and oak. Broadleaves currently constitute over 36% of the annual planting programme.

At the beginning of the afforestation programme there was far less appreciation of the importance of forest genetic resources (FGR) than there is today. For example, during the 1950s and 60s large-scale planting of unsuitable inland provenances of lodgepole pine (*Pinus contorta*) occurred, which had serious financial consequences. From the late 1960s, however FGR became one of the main priorities of the national forest research programme. In addition, from the early 1970s seed stands were selected for EU scheduled species and registered in a National Catalogue of Seed Stands. Also from the late 1950s provenance trials have been established for most of the species used in the afforestation programme, resulting in the identification and use of the most suitable sources for Ireland. Tree breeding programmes have been established in Sitka spruce and for some broadleaves – birch (*Betula pubescens*), alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*) and pedunculate and sessile oak (*Quercus robur* and *Q. petraea*) (the later two in cooperation with the British and Irish Hardwood Improvement Programme). Breeding programmes were also established for pines but the programme for *Pinus contorta* has been suspended due to reduced peatland planting and the *Pinus radiata* programme was terminated due to limited suitability of the species to the Irish climate.

The Sitka spruce programme is the most advanced and has reached the second generation of improvement. Currently much of the reproductive material for the species is sourced from a Danish spruce improvement programme. However, improved material from the Irish programme is now becoming available as cuttings and seed.

Ireland is working towards self-sufficiency in reproductive material for all species. However, the cool, moist summers that generally prevail in Ireland are not conducive to abundant seed production. Good seed crops are infrequent, and while every effort is made to maximise collections and store material arising from mast years, there is still the necessity to import seed, especially for oak and Douglas fir (*Pseudotsuga menziesii*).

In Ireland, forest genetic resources are managed by a number of agencies, with the Forest Service having the main role as the regulator of the sector. Research into broadleaf breeding, mass propagation techniques and molecular studies is funded under the COFORD programme of the Department of Agriculture, Food and the Marine and is undertaken by a number of agencies including third level institutions and Teagasc, the agricultural research and advisory body. Molecular studies are also being undertaken by the universities. Coillte, the state forestry company, has a programme of conifer breeding with the emphasis on Sitka spruce. Coillte also manages a number of seed stands, seed orchards and the national seed extractory.

A national strategy has also been developed for FGR. A team of national experts has recommended that a national Advisory Group be established to guide developments in the sector. That strategy has also recommended that organisations currently involved in FGR build on their strengths and develop new skills and facilities as part of a national programme with defined objectives and targets, and that existing FGR networks be formalised and a structured programme be developed under the guidance of the Advisory Group. This proposal is currently under active consideration.

Key issues concerning the FGR sector are:

- National coordination of activities
- Need for self-sufficiency in reproductive material supply
- Increased uptake of improved material
- Continuity of long-term funding
- Continuity of succession planning of FGR expertise

This report on Ireland's FGR focuses on the historical development of the forestry sector and the role of FGR within the sector over past decades, as well more recent developments. The report was prepared by a working group representing all the main participants in the sector, using the guidelines provided by the FAO.

Section I describes Ireland's location on the north-western periphery of Europe and the prevailing climate which is very favourable for the growth of trees and woody plants. The report highlights the extent of forest cover in earlier times and documents the decline of native forest over many centuries, until the stage was reached at the beginning of the twentieth century when forest cover represented just over 1% of the land area. It highlights the development of plantation forests which have been greatly expanded since the early 1900s.

Section II describes current forests and their species composition and lists priority species. It describes the role of forests and how they are managed including native tree species. In general none of the native species are threatened, but nevertheless some have a very limited distribution and on which precise information is lacking.

The documentation of FGR is described, as well as the quantities of seed that are utilized. Recent Forest Service grant aid programmes, such as the *Native Woodland Scheme* introduced in 2001 are also described. This programme supports the protection and expansion of the native woodland resource and its associated biodiversity.

Section III forms the main body of the report. Chapter 1 provides information on Ireland's forest genetic resources and list the priority species as well as the species which are utilised and describes their management. While Ireland does not collect information on forest genetic resources as part of its national forest surveys, it has developed gene conservation strategies and programmes (including *in-situ* and *ex-situ* programmes) for specific forest tree and other woody plant species and these are described in Chapter 2 and Chapter 3 of Section III.

The seed trade between Ireland and other countries is described in Chapter 4. This chapter also describes the state of use and sustainable management of forest genetic resources.

Ireland has a national forest programme and Chapter 5 provides an overview of its development as well as research on genetic resources, and education, training and forest legislation. Chapter 6 outlines the state of regional and international agreements and Ireland's participation. In Chapter 7 access to forest genetic resources in Ireland is described, while Chapter 8 outlines their contribution to sustainability.



Mature Sitka spruce - sprús Sitka (*Picea sitchensis*) at Baunreagh, Co Laois



Birch – beith (*Betula pubescens*) indoor seed orchard at Teagasc Research Station, Kinsealy, Co Dublin

Section II

Introduction to Ireland and its forests

The Republic of Ireland occupies most of the island of Ireland, which is located in northwest Europe, between 51.5° and 55.5° latitude (north) and between 5.5° and 10.5° longitude (west). The topography comprises the central lowland area, which has a limestone bedrock overlain by glacial till, and this is surrounded by a border of coastal mountains, which vary in geology. Ireland's climate is greatly influenced by the Gulf Stream, which leads to mild year-round climatic conditions, and contributes to a long growing season and to excellent tree growing conditions. The mean daily maximum air temperatures in July, the warmest month of the year, vary from 17° C in the north, to 20° C in the south east, and in January from 2° C in the north east to 4.5° C in the south.

Mean annual rainfall is approximately 1,000 mm, varying from a low of 700 mm in the eastern part of the country around Dublin, to 1250 mm in the lowlands of the west, and to over 2,000 mm (and locally over 3,000 mm) in the mountains of Kerry, Connemara and Donegal in the west. Rainfall is distributed fairly evenly throughout the year. Generally the climate on the east coast is drier and warmer than in the west.

Wind is a persistent and influential feature of the Irish climate. There are few days without some wind. The prevailing wind direction is south-westerly, with the mean annual wind speed over the year ranging from 11.5 km/h in the north and north-west coastal regions to 7.0 km/h over inland areas. Gales are prevalent from November to March in exposed coastal areas. Wind and exposure are the limiting factor in the growth of many tree species, particularly at high elevations, and windthrow is one of the greatest abiotic risks to Irish forests.

Soil is the most important site factor influencing tree growth. Variation in forest soils is mainly as a result of the wide range of parent materials and is also influenced by climatic, ecological and topographic factors. In Ireland, an excess of precipitation over evapotranspiration over some areas of the country has resulted in podzolisation or intensive leaching of mineral soil. Where drainage is impeded it results in peat formation. This has resulted in significant areas of peatland being formed, most of which have a low nutrient status.

Being an island, Ireland is relatively free from forest insect pests and diseases.

Preliminary results from the 2011 estimate the population of the Republic of Ireland as 4.58 million, an increase of 8% since the 2006 census and the highest numbers in 150 years. A substantial factor in the population increase has been inward migration to Ireland as a consequence of a boom in the economy in the 15-year period from 1996. The overall population density in Ireland is 61 inhabitants per square km, which is low when compared with the EU average of 116. Forty percent of Ireland's population is classified as living in rural areas.

In 2006 direct employment in the wood products sector was 6,870 and when the indirect and induced impacts are derived using the employment multiplier, the wood products sector supports 12,246 jobs which is 70% more than the total employment attributed to the forestry sector alone (Ni Dhubhain et al. 2006). Forestry plays an increasingly important role in rural development not only through the diversification of farm income but also through the provision of rural based employment both of which contribute to rural stabilisation and stability. In 2010 the total employment supported by the forest sector was estimated to be 11,939 with the majority of the jobs rurally based (FORECON 2011).

The main silvicultural system in Ireland is clearfelling, followed by regeneration planting. As the broadleaf estate develops it is anticipated that increasing use will be made of shelterwood and group systems. In more recent times a small number of owners have introduced continuous cover systems but these are in their infancy.

Total roundwood production is currently 3 million m³/annum but it is projected to double by 2028 (Phillips 2011).

The processing sector in Ireland comprises nine large sawmills and three board mills. In 2009, Irish sawmills produced almost 850,000 m³ of sawn timber products, of which more than half was exported. Key export markets are the UK and France. The main products manufactured by the sawmilling sector are construction/structural timber, pallets/packaging and fencing material. The development of the indigenous timber sector has given Irish consumers a degree of self-sufficiency and displaced imports of softwood construction products.

IRISH FORESTRY – HISTORICAL BACKGROUND

As the ice sheets retreated northwards at the end of the last glacial period over 10,000 years ago, Ireland began to be colonised by vegetation, including trees which migrated from the continent. Ash (*Fraxinus excelsior*) and elm (*Ulmus glabra*) migrated from Britain, while oak (*Quercus*), alder (*Alnus glutinosa*) and Scots pine (*Pinus sylvestris*) are thought to have come across a land-bridge from France. Between 7,500 and 5,000 years ago, woodland is considered to have covered

approximately 80% of the land surface of the country (Joyce et al. 1998). Towards the end of this period Neolithic farmers began a limited clearance. As the population increased during the Bronze Age, pressure from agriculture intensified and became more widespread. The popular belief that Ireland still had substantial areas of ancient woodland at the beginning of the 17th century is subject to controversy. In the latter half of the eighteenth century efforts to restore Irish woodland cover commenced, but by the beginning of the twentieth century the area of woodland had declined to about 1% of the land area.

Concern about the parlous state of Irish forests at the beginning of the twentieth century led to the establishment of a Committee of Inquiry in 1908. Some of its main recommendations included greater state involvement in afforestation and the use of *quicker-growing varieties of coniferous timber*. This set the scene for the establishment of conifer forests, which today are a feature of the uplands. Because of the success of exotic conifers from the Pacific Northwest of North America, several of those species are now a common feature of Irish forests and many are considered naturalised. During this period, broadleaves played a minor role in the afforestation programme and were confined mainly to remnants of once extensive natural and semi-natural woodlands.

A Research Branch was established in the Forestry Division of the Department of Lands in 1957. It included a Tree Improvement Section. Studies were conducted to determine the most suitable provenances, particularly those from the Pacific Northwest. In 1996 *Growing for the Future – a Strategic Plan for the Development of the Forestry Sector in Ireland* was published, which had as its overall aim: “To develop forestry to a scale and in a manner which maximises its contribution to national economic and social well-being on a sustainable basis and which is compatible with the protection of the environment” (Forest Service 1996). To achieve its aims, the plan proposed afforestation levels of 25,000 ha per annum until 2000 and 20,000 ha per annum thereafter until 2030, resulting in a projected increase of the forest estate to 1.2 million ha, or 17% of the land area of the country.

However, the targets were not fully achieved due to a combination of factors including exceptionally high land prices and a high demand for agricultural commodities. Nevertheless, since the mid 1990s conversion to forest has increased substantially and some 8,000 ha per annum has been planted on average. Planting has been mainly by farmers and it is subsidised by the State.

Approximately 18,000 farmers now own forest in Ireland, with an average size of 10 ha. In the public sector there are approximately 5,500 forest properties of varying sizes in the Coillte (state forestry company) estate.

While coniferous still play a major part in afforestation and reforestation programmes, there has been a substantial and sustained broadleaf planting programme over the last decade. Table 1 lists the main forest origin types and their area.

Table 1: Ireland - forest origin types and area.

Main forest types	Area ha
Primary forest	–
Semi-natural and planted forest	5,736
Naturally regenerated forest	–
Planted forest – afforestation	731,406

(Adapted from Forest Service 2010 and O'Sullivan 1999)

Up to the late 1980s, Ireland's forests were predominantly state-owned and comprised of planted conifers but this there has been substantial change in recent years, with a large increase in private sector planting. The current state of forest ownership in Ireland is shown in Table 2.

Table 2: Ireland -forest ownership and area.

Forest ownership	Area ha
Public	400,334
Private	337,126
Total	737,460

(Adapted from the National Forest Inventory 2007 and Forest Service 2010)

Most forests and processing facilities are Irish-owned.

Recreational use of forests, both public and private has grown substantially in Ireland, with growing demands for greater access to outdoor areas as Irish society becomes more urbanised. The use of forests for the provision of public goods has also increased as a result EU and international and agreements and Directives.



Scots pine – péinne Albanach (*Pinus sylvestris*), Laragh, Co Wicklow (planted in mid 19th century), photographed 2008 (photo courtesy of Dr Michael Carey)



Beech - feá (*Fagus sylvatica*) at Kilbora Co Wexford. Planted in mid 1930's with larch

Section III

The current state of Ireland's forest genetic resources

Chapter 1: Irish forest genetic resources

At the commencement of the afforestation programme, in the early part of the twentieth century, little attention was paid to Ireland's forest genetic resources. For many years forest reproductive material was purchased on a tender basis and was sourced from outside of Ireland. However, from the late 1950s seed source trials were established to test the suitability of material for Irish conditions. These national and international provenance trials clearly demonstrated the importance of seed origin and as a result, this area received much greater attention. At around this time Ireland also attained membership of the European Union, resulting in the introduction of new rules and regulations governing forest reproductive material. Later, in 2000, COFORD (the National Council for Forest Research and Development) issued a *Discussion paper towards a strategy for gene conservation and tree improvement of broadleaved and indigenous coniferous species on the island of Ireland* (Fennessy et al. 2000) which highlighted issues such as the genetic conservation of indigenous tree species and provided a simple strategic action on how this might be achieved. This was followed by a report (Cahalane et al. 2007) on Ireland's forest genetic resources which outlined a strategy for the development of forest genetic resources in Ireland. It comprised an evaluation of historical developments, together with a review of the current national situation, and concluded by making recommendations for the future development of the sector. It also presented a framework to work towards attaining self-sufficiency in forest reproductive material, and made suggestions on how to develop well adapted, high quality reproductive material to meet current and future needs of the forestry sector, taking into account future climate change scenarios.

Awareness of gene conservation and management issues has increased in Ireland over the past 10 years. This is mainly due to participation in pan-European and other international initiatives such as the European Forest Genetic Resources Network (EUFORGEN). In 1996 a National Advisory Committee for Genetic Resources was established by the Department of Agriculture, which in more recent times has been extended to include the forest sector. The committee allocates funds on an annual basis to specific genetic conservation projects. Recently a number of forestry projects have been supported by this initiative. Other factors contributing to increased awareness include the need to undertake assessment of Irish forest genetic resources as highlighted in the COFORD report and publication referred to earlier.

Table 3 lists the main forest types in Ireland and the associated tree species. It also broadly defines the major forest types.

Table 3: Major forest type categories in Ireland and the main tree species.

Main forest type	Area covered by forest type	Main tree species
Commercial forests are dominated by exotic coniferous. Native forests are dominated by broadleaf species such as oak and ash. Woodland types are influenced mainly by wet Atlantic climate and include upland and lowland oak woods, oak-ash-hazel woods, yew woods, willow and alder wet woodlands and birch woods	Area of different types in semi-natural woodland is unknown. The most dominant woodland types are ash and oak woods.	The main commercial species are coniferous (particularly <i>Picea sitchensis</i>). The main species in native woodlands tend to be broadleaves such as, <i>Quercus petraea</i> , <i>Q. robur</i> , <i>Fraxinus excelsior</i> , <i>Betula pendula</i> and <i>B. pubescens</i> . The main species found in riparian woodlands include <i>Alnus glutinosa</i> and <i>Salix spp.</i> Two notable native conifers are <i>Juniperus communis</i> and <i>Taxus baccata</i> .

The Forest Service has estimated that there are 85,000 ha of woodland with a canopy consisting of >80% native species, including hazel and willow scrub, representing 1.25% of the land surface of the country. Much of this area has been planted over the past two decades, with most being established using imported plant material. In addition, there are 36,000 ha of mixed conifers and native tree species, in which the latter constitute between 20-80% of the cover, so that the total area under native species is considerably higher than 85,000 ha. This represents an increase of c. 50,000 ha since 1996, largely as a result of the afforestation and Native Woodland schemes, forest expansion through agricultural abandonment, scrub developing into forest. The species forming these types, plus associated trees and shrubs, would all have high importance for biodiversity/conservation. These are the principal species in terms of abundance and frequency and are the main elements in the woodland types (i.e. canopy, shrub layer).

1.1 PRIORITY FOREST TREE SPECIES AND OTHER WOODY PLANT SPECIES IN IRELAND

Due to the almost complete destruction of the Irish forest resource since the first arrival of man on the island, the re-establishment of Ireland's forest resource was prioritised as discussed earlier, through an afforestation programme which began at the start of the twentieth century. Since the beginning of this process, heavy reliance has been placed on the use of exotic conifers from the Pacific Northwest, which are particularly well adapted to the soils and climate of Ireland. The productivity of these species far surpasses that of native species (mainly broadleaves), to such an extent that the planting of the latter only amounted to less than 5% of the annual planting programme in the period up to the 1980s. While this situation has changed radically in recent years in order to diversify the overall species composition of the forest estate, Ireland's managed forests are still dominated by exotic conifers and are likely to remain so for the future.

Table 4 lists the priority Irish forest tree and other woody species and the reason (economic, social or cultural importance as well as threatened or in a few cases invasive which are prioritised for removal).

Table 4: Priority forest and woody species in Ireland.

Scientific name	Tree (T) or other (O)	Native (N) or exotic (E)	Reasons for priority
<i>Alnus glutinosa</i>	T	N	Economic/social/cultural
<i>Betula pendula</i>	T	N	Economic/social/cultural
<i>Betula pubescens</i>	T	N	Economic/social/cultural
<i>Corylus avellana</i>	T	N	Social/cultural
<i>Crataegus monogyna</i>	T	N	Social/cultural
<i>Fraxinus excelsior</i>	T	N	Economic/social/cultural
<i>Ilex aquifolium</i>	T	N	Social/cultural
<i>Picea abies</i>	T	E	Economic
<i>Picea sitchensis</i>	T	E	Economic
<i>Pinus contorta</i>	T	E	Economic
<i>Prunus laurocerasus</i>	O	E	Invasive
<i>Pseudotsuga menziesii</i>	T	E	Economic
<i>Quercus petraea</i>	T	N	Economic/social/cultural
<i>Quercus robur</i>	T	N	Economic/social/cultural
<i>Rhododendron ponticum</i>	O	E	Invasive
<i>Sorbus aucuparia</i>	T	N	Social/cultural

Genetic studies (provenance trials) have identified the most suitable sources for most conifer species as well as many of the broadleaf species. Seed purchases for all exotic material have been focused on obtaining best adapted reproductive material from the species natural range for the annual planting programme. Today, substantial mature plantation areas already exist for most species and the best of these are designated and registered as seed stands. A modern seed extractory and seed storage facility is ensuring that seed from these stands is being used in the current afforestation and reforestation programmes.

As seed acquisitions have been made over a considerable period and from many different sources, there is a wide range of genetic variation within Irish populations, particularly lodgepole pine and Sitka spruce. example There are a number of risks to the continuing availability of good genetic material, particularly so with exotic species where factors such as logging, fire and disease can destroy proven stands at their source.

There is always the risk in Ireland of losing particularly good stands to windthrow; though retaining stands beyond a certain top height puts them at serious risk.

Also, Ireland's climate is not conducive to prolific seed production due to cool, wet summers. Stands designated and managed for seed production can often not produce seed in commercially collectable quantities which can result in the loss of that particular reproductive material.

Disease has been a major threat to genetic diversity of elm, with the almost complete disappearance of mature trees. However it is re-emerging in hedgerows and locally in the shrub layer due to vegetative sprouting. Currently Japanese larch *Larix kaempferi* is under threat from *Phytophthora ramorum*.

In general, apart from diseases specific to a very small number of species, there are no major perceived threats to the genetic diversity of forest reproductive material of the main economic species in Ireland. In fact the increased planting of

native broadleaf species and the interest in continuous cover silvicultural systems using natural regeneration is likely to have a positive effect on the genetic diversity of the forest estate.

1.2 TREE AND OTHER FOREST SPECIES MANAGED FOR HUMAN UTILIZATION IN IRELAND

The main forest tree species which are managed for human utilization in Ireland are set out in Table 5. The main aim is commercial roundwood production, much of which is converted into sawn timber and particle board for use in building construction and to a much lesser extent in joinery. Forest-based biomass, sourced directly from the forest or as residues from wood processing is being increasingly used for energy provision.

Table 5: Forest species currently used and managed in Ireland (not in order of priority).

Species/ (scientific name)	Native (N) or Exotic (E)	Current use (code)	Management system	Area managed ha
Alder (<i>Alnus glutinosa</i>)	N	1; 3	Plantation/natural	11,500
Ash (<i>Fraxinus excelsior</i>)	N	1; 3; 6 (sports goods)	Plantation/natural	19,200
Beech (<i>Fagus sylvatica</i>)	E	1; 3	Plantation	8,710
Downy birch (<i>Betula pubescens</i>)	N	1; 3	Plantation/natural	15,490
Pedunculate oak (<i>Quercus robur</i>)	N	1; 3	Plantation/natural	7,300
Sessile oak (<i>Quercus petraea</i>)	N	1; 3	Plantation/natural	7,340
Silver birch (<i>Betula pendula</i>)	N	1; 3	Plantation/natural	14,200
Sycamore (<i>Acer pseudoplatanus</i>)	N	1; 3	Plantation	8,060
Other broadleaves	N/E	1; 2; 3	Plantation/natural	60,150
Douglas fir (<i>Pseudotsuga menziesii</i>)	E	1	Plantation	10,200
Larches (<i>Larix spp</i>)	E	1	Plantation	22,960
Lodgepole pine (<i>Pinus contorta</i>)	E	1; 2; 3	Plantation	63,120
Noble fir (<i>Abies procera</i>)	E	1; 4	Plantation	2,600
Norway spruce (<i>Picea abies</i>)	E	1; 2; 3	Plantation	25,960
Scots pine (<i>Pinus sylvestris</i>)	N	1; 2; 3	Plantation	7,340
Sitka spruce (<i>Picea sitchensis</i>)	E	1; 2; 3	Plantation	327,830
Other conifers	E	1; 3	Plantation	2,570

Categories = (1) Solid wood products; (2) Pulp and paper; (3) Forest-based biomass; (4) Non-wood forest products; (5) Used in agroforestry systems and (6) Other.

1.3 MAIN TREE AND OTHER WOODY SPECIES MANAGED FOR ENVIRONMENTAL SERVICES

Table 6: Main tree and other woody forest species providing environmental services or social values in Ireland.

Species (scientific name)	Native (N) or Exotic (E)	Environmental service or social value
Alder (<i>Alnus glutinosa</i>)	N	2, 3
Ash (<i>Fraxinus excelsior</i>)	N	3, 4
Beech (<i>Fagus sylvatica</i>)	E	2
Caucasian fir (<i>Abies nordmanniana</i>)	E	4
Common osier (<i>Salix viminalis</i>)	E	1
Crab apple (<i>Malus sylvestris</i>)	N	4
Downy birch (<i>Betula pubescens</i>)	N	1, 3, 5
Hawthorn (<i>Crataegus monogyna</i>)	N	4, 6
Hazel (<i>Corylus avellana</i>)	N	3
Holly (<i>Ilex aquifolium</i>)	N	3, 4, 6
Noble fir (<i>Abies procera</i>)	E	4
Pedunculate oak (<i>Quercus robur</i>)	N	3
Plane (<i>Platanus acerifolia</i>)	E	5
Purging buckthorn (<i>Rhamnus cathartica</i>)	N	3
Silver birch (<i>Betula pendula</i>)	N	1, 3, 5
Scots pine (<i>Pinus sylvestris</i>)	N	3, 5
Sessile oak (<i>Quercus petraea</i>)	N	3, 4
Sitka spruce (<i>Picea sitchensis</i>)	E	7 (climate change mitigation)
Strawberry tree (<i>Arbutus unedo</i>)	N	3
Wild cherry (<i>Prunus avium</i>)	N	3, 5
Yew (<i>Taxus baccata</i>)	N	3, 6

Services and values include:

- 1 Soil and water conservation including watershed management
- 2 Soil fertility
- 3 Biodiversity conservation
- 4 Cultural values
- 5 Aesthetic values
- 6 Religious values
- 7 Other (as specified)

1.4 FOREST TREE AND OTHER WOODY PLANT SPECIES ENDEMIC TO IRELAND

Chambers Biology Dictionary (1990) defines endemic as “Said of a species or family confined to a particular region”. Chambers’ understanding of endemic is used in this report. The forest tree species endemic to Ireland is shown in Table 7.

Table 7: Forest tree and other woody species endemic to Ireland.

Species	Species scientific name	Native or exotic
Whitebeam*	<i>Sorbus hibernica</i>	Native

*Irish whitebeam (*Sorbus hibernica*) is endemic to Ireland and has a widespread but localized distribution.

1.5 TREE AND OTHER WOODY FOREST SPECIES THREATENED IN IRELAND

No tree species or woody forest species has been identified as being threatened or placed on a red list in Ireland. Of the native species, only black poplar (*Populus nigra*) may be under some threat. A number of species have restricted distributions and limited populations, such as tea-leaved willow (*Salix phylicifolia*), buckthorn (*Rhamnus cathartica*) and alder buckthorn (*Frangula alnus*). Other species are important components of EU Annexed habitats, which are protected under the Habitats Directive (for example, oak species and yew). Black poplar has been shown to have a restricted genetic diversity in Ireland (Keary et al. 2005).

1.6 ASSESSMENT OF THREATENED SPECIES IN IRELAND

The status and assessment of threatened species in Ireland is ongoing. Responsibility for this task rests with the Department of the Environment, Community and Rural Affairs, which reports on a regular basis on threatened species to the EU.

1.7 TREE SPECIES WITH INSUFFICIENT INFORMATION TO DETERMINE STATUS OF GENETIC DIVERSITY

There is insufficient information available on the genetic diversity of tea-leaved willow (*Salix phylicifolia*) in order to determine its status from a conservation viewpoint.

1.8 SYSTEM IN IRELAND FOR DOCUMENTING FOREST REPRODUCTIVE MATERIAL

On joining the European Union in 1973, Ireland implemented Council Directives 66/404/EEC on the marketing of forest reproductive material and 71/161/EEC on external quality standards for forest reproductive material marketed within the community. The latter also sets out requirements relating to genetic characters and external quality to be met before reproductive material may be marketed in the Community. This legislation has been substantially amended since the 1970s; from January 1 2003, Council Directive 1999/105 EC on the marketing of forest reproductive material repealed and replaced the two earlier Directives. This new Directive was transposed into Irish law under SI 618/2002 European Communities (Marketing of Forest Reproductive Material) Regulation 2002.

1.9 CURRENT STATE OF FOREST REPRODUCTIVE MATERIAL IDENTIFICATION AND UTILIZATION

In Ireland, afforestation is the predominant method of forest establishment, most of it on former agricultural land. Regeneration following clearfelling is almost always by planting. The country is classified as one region of provenance. Forest reproductive material is identified and utilized according to the regulations as prescribed by EU Council Directive 1999/105/EC. Table 8 shows the annual number of seedlings (transplants) planted, together with the number of vegetative propagules from a tree improvement programme in Sitka spruce, the only species for which such material is available. Limited quantities of improved birch seed have become available for the first time in 2010.

Table 8: Annual number of seedlings (or vegetative propagules¹) planted and the state of identification of the reproductive material used for the main forest tree and other woody species in Ireland.

Species scientific name	Native (N) or Exotic (E)	Seedlings planted	Seedlings from documented sources (provenance/seed zones delimited)	Quantity of seedlings from tested provenances (seed stands) (provenance trials established and evaluated)	Quantity that is genetically improved (from seed orchards)
000,000					
<i>Picea sitchensis</i>	N	19.00		3.50	14.00
<i>Pinus contorta</i>	N	2.30		2.30	
<i>Pinus sylvestris</i>	E	1.00			1.00
<i>Larix spp</i>	E	3.50		3.00	0.50
<i>Pseudotsuga menziesii</i>	E	0.20	0.20		
<i>Picea abies</i>	N			2.00	0.80
<i>Pinus radiata</i>	N	0.05		0.05	
<i>Thuja plicata</i>	N	0.03	0.03		
<i>Abies procera</i>	N	0.08	0.04	0.04	
<i>Tsuga heterophylla</i>	N	0.02	0.02		
<i>Abies nordmanniana</i>	E	0.20	0.20		
<i>Quercus species</i>	N	2.00		2.00	
<i>Fraxinus excelsior</i>	E	1.50	1.50		
<i>Acer pseudoplatanus</i>	N	0.15	0.15		
<i>Prunus avium</i>	N	0.01		0.01	
<i>Betula</i>	N	1.50	1.50		
<i>Alnus glutinosa</i>	N	2.80	2.80		
<i>Alnus cordata</i>	E	0.01	0.01		
<i>Alnus rubra</i>	N	0.01	0.01		
<i>Alnus incana</i>	N	0.04	0.04		
<i>Yew (Taxus baccata)</i>	N		0.30		
<i>Fagus sylvatica</i>	E	0.60	0.30	0.30	
<i>Prunus spinosa</i>	N	0.01	0.01		
<i>Crataegus monogyna</i>	N	1.20	1.20		
<i>Corylus avellana</i>	N	0.05	0.05		
<i>Sorbus aucuparia</i>	N	0.40	0.40		
<i>Ilex aquifolium</i>	N	0.04	0.04		
<i>Eucalyptus spp.</i>	E	0.40	0.40		
<i>Acer pseudoplatanus</i>	E	0.03	0.03		

¹ *Picea sitchensis* is the only species where vegetatively propagated material from a tree improvement programme is used; approximately 1.5 million plants are produced annually.

1.10 CURRENT STATE OF GENETIC CHARACTERISATION OF FOREST TREE AND WOODY PLANT SPECIES

The current state of genetic characterization of the main forest tree and other woody plant species in Ireland is presented in Table 9.

Table 9: Forest species for which genetic variability has been evaluated in Ireland.

Species		Morphological traits	Adaptive and production characters assessed	Molecular characterisation
Scientific name	Native (N) or exotic (E)			
<i>Abies amabilis</i>	E		+	
<i>Abies procera</i>	E		+	
<i>Acer pseudoplatanus</i>	E			
<i>Alnus glutinosa</i>	N			
<i>Betula spp</i>	N		+	
<i>Castanea sativa</i>	E			
<i>Cryptomeria japonica</i>	E		+	
<i>Fraxinus excelsior</i>	N	+	+	+
<i>Larix spp</i>	E		+	
<i>Nothofagus procera</i>	E		+	
<i>Picea abies</i>	E		+	
<i>Picea sitchensis</i>	E		+	
<i>Pinus contorta</i>	E		+	
<i>Pinus radiata</i>	E		+	
<i>Pinus sylvestris</i>	N		+	
<i>Populus nigra</i>	N			+
<i>Prunus avium</i>	N			
<i>Pseudotsuga menziesii</i>	E		+	
<i>Quercus petraea</i>	N	+	+	+
<i>Quercus robur</i>	N	+	+	+
<i>Thuja plicata</i>	E		+	
<i>Tsuga heterophylla</i>	E		+	

1.11 COLLECTION OF INFORMATION ON FOREST GENETIC RESOURCES IN NATIONAL SURVEYS

The first National Forest Inventory (NFI) was undertaken during the period 2004 to 2006 and was reported on in 2007. It did not collect specific information on forest genetic resources other than species composition.

1.12 GENETIC CONSERVATION STRATEGIES FOR FOREST TREES AND WOODY PLANTS

Chapter 2 – The State of *In-situ* Genetic Conservation in Ireland - lists forest species for which a gene conservation strategy has been developed in Ireland.

Future needs and priorities

Prior to 1989 most work on forest genetic resources was undertaken by the Forest and Wildlife Service. Due to reorganisation, this work is now spread across several agencies. As a result, a comprehensive national strategy, with a set of focused objectives and goals, together with a programme to support and implement it, is needed to co-ordinate and promote ongoing work. The COFORD Strategy (2007) is an important milestone in this development but the findings have still to be implemented. It is essential that they are so as to safeguard genetic resources of native and introduced forest tree species and develop them in a sustainable way.

Funding for existing work on forest genetic resources is provided through research grants from the EC and the national CoFoRD programme, and through development support for nurseries and seed collection provided by Forest Sector Development Division of the Department of Agriculture, Food and the Marine.

As stated, information on forest genetic resources is not collected as part of national forest surveys but genetic conservation programmes have been developed for specific forest trees, details of which are presented below.



Pedunculate oak – dair (*Quercus robur*) seed stand, planted in 1935, at Kilcooly, Co Tipperary

Chapter 2: The state of *in-situ* genetic conservation in Ireland

Ireland has commenced collection of some information on forest genetic resources as part of its national forest surveys. It is intended that gene conservation strategies and programmes (including *in-situ* and *ex-situ*) for specific forest tree and other woody plants species will be further developed. Table 10 below lists those species for which there is a gene conservation strategy. There are also a number of government initiatives to encourage expansion or establishment of native broadleaf woodland, for example the Native Woodland Scheme. The Native Woodland Scheme is aimed at encouraging the proactive protection and expansion of Ireland's native woodland resource and associated biodiversity, using appropriate close-to-nature silviculture. The gene conservation element in this scheme is secured through the use of native planting stock.

Table 10: Forest species for which a gene conservation strategy has been developed in Ireland.

Species scientific name	Common name
<i>Acer pseudoplatanus</i>	Sycamore
<i>Alnus glutinosa</i>	Alder
<i>Betula</i> spp.	Birch
<i>Castanea sativa</i>	Spanish chestnut
<i>Fraxinus excelsior</i>	Ash
<i>Picea sitchensis</i>	Sitka spruce
<i>Pinus contorta</i>	Lodgepole pine
<i>Pinus sylvestris</i>	Scots pine
<i>Prunus avium</i>	Cherry
<i>Quercus</i> spp.	Oak
<i>Thuja plicata</i>	Western red cedar

2.1 GENETIC CONSERVATION OF FOREST TREE AND OTHER WOODY PLANT SPECIES IN PROTECTED AREAS

Of the estimated 85,000 ha of native woodland (Chapter 1), not more than 6,000 ha are legally protected for conservation in National Parks and Nature Reserves (O'Sullivan 1999). Some 2,628 ha are protected within 32 nature reserves and 2,854 ha within national parks. A further 6,468 ha are designated as Special Areas of Conservation (SACs) under EU legislation and 23,784 ha are proposed as National Heritage Areas (NHAs) under national legislation. (The areas overlap and the figures are not cumulative.)

A limited number of studies have been undertaken on sites containing some of the main species including oak (species, ash and black poplar, including populations in protected areas. The results have provided information on population (including provenance) differences in genetic traits and genetic diversity. However, decisions have not been made as to how genetic diversity should be preserved, such as wild population sizes, connectivity of populations and designation of areas in different genecological zones of the country. Such decisions are necessary to support the development of FGR in individual species.

2.2 NATIVE TREES AND OTHER WOODY SPECIES CONSERVED IN *IN-SITU* PROGRAMMES

All broadleaf species are conserved *in-situ* in National Parks, SACs and NHAs, as well as those selected and registered as seed stands and listed in the national catalogue of seed stands.

The main constraints to improving *in-situ* genetic conservation programmes in Ireland are outlined below and include

- (1) lack of information on species, particularly minor species,
- (2) limited public interest in conservation programmes and
- (3) lack of sufficient resources to undertake this task.

2.3 *IN-SITU* CONSERVATION OF FOREST GENETIC RESOURCES IN IRELAND

Ireland participated in the EUFGIS project (Establishment of a European Information System on Forest Genetic Resources – April 2007 to September 2010 (<http://www.eufgis.org>), which was implemented in collaboration with the European Forest Genetic Resources Programme (EUFORGEN). EUFGIS involved the creation of an online information system and a documentation platform for forest genetic resources (FGR) inventories in Europe. While EUFGIS is not itself a programme for *in-situ* gene conservation of forest genetic resources it will support participating countries in their efforts to implement

forest tree gene conservation as part of sustainable forest management. After September 2010, the EUFGIS information system is to be maintained and further developed as part of EUFORGEN. Table 10 provides information on the Irish stands provisionally entered on the EUFGIS portal to date.

Table 10: Target forest species included *in-situ* conservation programmes in Ireland.

Species (scientific name)	Purpose of establishing conservation unit	Number of populations or stands conserved	Area ha
<i>Quercus petraea</i>	Conservation	10	386.8
<i>Quercus robur</i>	Conservation	4	246.2

2.4 CONSTRAINTS FOR IMPROVING *IN-SITU* CONSERVATION PROGRAMMES

In Ireland the main constraints to improving *in-situ* conservation programmes are resources, both human and financial.

2.5 PRIORITIES FOR *IN-SITU* CONSERVATION PROGRAMMES

The National Strategy for Plant Conservation sets out a programme for plant conservation in response to the Global Strategy for Plant Conservation (GSPC), which was adopted by the Convention on Biological Diversity in 2002.

2.6 OTHER RELEVANT INFORMATION ON *IN-SITU* CONSERVATION

In a recent call for forest research proposals issued by the Department of Agriculture, Food and the Marine under the COFORD programme the sectoral needs element highlighted a requirement for “Developing a National Gene Conservation Strategy for native and non-native forest trees of importance”. The call focused on:

- A critical review of the genetic resources of forest tree species already existing in the country from a gene conservation perspective;
- Prioritising tree species for conservation, identifying the rationale for their conservation, developing appropriate methods for their conservation – *in-situ*, *ex-situ* etc.;
- Identifying any infrastructure gaps;
- Making practical recommendations of how the strategy could be implemented within the existing national forest genetic resources infrastructure.

As a result of the call a number of proposals were received and a new project covering this area has recently been selected for funding.



Birch – beith (*Betula species*), clone bank at Kilmacurra, Co Wicklow (2010)



Ash – fuinnseog (*Fraxinus excelsior*) clone bank (2000) at Kilmacurra, Co Wicklow

Chapter 3: The state of *ex-situ* genetic conservation in Ireland

3.1 TARGET FOREST SPECIES INCLUDED IN *EX-SITU* CONSERVATION PROGRAMMES

Ireland has an active programme of *ex-situ* conservation as outlined in Table 11, which lists Ireland's target forest species, as well as information on species and materials in germplasm collections.

Table 11: *Ex-situ* forest species gene conservation in Ireland.

Species		Field Collection				Germplasm banks			
Species (scientific name)	Native (N) or exotic (E)	Collection, provenance or progeny tests, arboreta or conservation stands		Clone banks		In vitro, including cryo-conservation		Seed banks	
		No. of stands	No. of accessions	No. of banks	No. of clones	No. of banks	No. of clones	No. of banks	No. of clones
<i>Abies amabilis</i>	E	2	13	-	-	-	-	-	-
<i>Abies procera</i>	E	3	15	-	-	-	-	-	-
<i>Acer pseudoplatanus</i>	N	1	1	2	173	-	-	-	-
<i>Alnus glutinosa</i>	N	3	85	1	1	1	-	-	-
<i>Betula spp</i>	N	1	44	1	27	1	-	-	-
<i>Castanea sativa</i>	N	-	-	1	55	-	-	-	-
<i>Cryptomeria japonica</i>	E	2	10	-	-	-	-	-	-
<i>Fagus sylvatica</i>	E	1	34	-	-	-	-	-	-
<i>Fraxinus excelsior</i>	N	1	48	3	279	-	-	-	-
<i>Larix spp</i>	E	1	29	-	-	-	-	-	-
<i>Nothofagus procera</i>	E	1	6	-	-	-	-	-	-
<i>Picea abies</i>	E	2	2	-	-	-	-	-	-
<i>Picea sitchensis</i>	E	52	619	3	562	1	100	1	75
<i>Pinus contorta</i>	E	12	178	3	58	-	-	-	-
<i>Pinus muricata</i>	E	1	14	-	-	-	-	-	-
<i>Pinus radiata</i>	E	2	15	-	-	-	-	-	-
<i>Pinus sylvestris</i>	N	2	2	3	97	-	-	-	-
<i>Prunus avium</i>	E	-	4	2	88	-	-	-	-
<i>Pseudotsuga menziesii</i>	E	4	52	-	-	-	-	-	-
<i>Quercus spp</i>	N	5	57	2	140	-	-	-	-
<i>Thuja plicata</i>	E	-	-	2	126	-	-	-	-
<i>Tsuga heterophylla</i>	E	1	16	-	-	-	-	-	-

3.2 CONSTRAINTS TO IMPROVING *EX-SITU* CONSERVATION

The main constraints to improving *ex-situ* conservation in Ireland are a lack of resources and a committed continuing national long-term support for such a programme.

3.3 PRIORITIES FOR FUTURE *EX-SITU* CONSERVATION ACTIONS

As outlined, a considerable amount of work has been undertaken in Ireland in *ex-situ* conservation work. In the recent call for forest research proposals under the COFORD programme Forest Genetic Resources Call - 2010, priority was given to developing a national gene conservation strategy for native and non-native forest trees of importance. This programme will focus on, *inter alia*, a prioritising of tree species for conservation, including identifying the rationale for their conservation and making recommendations for appropriate methods for their conservation – *in situ*, *ex situ* etc. This programme will also

help in identifying infrastructure gaps which need to be addressed and examine ways for making practical recommendations of how the strategy could be implemented within the existing national forest genetic resources infrastructure.

3.4 OTHER RELEVANT INFORMATION ON *EX-SITU* CONSERVATION

As in Section 2 (*in-situ* information) the recent call for forest research proposals under the COFORD programme, the sectoral needs element highlighted a requirement for “Developing a National Gene Conservation Strategy for native and non-native forest trees of importance” with the elements as indicated in Section 2.6



Alder – fearnóg (*Alnus glutinosa*), young stand at Shelton, Co Wicklow marked for thinning (2008)



Douglas fir – giúis Douglas (*Pseudotsuga menziesii*) at Powerscourt, Co Wicklow, where trees reach well over 50 m in height and include the tallest tree in Ireland at 56 m

Chapter 4: The state of use and sustainable management of forest genetic resources in Ireland

4.1 ANNUAL QUANTITY OF FOREST TREE SEED TRANSFERRED INTERNATIONALLY

Because of the lack of self-sufficiency in Ireland's forest genetic resources referred to earlier a forest tree seed trade has been in existence for a considerable period between Ireland and other countries (Table 12).

Table 12: Seed and vegetative propagules transferred internationally on an annual basis (average of last five years).

Species (scientific name)	Native (N) or exotic (E)	Quantity of seed kg		No. of vegetative propagules		No. of seedlings (000)		Purpose
		Imports	Exports	Imports	Exports	Imports	Exports	
<i>Alnus glutinosa</i>	N	7.5	3	0	0	600	206	Forestry
<i>Betula pendula</i>	N	5	1	0	0	50	65	Forestry
<i>Betula pubescens</i>	N	3	1	0	0	160	105	Forestry
<i>Fagus sylvatica</i>	E	562	24	0	0	70	120	Forestry
<i>Fraxinus excelsior</i>	N	28	150	0	0	130	200	Forestry
<i>Larix decidua</i>	E	10	0	0	0	10	0	Forestry
<i>Larix kaempferi</i>	E	16	6	0	0	50	180	Forestry
<i>Larix x eurolepis</i>	E	25	7	0	0	0	720	Forestry
<i>Picea abies</i>	E	83	3	0	0	50	735	Forestry
<i>Picea sitchensis</i>	E	152	17	0	400	350	3700	Forestry
<i>Pinus contorta</i>	E	4	0	0	0	0	25	Forestry
<i>Pinus sylvestris</i>	E	17	6	0	0	0	290	Forestry
<i>Pseudotsuga menziesii</i>	E	45	1	0	0	0	500	Forestry
<i>Quercus petraea</i>	N	29	618	0	0	100	120	Forestry
<i>Quercus robur</i>	N	8282	559	0	0	150	100	Forestry

4.2 CURRENT TREE IMPROVEMENT PROGRAMMES

Since the establishment of a Research Branch in the Forestry Division in the 1950s the importance of correct provenances selection has been recognised and extensive research has been undertaken in this area. Work in plus tree selection and the development of seed orchards commenced in the early 1960s. Current work on tree improvement programmes cover a number of species, both native and introduced (Table 13).

4.3 MAIN IMPROVEMENT OBJECTIVES

Table 13 lists all species in the current improvement programme and provides information on the main objectives for each one.

Table 13: Forest tree improvement programmes in Ireland.

Species		Improvement programme objectives					
Scientific name	Native (N) or Exotic (E)	Timber	Pulpwood	Energy	Multi-purpose	Non-wood forest products	Other
<i>Abies procera</i>	E		+			+	
<i>Abies amabilis</i>	E					+	
<i>Alnus glutinosa</i>	N	+					
<i>Betula spp</i>	N	+					
<i>Fagus sylvatica</i>	E	+					
<i>Fraxinus excelsior</i>	N	+		+			+
<i>Larix spp</i>	E	+	+		+		
<i>Picea abies</i>	E	+	+		+		
<i>Picea sitchensis</i>	E	+	+	+	+		
<i>Pinus contorta</i>	E		+	+			
<i>Pinus radiata</i>	E	+					
<i>Pinus sylvestris</i>	N	+	+		+		
<i>Prunus avium</i>	N	+					+
<i>Pseudotsuga menziesii</i>	E	+	+		+		
<i>Quercus spp</i>	N	+		+			
<i>Thuja plicata</i>	E	+					

4.4 SPECIES SUBJECT TO TREE IMPROVEMENT PROGRAMMES (AS LISTED IN TABLE 13)

Table 14 provides data for each species listed in tree improvement programmes, including the number of plus trees and genetic tests.

Table 14: Tree improvement programmes in Ireland.

Species		Plus trees	Provenance trials		Progeny trials		Clonal testing and development			
Scientific name	Native (N) or Exotic (E)	No.	No. of trials	No. of provenances	No. of trials	No. of families	No. of tests	No. of clones tested	No. of clones selected	No. of clones used
<i>Abies procera</i>	E	-	3	15	-	-	-	-	-	-
<i>Abies amabilis</i>	E	-	2	13	-	-	-	-	-	-
<i>Acer pseudo-platanus</i>	E	173	-	-	-	-	-	-	-	-
<i>Alnus glutinosa</i>	N	111	1	3	85	-	-	-	-	-
<i>Betula spp.</i>	N	121	3	121	-	-	-	-	-	-
<i>Castanea sativa</i>	E	55	-	-	-	-	-	-	-	-
<i>Cryptomeria japonica</i>	E	-	2	10	-	-	-	-	-	-
<i>Fagus sylvatica</i>	E	-	1	34	-	-	-	-	-	-
<i>Fraxinus excelsior</i>	N	92	3	68	-	-	-	-	-	-
<i>Larix spp.</i>	E	-	13	40	-	-	-	-	-	-
<i>Notofagus procera</i>	E	1	6	-	-	-	-	-	-	-
<i>Picea abies</i>	E	-	2	2	-	-	-	-	-	-
<i>Picea sitchensis</i>	E	747	4	69	42	447	4	113	-	-
<i>Pinus contorta</i>	E	179	2	58	10	118	-	-	-	-
<i>Pinus muricata</i>	E	-	1	14	-	-	-	-	-	-
<i>Pinus radiata</i>	E	456	2	15	6	212	9	216		
<i>Pinus sylvestris</i>	N	69	-	-	-	-	-	-	-	-
<i>Pseudotsuga menziesii</i>	E	-	3	32	1	20	-	-	-	-
<i>Prunus avium</i>	N	52	-	-	-	-	2	36	-	-
<i>Quercus spp.</i>	N	102	5	43	1	30	-	-	-	-
<i>Thuja plicata</i>	E	126	-	-	-	-	2	126	-	-
<i>Tsuga heterophylla</i>	E	-	1	16	-	-	-	-	-	-

Table 15 shows Irish seed orchards, including the number of orchards for each species, approximate area and stage of development - whether first generation or other.

Table 15: Irish seed orchards.

Species (scientific name)	Seed orchard		
	Number	Generation	Area ha
<i>Acer pseudoplatanus</i>	1	1 st	0.5
<i>Alnus glutinosa</i>	1	1 st	1.3
<i>Betula spp.</i>	2	1 st	0.3
<i>Fraxinus excelsior</i>	2	1 st	8.4
<i>Larix spp.</i>	1	1 st	0.7
<i>Picea sitchensis</i>	3	1 st	12.0
<i>Pinus contorta</i>	8	1 st	6.4
<i>Pinus radiata</i>	1	1 st	1.5
<i>Pinus sylvestris</i>	3	1 st	5.5
<i>Prunus avium</i>	1	1 st	0.8
<i>Quercus spp.</i>	1	1 st	3.3

4.5 INFORMATION SYSTEMS ON TREE BREEDING PROGRAMMES IN IRELAND

There is information on all germplasm material conserved including that in the Coillte collection, which includes origin, the location of the material and its availability, as well as performance information. Similarly, information on location of material which is part of the British and Irish Hardwoods Improvement Programme is also recorded and documented for the germplasm collections of the seven species in the programme.

4.6 QUANTITIES OF IMPROVED MATERIAL AVAILABLE

The type of reproductive material (seed, pollen, scions and/or other reproductive material) available for commercial and international use from the Irish tree improvement programmes are listed in Table 16.

Table 16: Type of reproductive material available from tree improvement programmes in Ireland.

Species (scientific name)	Type of material	Available for national requests		Available for international requests	
		Commercial	Research	Commercial	Research
<i>Acer pseudoplatanus</i>	Scions	-	+	-	+
<i>Alnus glutinosa</i>	Scions	-	+	-	+
<i>Betula spp</i>	Scions, pollen, seed	-	+	-	+
<i>Fraxinus excelsior</i>	Scions	-	+	-	+
<i>Picea sitchensis</i>	Scions, seed, pollen and emblings	-	+	-	+
<i>Pinus sylvestris</i>	Scions	-	+	-	+
<i>Prunus avium</i>	Scions	-	+	-	+
<i>Quercus spp</i>	Scions	-	+	-	+
<i>Thuja plicata</i>	Cuttings	-	+	-	+



Hazel – coll (*Corylus avellana*) coppice at Oughaval, Co Laois (in Brehon Laws hazel is associated with wisdom)

Chapter 5: The state of national programmes, research, education, training and legislation in Ireland

National programmes

5.1 NATIONAL PROGRAMMES AND FOREST GENETIC RESOURCES

Ireland has a national forestry programme which is administered by the Forest Service of the Department of Agriculture, Food and the Marine. Forest genetic resources are included in this programme. Funding for the study of forest genetic resources is through work on prescribed seed origins and provenances for reproductive material for specific species used, research funding under the COFORD programme, and work carried out in the National Botanic Gardens, Teagasc and at John F Kennedy Arboretum.

5.2 INSTITUTIONS ENGAGED IN CONSERVATION/SUSTAINABLE USE OF FOREST GENETIC RESOURCES

The main national effort on the research and development of forest genetic resources is divided among a number of state institutions: Forest Service, Coillte, National Botanic Gardens, John F Kennedy Arboretum and Teagasc and to a lesser extent the third level colleges (Table 17). The Forest Service is responsible for the regulation and control of forest reproductive material. It also provides funding for both genetic studies and part funding for the development of improved reproductive material.

Coillte undertakes commercial tree improvement programmes and seed processing, extractory and storage, while Teagasc is largely concerned with genetics research and developing micropropagation technologies. Individual research projects relating to forest genetic resources are undertaken by the universities and the National Botanic Gardens of Ireland. Table 17 lists the institutions which are actively engaged in conservation of forest genetic resources in Ireland.

Table 17: Institutions involved with conservation and use of forest genetic resources in Ireland.

<i>Institution</i>	<i>Type of institution</i>	<i>Activities of programme</i>
Forest Service, Department of Agriculture, Food and the Marine	Government	Regulatory and funding body
National University of Ireland, Galway	Academic	Research
National University of Ireland, Maynooth	Academic	Research
Trinity College Dublin	Academic	Research
University College Cork	Academic	Research
University College Dublin	Academic	Research
Waterford Institute of Technology	Academic	Research
National Botanic Gardens	Government	Research and collections
John F Kennedy Arboretum	Government	Research and collections
National Parks & Wildlife Service	Government	Research and collections
Teagasc	Government	Research and advisory
Coillte	Commercial state company	Research, Production and Management

5.3 NATIONAL COORDINATION MECHANISM FOR FOREST GENETIC RESOURCES

Ireland has not established a formal national coordination mechanism to include different institutions or a national programme for forest genetic resources. However, the COFORD report *Sustaining and developing Ireland's Forest Genetic Resources* made the following recommendation: "That a National Forest Genetic Resources Advisory Group comprising relevant stakeholders be established to guide the development of the sector". As stated earlier the implementation of this recommendation is currently under active consideration.

5.4 STRUCTURES AND FUNCTIONS OF FOREST GENETIC RESOURCES MECHANISMS

To-date there has been little coordinating of forest genetic resources in Ireland however that situation is beginning to change.

5.5 TRENDS IN SUPPORT FOR FOREST GENETIC RESOURCES OVER THE PAST 10 YEARS

Support for research on forest genetic resources has increased over the past decade as highlighted by the recent call for proposals referred to in Section 2.

Research, Education and Training

5.6 ESTIMATED BUDGET ALLOCATED TO FOREST GENETIC RESOURCES

The budget allocated to forest genetic resource research in Ireland is approximately €120,000 annually, while the current total forestry budget is €120 million. This indicates that approximately 0.1% is allocated to forest genetic resources research.

5.7 COURSES ON FOREST GENETIC RESOURCES IN THIRD LEVEL INSTITUTIONS

Currently there are no specialist personnel working exclusively in forest genetic resources in any Irish third level institution, but this is not surprising given the relatively small scale of forestry in Ireland. However, the third level institutions listed below have expertise in some areas closely related to FGR conservation. In particular, the Forestry Section of the UCD School of Agriculture, Food Science and Veterinary Medicine provides a comprehensive course in forestry, focusing on the sustainable development and management of Ireland's forest resources. This programme does not contain a module dedicated to FGR conservation, but this subject is addressed in the tree improvement section of the Principles of Forestry module. Conservation issues are also covered in other modules. The only other forestry Degree Course in the country delivered at Waterford Institute of Technology does not specifically have modules in FGR, however, within the silviculture modules the subject is comprehensively covered. The Botany section of the UCD School of Biology and Environmental Science is also engaged in conservation research, of relevance to FGR. A module of the University College Galway Botany degree programme deals with tree biology and methods of genetic characterisation in trees.

The following educational institutions are involved in the areas of plant and forest research, environmental management and molecular studies of relevance to FGR:

- University College Dublin, Forestry Section, School of Agriculture, Food Science and Veterinary Medicine
- National University of Ireland, Maynooth – Department of Biology, Molecular Ecology Laboratory.
- Trinity College Dublin – School of Natural Sciences, Botany
- University College Cork – Department of Zoology, Ecology and Plant Science
- University College Galway – Botany and Plant Science, School of Natural Sciences
- Waterford Institute of Technology – Chemical and Life Science Dept. School of Science.

There is no post-graduate course specifically in FGR in Ireland, although there is sufficient expertise to facilitate this. In particular, the National Botanic Gardens of Ireland has the experience and expertise in the area of FGR conservation that would facilitate the delivery of post-graduate level degrees in FGR in collaboration with third level institutions.

5.8 NEEDS AND PRIORITIES FOR RESEARCH, EDUCATION AND TRAINING

There is a need to increase the focus on the importance of FGR in forestry courses at undergraduate level in Irish third level institutions. These institutions should be encouraged to increase the content of FGR related material in existing modules at undergraduate level. The provision of FGR courses also needs to be examined, in the context of the training needs of forestry professionals. The Society of Irish Foresters and the Forest Service should be encouraged to include FGR training in any new short course offerings.

National legislation

5.9 LEGISLATION AND REGULATION RELEVANT TO FOREST GENETIC RESOURCES

Ireland implements EU Council Directive 1999/105/EC on the marketing of forest reproductive material, commonly called the FRM Directive. The Forest Service, Department of Agriculture, Food and the Marine is the national authority with responsibility for the implementation of the Council Directive. This Directive is transposed into Irish legislation by Statutory Instrument No. 618/2002, the European Communities (Marketing of Forest Reproductive Material) Regulations 2002. Additionally, the Forest Service is responsible for the implementation of the forestry aspects of Council Directive 2000/29/

EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community, as amended. This Directive is commonly known as the Plant Health Directive and is transposed into Irish legislation by Statutory Instrument No.894/2004, European Communities (Control of Organisms Harmful to Plants and Plant Products) Regulations 2004.

Ireland is a member of the Organisation for Economic Co-operation and Development (OECD) scheme for the certification of forest reproductive material moving in international trade. The objective of the scheme is to encourage the production and use of seeds, parts of plants and plants that have been collected, transported, processed, raised, labelled, and distributed in a manner that ensures their trueness to name.

5.10 LEGAL FRAMEWORK FOR FOREST GENETIC RESOURCES STRATEGIES

Ireland has not established a legal framework for genetic resources strategies, plans and programmes.

5.11 NEEDS FOR DEVELOPING OR STRENGTHENING FOREST GENETIC RESOURCES LEGISLATION

The needs for developing forest genetic resources legislation in Ireland are prioritised as set out in Table 18.

Table 18: Needs for developing forest genetic resources legislation in Ireland.

Needs	Priority level			
	Not applicable	Low	Moderate	High
Improve forest genetic resources legislation	x	x		
Improve reporting requirements	x			
Consider sanctions for non-compliance	x			
Create forest genetic resources regulation				
Improve effectiveness of forest genetic resources regulation	x			
Enhance cooperation between forest genetic resources national authorities		x		
Create a permanent national commission for conservation and management of forest genetic resources			x	

Public awareness

5.12 INITIATIVES NECESSARY FOR GREATER VISIBILITY FOR FOREST GENETIC RESOURCES

In Ireland a number of initiatives have been undertaken to highlight the importance of forest genetic resources. These include the strategy as developed by COFORD in 2007 and already mentioned in Section 2. Other initiatives include publications and information notes. Developments which are also helping to create greater visibility for forest genetic resources include the establishment of the People's Millennium Forest project, the largest ever project undertaken in Ireland and directed at the expansion and enhancement of Ireland's native woodland and the publication of the National Biodiversity Plan. These developments have all helped to address the issue of greater visibility for forest genetic resources in Ireland.

5.13 SPECIFIC AWARENESS PROGRAMME FOR FOREST GENETIC RESOURCES

While not specifically targeted at the forest genetic resources area, the Native Woodland Scheme is aimed at protecting and enhancing Ireland's native woodlands and conservation and biodiversity are prioritised, with wood production encouraged where appropriate.

5.14 NEEDS AND PRIORITIES FOR RAISING AWARENESS OF FOREST GENETIC RESOURCES

Specific awareness programme for forest genetic resources are outlined in Table 19.

Table 19: Public awareness raising needs for forest genetic resources in Ireland.

Needs	Priority level			
	Not applicable	Low	Moderate	High
Prepare targeted forest genetic resources information			x	
Prepare targeted forest genetic resources communication strategy			x	
Improve access to forest genetic resources information		x		
Enhance forest genetic resources training and education			x	
Improve understanding of benefits and values of forest genetic resources			x	



Beech – feá (*Fagus sylvatica*), spring foliage



Cherry – silín (*Prunus avium*) planted in 1995 near Clonmel, Co Tipperary

Chapter 6: The state of regional and international agreements and collaboration in Ireland

International agreements

Ireland, as an EU Member State, is responsible for the implementation of Council Regulation (EC) No 2173/2005 and is implementing Commission Regulation (EC) No 1024/2008, on forest law enforcement governance and trade (FLEGT) regarding timber import controls to combat illegal logging.

The National Parks and Wildlife Service (NPWS) is the management authority in Ireland for the Convention in the International Trade in Endangered Species of Wild Fauna and Flora (CITES).

6.1 CURRENT INTERNATIONAL COLLABORATION

The European Forest Genetic Resources Programme (EUFORGEN) is a collaborative initiative among European countries to promote conservation and sustainable use of forest genetic resources as well as protect and promote forest biodiversity. It was established in October 1994 to implement the Strasbourg Resolution S2 on the conservation of forest genetic resources of the first Ministerial Conference on the Protection of Forest in Europe (MCPFE), held in France in 1990.

EUFORGEN is financed by the participating countries, (currently 32), and is coordinated by the International Plant Genetic Resources Institute (IPGRI) in collaboration with FAO. The EUFORGEN Steering Committee is composed of national coordinators nominated by the participating countries and has the overall responsibility for the programme. Ireland has been a member of EUFORGEN since 1998 and membership is supported financially by the Forest Service, while the programme is serviced by Forest Sector Development Division of the Department of Agriculture, Fisheries and Food.

6.2 REGIONAL, SUB REGIONAL THEMATIC NETWORKS FOR FOREST GENETIC RESOURCES

Regional and sub-regional forest genetic resource based thematic networks which Ireland participates in are given in Table 20.

Table 20: Thematic networks on forest genetic resources with Irish participation.

Network	Activities	Genus/species (scientific names)
Treebreedex	Information exchange, development of technical guidelines, development of shared databases.	<i>Pinus, Picea, Larix, Acer pseudoplatanus, Fraxinus, Prunus</i>
British and Irish Hardwoods Improvement Trust (BIHIT)	Information exchanges, development of technical guidelines, development of shared databases, germplasm exchange and the development and coordination of tree improvement programmes and seed orchards.	<i>Quercus, Fraxinus, Betula, Acer pseudoplatanus, Prunus, Castanea</i>
European Forest Genetic Resources Network (EUFORGEN)	Information exchanges, establishment of gene conservation strategies.	<i>All species</i>
Larch wood chain	Information exchange, development of technical guidelines, development of shared database, germplasm exchange.	<i>Larix spp</i>
Realising Ash's Potential (RAP)	Information exchange, development of technical guidelines, germplasm exchange.	<i>Fraxinus excelsior</i>

6.3 NEEDS AND PRIORITIES FOR FUTURE INTERNATIONAL COLLABORATION

Table 21 lists the needs and future priorities for future international collaboration.

Table 21: Needs for international collaboration and networking.

Needs	Level of priority			
	Not applicable	Low	Moderate	High
Understanding the state of diversity				x
Enhancing <i>in-situ</i> management and conservation			x	
Enhancing <i>ex-situ</i> management and conservation			x	
Enhancing use of forest genetic resources				x
Enhancing research				x
Enhancing education and training			x	
Enhancing legislation		x		
Enhancing information management and early warning system for forest genetic resources		x		
Enhancing public awareness				x

Chapter 7: Access to forest genetic resources and sharing of benefits arising from their use in Ireland

Access to forest genetic resources

7.1 REGULATIONS ON ACCESS TO, AND BENEFIT SHARING OF FOREST GENETIC RESOURCES

There is no regulation regarding access and benefit sharing specific to Ireland, but Ireland is a signatory to the Convention on Biological Diversity.

7.2 LEGISLATION LIMITING ACCESS AND MOVEMENT OF FOREST GENETIC RESOURCES

Legislation in Ireland does not limit access and movement of forest genetic resources into or out of the country.

7.3 WHAT CAN BE DONE TO IMPROVE ACCESS AND MOVEMENT OF FOREST GENETIC RESOURCES?

Since there is no legislation limiting the movement of forest genetic resources into or out of the country, it is not necessary to improve access.

Sharing of benefits arising out of the use of forest genetic resources

7.4 RECOGNISING INTELLECTUAL PROPERTY RIGHTS IN FOREST GENETIC RESOURCES

Ireland has not established mechanisms for recognising intellectual property rights related to forest genetic resources, although some work is currently underway in Teagasc.

7.5 SHARING BENEFITS ARISING FROM THE USE OF FOREST GENETIC RESOURCES

Ireland has not established mechanisms for sharing benefits arising out of the use of forest genetic resources.



Pedunculate oak – dair (*Quercus robur*) acorns and foliage

Chapter 8: The contribution of forest genetic resources to food security, poverty alleviation and sustainable development

The maintenance of forest genetic resources is fundamental to the sustainability of the overall forest resource. This is particularly important given the fact that there is high dependency in Ireland on the use of non native species for economic forestry. Ensuring that the best adapted and most productive reproductive material for Irish conditions is maintained will ensure the sustainability of the forests that provide goods and services to the communities and industries that are dependent on the resource.

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Appendix 1: National Consultative Committee on Forest Genetic Resources

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