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The Society of Irish Foresters

An Cumann Foraoiseoirí na hÉireann

Mission Statement

To lead and represent the forestry profession, which meets, in a sustainable manner, society's needs from Irish forests, through excellence in forestry practice.

Objectives

- To promote a greater knowledge and understanding of forestry in all its aspects, and to advance the economic, social and public benefit values arising from forests.
- To support professionalism in forestry practice and help members achieve their career goals.
- To establish, secure and monitor standards in forestry education and professional practice.
- To foster a greater unity and sense of cohesion among members and provide an appropriate range of services to members.

Submissions of articles to Irish Forestry

Submissions

1. Original material only, unpublished elsewhere, will be considered for publication in *Irish Forestry*. Where material has been submitted for publication elsewhere, authors must indicate the journal and the date of submission.
2. All submissions must be in MS Word, submitted electronically to the Editor, *Irish Forestry* at info@soif.ie (see Guidelines). Authors are requested to keep papers as concise as possible and no more than 12 pages in length (including tables and figures).
3. Submissions will be acknowledged by the Editor. Authors will be informed if the paper is to be sent for peer review. If peer review is not envisaged an explanation will be provided to authors.
4. On submission, authors should indicate up to three potential referees for their paper (providing full contact details for each referee). Choice of peer reviewer rests in all cases with the Editor.
5. Peer reviews will be communicated to authors by the Editor. Changes suggested by the reviewer must be considered and responded to. It is expected that co-authors should be informed of, and in agreement with, such changes and responses. The decision to publish will be taken by the Editor, whose decision is final.
6. Guidelines for authors on *Irish Forestry* house style and layout can be downloaded as an MS Word template from http://societyofirishforesters.ie/IrishForestry.

Front cover: "The remains of the day". These oft-photographed and statuesque Scots pine trees were planted on the shores of the black-watered Doo Lough beneath Ben Creggan in Connemara Co. Mayo by a Scottish sheep farmer, William Houstoun, in the mid-1800s. Although grown from Scottish seed, their remnant presence in the landscape seems appropriate since the surrounding pass is littered with pine root systems, semi-buried in the eroding peat. Their presence on the front cover of this issue is also appropriate because the Roche article published herein presents evidence confirming that the species has indeed managed to survive the ravages of the last number of centuries to qualify as fully native!

Acknowledgements

The Editors would like to thank the anonymous reviewers who have contributed considerably to maintaining the quality of the scientific and other articles published here. Our Technical Director, Pat O'Sullivan, has done sterling work in the background, tirelessly proofing much of the content. Many thanks are due to John Mc Loughlin for organising another exciting book review section. Emma Golding handled the laying out and styling of the material. We appreciate the review copy of *The Silviculture of Trees Used in British Forestry* supplied by Springer.

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EDITORIAL

Getting our house in order

I am the heat of your hearth on the cold winter nights,
the friendly shade screening you from the summer sun,
and my fruits are refreshing draughts quenching your thirst as
you journey on.

I am the beam that holds your house, the board of your table,
the bed on which you lie, and the timber that builds your boat.
I am the handle of your hoe, the door of your homestead,

the wood of your cradle, and the shell of your coffin.
I am the bread of kindness and the flower of beauty.
Ye who pass by, listen to my prayer: Harm me not.

Attributed to Alberto da Veiga Simões (1888 – 1954)

During the course of the last century, forestry in Ireland has fought its way to becoming a significant land use and industry. It now accounts for 11% of the country's land area and has been contributing over two billion euro annually to the economy over recent years. Forestry is a key aspect of the country's National Mitigation Plan under the recent Climate Action and Low Carbon Development Act (2015). Not for over 250 years has the sector enjoyed such good prospects. True, the continuation of the recent ambitious afforestation plan has been fraught with issues such as competition for land and the inflexibility of forestry's permanent land-use classification. However, the failure of the State's approvals system to cope with the blanket objections to afforestation, roading and felling licence applications over the course of the last year has the potential to become the greatest catastrophe the sector has had to cope with for some considerable time. The external review carried out by Jim MacKinnon described the systemic failure in detail and warned that the situation may have grave impacts on the livelihoods of all those involved in forestry. However, the considerable professionalism within Irish forestry means we don't need to shy away from its defense. But we do require a fair playing field that ensures that objections are meaningful, rather than just for their own sake. As a consequence, if it was difficult to convince a landowner of the benefits of forestry previously, the task to convince them now is about to become much more difficult.

This problem is at odds with an excellent situation for forest research. In the wake of questions about the capacity of the Irish research community to respond to forest research needs, there was a very strong response to the 2019 research call. Happily, the Department of Agriculture, Food and the Marine has funded twelve forestry projects to the tune of a little over €4 million.

Offering hope in the face of great odds is the story of one of Ireland's tiny refugial populations of Scots pine. This inspiring tale is presented by Dr Jenni Roche as a meticulous investigation into various strands of evidence marking the right of the species to be viewed as "fully native" and the article reinforces rigorous scientific evidence with considerable historical detail. There is much in this article to inspire consideration of our forest and land-use policies. Other forms of sylvan relics are considered by John Mc Loughlin in his article about "modern" sacred trees. Our innate association with trees would appear to have survived intact in many areas from pre-Christian times -alas apparently not in Co. Leitrim, where 2019 has seen already considerable objections to forestry become ever more vociferous. However, we are not alone in such challenges as the Society's study tour to Lithuania discovered. Although endowed with substantially greater forest cover (33%) than Ireland, there is a vigorous public debate about how this resource should be managed. The tour report also mentions the curious travails of Scots pine in that country, where it has to cope with infestations of aggressive nesting cormorants. Another study tour, though of a different group, found similar sensitivity to commercial forest management in Wales. The Hardwood Focus discussion group visited our nearest Celtic neighbours to explore potential markets for Irish hardwood produce. Their discussions with producers and processors of small-dimensioned timber make interesting reading and identify some excellent examples of potential products which could stimulate such innovation using material from early thinnings of Irish hardwood species. It is a pity it hasn't been possible to develop such markets in the UK prior to Brexit!

A very different hardwood legacy is considered by Dr Mary Forrest in her article about Dublin's street tree planting in the 19th and early 20th century. This is indeed timely in the light of the public outcry at the proposed removal of substantial numbers of street trees to facilitate the development of bus corridors. It is interesting to note that quite a large proportion of the urban trees established during this period were privately funded.

The Trees Woods and Literature article in this issue has been written by Dr Anna Pilz about Lady Gregory's planting and woodland management at Coole, Co. Galway. This piece traces the awakening of interest and ultimately the development of expertise in someone whose place in society did not directly dictate such a calling. The concluding story of the catalpa tree at Coole is a touching legacy to this woodland history.

A silvicultural theme begins with the article by Jonathan Spazzi et al., who report

on an investigation into inventory protocols suitable for use in small-scale stands managed as continuous cover forestry. This is further developed by reviews of two recently revised text books. Savill's *Silviculture of Trees Used in British Forestry* has reached its third edition while Ashton and Kelty's *The Practice of Silviculture: Applied Forest Ecology* its tenth. Ted Wilson has provided a thought-provoking consideration of the latter in his review.

Interestingly, 2020 is the International Year of Plant Health (ironically, likely to be somewhat overshadowed by concerns for human health). Dr Richard O'Hanlon draws on some recent experiences in New Zealand in a Letter to the Editor to highlight how national approaches to biosecurity could be enhanced. He identifies the human element as the weakest link when it comes to forest health protection. Perhaps his advice should apply more generally to how biosecurity should be handled by State services as well as by the citizenry. This should apply equally to how we handle our borders as to how we handle hygiene and sanitation at and between sites.

The over-arching lesson to be learned from this issue's articles on the historical aspects of forestry and tree planting, is that they belie an innate resilience, often despite our human carelessness. Let us hope that with some more considered care and practicality we can use such inspiration to solve the difficulties besetting our sector and quickly "get our house in order". To follow Alberto da Veiga Simões' poem above, we should listen to the benevolent-but-fearful forest that appeals to us - not to harm it.

Comparison of three inventory protocols for use in privately-owned plantations under transformation to Continuous Cover Forestry

Jonathan Spazzi[a*], Padraig O Tuama[b], Edward R.Wilson[c,d] and Ian Short[d]

Abstract

Interest is growing in Continuous Cover Forestry (CCF) as a management approach among private forest owners in Ireland. Developments in forest policy are directed at promoting CCF as a means of enhancing forest resilience, sustaining forest production and delivering diverse ecosystem services. In 2019 the Department of Agriculture, Food and the Marine (DAFM) introduced a new pilot funding measure to support the adoption of CCF management in suitable private forests. Currently the area of forest under CCF management is relatively small (estimated at around 1% of the total forest area) and several barriers to wider adoption have been identified. These include the lack of a simple template for the transformation of planted forests to CCF and a monitoring protocol with known inventory costs and outputs. In this study three inventory protocols were compared in terms of their ease of use, the types of data outputs and cost effectiveness in a forest stand at an early stage of transformation to CCF. These protocols were compared to a complete enumeration approach. The inventory protocols being tested were developed by the UK Forestry Commission (FCIN45), a group of French and Belgian researchers (VISUAL) and the Irregular Silviculture Network (ISN). Results indicate that by using modern technology and careful design, a cost-effective inventory protocol can be implemented to collect information of sufficient accuracy to inform management decisions. Advantages and limitations of each protocol are discussed. The ultimate outcome would be the development and adoption of a common inventory and monitoring approach to enable private owners to critically compare stand management and performance. This is essential to support and guide forest managers and forest owners during the transformation process.

Keywords: *Continuous cover forestry, transformation, irregular structure stands, forest inventory, inventory costs.*

Introduction

Continuous Cover Forestry (CCF) can be an attractive management option for owners of private forests as it supports regular and profitable timber production, reduced establishment costs by exploiting natural regeneration, while retaining, in the long

[a] Teagasc Forestry Development Department, The Pavilion, Austin Stack Park, Tralee, Co. Kerry.
[b] Forestry Consultant, Dromanallig, Ballingeary, Co. Cork.
[c] UCD Forestry, School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4.
[d] Teagasc Forestry Development Department, Ashtown Research Centre, Dublin 15.
[*] Corresponding author: jonathan.spazzi@teagasc.ie

term, key ecological functions associated with natural woodlands (Ní Dhubháin 2003, Helliwell and Wilson 2012, Sanchez 2017). CCF can be achieved using many silvicultural systems, from shelterwood to *selection-irregular* silviculture (Ní Dhubháin 2003). This study will focus on the latter. Irregular silviculture aims to develop balanced irregular forest structures and promotes the use of complementary species and natural regeneration. As it makes use of natural forest processes, it is also known as Close-to-Nature Forest Management (Puettmann et al. 2015). In particular, it can offer increased ecological resilience compared with monoculture plantations (Brang et al. 2014) and delivers a wide range of timber products and ecosystem services, including the conservation of soils, water resources and wildlife habitats (Reynolds 2004, Ireland et al. 2006, O'Hara 2014).

Recent research and best-practice guidelines promote a process of "progressive transformation" as the most effective pathway to securing the targeted irregular stand structure for CCF management (Poore 2007, Poore and Kerr 2010, Poore 2016, Süsse et al. 2011, Price and Price 2006). Generally, this involves crown thinning of uniform plantations to promote high quality individual trees and introduce structural diversity. Progressive transformation of plantations to irregular stands moves through four well-defined stand development stages (Schütz 2001) (Table 1). In some ways, these stages mimic the process of natural forest succession (Oliver and Larson 1996, Schütz 2001, Poore 2007, Cameron and Hands 2010). At each stage, management interventions aim to select and promote future crop trees, improve breeding of forest stock and to ensure adequate levels of recruitment of desired species within each structural component in the stand (from seedlings to mature trees).

Unlike the clearfell and uniform shelterwood systems where all trees in the stand are managed towards a uniform target size to be harvested over a relatively short period of time, irregular silviculture aims to create a conveyor belt of timber where high quality stems within the stand reach maturity at different times, and sawlog is harvested continuously, at regular intervals, with recruitment of younger trees to the canopy without a loss of forest habitat at any stage (Sanchez 2017). The focus on individual tree selection and management enables the forester to concentrate stand increment on high quality stems resulting in high-value increment (Lähde et al. 2001, Sterba and Zingg 2001, Price and Price 2006, Süsse et al. 2011). The system ultimately aims to create a regular, steady income for the owner while minimising costs (Purser et al. 2015).

In Ireland, a growing number of private forest owners are interested in CCF (Vítková et al. 2013). This is being supported and encouraged by a pilot funding measure dedicated to CCF management in forests and launched by the Department of Agriculture, Food and the Marine (DAFM) in 2019 (Forest Service 2019). Of the 226,000 ha of grant-aided private plantations in Ireland, 59.4% are less than 20 years of age, and 37% are between 10 and 20 years (Forest Service 2018a) at first or

Table 1: *Summary of developmental stages in the transformation process to an irregularly structured CCF stand.*

Stage	CCF transformation stage	Natural forest development stage	Activities
1	Preparation thinning	Stem exclusion (pole-stage)	• removal of poor-quality stems to promote selected quality stems • selective thinning to improve tree stability while minimising disruption to stand stability (i.e. early first thinning and frequent light thinning to follow) • promote patchiness and suitable species diversity to assist with irregular structure development
2	Reduction of stand basal area to promote natural regeneration	Understory re-initiation stage (natural regeneration)	• increase timber removal to reduce basal area to facilitate the development of cohorts of regeneration of suitable species (and/or under-planting if needed)
3	Structural development	All sizes (beginning of "old growth" stage)	• using selective felling, shape the stand structure towards a desired broad diameter classes distribution, species distribution and desired standing volume • remove max 20% of the stand BA at each intervention and in general no more than the increment since previous intervention
4	Structural maintenance	All sizes ("old growth" stage)	• when a desired functioning structure is achieved (sustained yield, rejuvenation and ecosystem resilience) maintain the structure by removing the increment mostly from large trees. • manage disturbances (i.e. wind-blow) • review long term inventory learning of ecosystem functioning

second thinning stage; which makes optimal timing for initiating stand transformation (Mason and Kerr 2001, Cameron 2002, Wilson et al. 2018). While transformation from conventional plantation to irregular stand structure is not always possible, as elevation and soil quality could undermine forest wind stability during the transformation, the coming decade offers a considerable opportunity to initiate transformation in many suitable plantations. However, clearfelling remains the dominant silvicultural system and further work is required to overcome barriers to wider adoption of CCF among private forest owners in Ireland.

Several barriers to the wider application of CCF in Ireland were identified by Vítková et al. (2014) and include: a perception that CCF is too complex, a lack of existing working examples, and a lack of models for timber yield forecasting in irregular-structured, mixed-species stands. The lack of a transformation template and a monitoring protocol, with known costs and data outputs, are also recognised as major limiting factors (Vítková et al. 2014). Of particular importance is the control of stand basal area and its distribution between broad DBH classes across species. Yet many forests under transformation to CCF lack a permanent inventory that provides this and other quantitative information (Kerr et al. 2002). This limits an evidence-based approach to CCF management (Süsse et al. 2011); the manager's task is then made more difficult in terms of measuring silvicultural progress and deciding on the most appropriate stand interventions.

Inventory and monitoring protocols for CCF must incorporate several discrete elements to fully account for the structural complexity and dynamic processes associated with irregularly structured stands. These include basal area and stocking distribution between tree social classes and species; quality and distribution of selected trees; vitality and stability of selected trees; presence of sufficient seedling/sapling/pole cohorts for canopy recruitment (Süsse et al. 2011). Basal area increment is a proxy for volume increment. Increment will also become progressively important to measure the productivity rate of the stand and to facilitate the generation of a timber forecast from stage 2 onwards. This can be assessed by comparing data between two inventories. In early-stage transformation, volume estimates can be derived using basal area and form factor tables/charts used for uniform plantations (Deffee 2015, Poore 2007). As the stand advances into stage 2, it is likely that stand volumes will progressively diverge from standard tables. At this stage there will be a need for adopting new methods for assessing standing volume in irregular stands. This problem can be solved in several ways, e.g. by applying tables in use in Europe for irregular stands, using the volume/basal area ratio (VBAR) (Deffee 2015, Poore 2007) or using single-tree volume equations as developed by the National Council for Forest Research and Development (COFORD) though the TREEMODEL project and applied to the National Forest Inventory in 2015 and 2017 (Forest Service 2018b).

Ideally, an effective inventory protocol for CCF should facilitate the setting of management objectives, be affordable and be relatively user-friendly with respect to monitoring the transformation process (Sterba and Ledermann 2006). It should also provide, over time, increment data from which reliable stand-level roundwood production forecasts can be derived to guide management interventions. Several organisations have developed inventory and stand monitoring protocols for CCF management, including the Forestry Commission (Kerr et al. 2002), forest researchers in France and Belgium (Visual project) (Lejeune et al. 2005, Sanchez

and Van Driessche 2016), and the Irregular Silviculture Network (ISN 2017). The ISN protocol has been adapted by a group of foresters in Ireland and the UK from methodologies originally devised by the *Association Futaie Irrégulière* (Süsse et al. 2011). Each of these protocols defines an optimal sampling intensity and provides key statistics on stand attributes that include basal area, size frequency distribution, species composition and density of natural regeneration. In the case of the ISN protocol, data on stem quality and habitat potential can also be recorded. The availability of a transformation roadmap derived from a simple and effective stand inventory would provide a valuable tool to guide and instil confidence among managers and owners of private forests interested in adopting irregular silviculture (Vítková et al. 2014).

Most inventory protocols cited in the literature for irregular stands are designed for research purposes, are resource intensive and more suited to large organisations (Süsse et al. 2011, Cameron and Hands 2010). No recent studies have assessed the potential of alternative inventory protocols relevant to the transformation to CCF of private planted forests in Ireland, where relevant information (including stocking, species and DBH distribution) must be collected in an efficient manner to minimise costs. Therefore, the primary objective of this study was to compare three established inventory protocols (i.e. FCIN45, VISUAL and ISN) in terms of the types of data outputs, efficiency of data collection and inventory time-costs. Each protocol was assessed with reference to CCF management in private forests and their effectiveness as a tool for monitoring changes in stand structure, regeneration and productivity over time. Control of management costs is a key consideration for private forest owners, and each protocol was measured in terms of time-cost to deliver key inventory data, under common site conditions. As this study focuses mainly on monitoring the restructuring of plantations through late stage 1 and early stage 2, volume and increment calculations will not be discussed in detail.

Methods and materials

Inventory Protocols

In total, four inventories were undertaken at the study site. A 100% enumeration of the research site was necessary as a basis to compare the performance of each of the selected inventories. Details of each protocol are as follows and are summarised in Table 2.

100% Enumeration

Complete enumeration, also known as "*Method du Controlle*" or Check Method, was introduced in Switzerland and continental Europe during the 19th century to monitor forest structure and growth in irregular stands (Knuchel 1953, Poore 2004). It involves recording diameter and species, plus other relevant data, for each tree within a stand

Table 2: *Comparison of execution protocol for FC45, VISUAL and ISN.*

	FCIN45	VISUAL	ISN
Plot type	Eight-meter fixed-radius.	Combination of a fixed 15-m radius plot and point sampling using relascope.	Combination of fixed 10-m radius plot and point sampling but measuring DBH for trees and poles within limiting distance from the plot centre.
Plot set up	Place vertex transponder in each of the plot centre. Place markers at north, south, east, west 8 m from centre using Vertex to measure distance. The markers will serve as plot demarcation.	Place vertex transponder in each plot centre. Demarcate a circular plot by placing 4 markers at north, east, south and west, 15-m from plot centre. Measure distances with Vertex. The markers serve as rough plot demarcation.	Place vertex transponder in each plot centre. Demarcate 10-m circular plot by placing 4 markers at north, east, south and west 10-m from plot centre. Measure distances with Vertex. The markers will serve as rough plot demarcation.
Tree sampling	Starting from the north marker and moving clockwise measure one DBH (east-west direction) for each tree, record species, visually assess crown and stem class and measure height of the largest DBH tree in the plot.	Take a relascope sweep using prism basal area factor 2. For each tree, visually estimate which broad diameter class it belongs to and enter relascope count in the appropriate column in a pre-prepared spreadsheet form using the datalogger. Do not count poles (stems <17.5 cm DBH). Starting a second time from the north marker and moving clockwise within the 15-m fixed plot for each tree, record species, visually assess crown and stem class and measure height (Vertex) and DBH of the largest DBH tree in the plot.	Starting from the 0 grads marker and moving clockwise measure DBH for each medium and large tree within limiting distance. At the selected basal area factor (BAF) 2, the max distance (m) for a tree to be included can be calculated by dividing the tree DBH (cm) by 2.83. Also, the Vertex has a BAF inbuilt function that instantly calculates and displays the minimum diameter each tree needs to be (at the selected BAF and measured distance) to be included. For each "in" tree, record the following: distance (Vertex) and bearing (Suunto), two DBH (first one parallel with the bearing, second one perpendicular to the bearing), species, visually assess crown and stem class and measure height of the largest DBH tree in the plot. All small trees (DBH 17.5-27.49 cm) are to be measured in the same way as medium-large trees but within the fixed-10-m radius of a sub plot.
Pole sampling	In the same fashion as for trees, measure all poles DBH, record species and note any PFT (Potential Future Tree) pole.	With a third clockwise movement, in the 15-m plot, count all poles by species and note any PFT (Potential Future Tree) pole.	Together with small trees within the 10-m subplot, measure for all the poles the distance from centre, bearing and one DBH (perpendicular to the bearing). Record species and note any PFT (Potential Future Tree) poles.
Seedling/ sapling sampling	With a clockwise movement count, for each species, all seedlings and saplings present in the 8-m radius plot.	In the 15-m radius plot carry out "walk-over survey" and visually assess all seedlings and saplings by allocating density classes for each species.	Starting from the 0 grads marker and with a clockwise movement, for all species count all seedlings and saplings in the three 1.5-m radius sub plots (see Figure 4).

and it is repeated at regular intervals. Due to the time and resource requirements of complete enumeration, alternative statistical sampling methods have been widely adopted.

Protocol 1: FCIN45

This sampling protocol was developed by Kerr et al. (2002, 2003) for use in plantations in transformation to CCF, hereafter called "FCIN45". It proposes a systematic grid of fixed area circular plots (either permanent or temporary) in order to capture species, tree DBH classes, natural regeneration and comes with associated MS Excel-based software to compute and compare current DBH distribution against an "ideal" reverse J-curve distribution. Stems in excess of ideal distribution can then be identified for future removal.

Protocol 2: VISUAL

This sampling protocol was devised by France and Belgium forestry researchers (Lejeune et al. 2005, Sanchez and Van Driessche 2016) for repeated surveys of irregular broadleaved stands based on a combination of permanent point-sampling and permanent fixed-radius plots. Point sampling makes use of a relascope and was first developed by Walter Bitterlich in 1948 as an effective alternative to basal area estimates compared with the conventional method which involves measuring tree DBH within plots of known area (Matthews and Mackie 2006).

The novel approach of this protocol is that all variables are visually assessed using only a relascope, pre-determined dimension-classes and the operator's judgment. Basal area readings for trees are visually split between species and broad diameter classes, poles are counted, stem quality is visually graded and natural regeneration allocated into visual density classes. This protocol will be hereafter called "VISUAL".

Existing trials (Lejeune et al. 2005) indicate that, given a trained operator, the deviation between 100% enumeration and visual inventory, for measured variables, is reasonably low (around 10%). VISUAL comes with Excel worksheets that compute and compare basal area values for broad diameter classes against target values for different stand types. This gives an indication of future removals required to achieve a desired broad diameter-class distribution (Table 3).

Protocol 3: ISN

This protocol, launched in 2017, was proposed by a group of UK and Ireland researchers and practitioners under the name "Irregular Silviculture Network" (ISN) as an inventory and valuation tool for permanent irregular stands. This protocol will be hereafter referred to as "ISN". The protocol is intended for use by foresters and represents a simplified version of a more complex "AFI" protocol commonly used for research across Europe

Table 3*: Information gathered in the VISUAL spreadsheet to measure stand structural balance (Sanchez and Van Dressche 2016).*

Species	Basal area (m^2 ha^{-1})				
	Small trees	**Medium trees**	**Large trees**	**Very large trees**	**%**
Birch	3.90	0.85	0.15	0.00	28.3
Oak	0.70	0.95	2.45	0.95	29.2
Scots pine	2.65	2.05	0.45	0.00	29.8
Larch	0.00	1.00	0.10	0.00	6.4
Rowan	0.70	0.40	0.00	0.00	6.4
Total					100.0
Total BA (m^2 ha^{-1})	7.95	5.25	3.15	0.95	17.3
Basal area %	46	30	18	5	
Total typology	Overrepresented	Optimal	Underrepresented		
Ideal basal area structure	Small trees 10-25%	Medium trees 30-50%	Large + very large trees 45-75%		

to monitor performance of irregular stands for a range of forest types (Süsse et al. 2011). ISN uses a combination of point sampling and fixed-area permanent plots for measuring large and medium trees, poles and seedling classes. Within the point-sampling "plot", however, instead of a relascope sweep (as for VISUAL) diameters are measured for trees found within the limiting distance determined by the basal area factor selected. This intends to allow for an accurate capture of DBH and basal area class distribution, especially of the more valuable larger trees (as sampling probability is proportional to size). ISN comes with a sophisticated Excel field worksheet that computes all variables and presents them in summary form, including a financial valuation. Volumes are estimated by applying single entry volume tables in use in irregular stands in Europe. Standing timber value is assessed using inventory data and price–size curves. In the first inventory, "increments estimate" and "increase in value" are provisional estimates, based on initial productivity assumptions which, as repeated inventories are carried out, will be further refined.

Study site

The stand chosen for the comparison of inventory approaches comprised 3.9 ha and is part of a 60-ha private estate in Raheen, Co. Clare (Figure 1). The forest is located at 50-70 m elevation, with precipitation of 1,200 mm yr^{-1}, has a Brown Earth soil and a moderately sheltered location. Transformation toward a CCF-managed irregular stand was initiated in 2012 to meet the owner's dual objectives of timber production and biodiversity enhancement.

The stand was selected for study for four main reasons. First, it represents a rare transformation site, under active management and at stage 2. The most recent

Figure 1: *A view of the interior of the mixed coniferous and broadleaved species stand in transformation to CCF that was used for the study.*

intervention was in autumn 2015 with the selective removal of 82 m^3 ha^{-1}, mostly large saw-log of Sitka spruce (*Picea sitchensis* (Bong.) Carr.), to favour Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco), Scots pine (*Pinus sylvestris* L.), European larch (*Larix decidua* Mill.) and sessile oak (*Quercus petrea* (Matt.) Liebl.). Second, natural regeneration of desirable species was already taking place. Third, the stand was established as a mixed-conifer plantation in the 1970s with downy birch (*Betula pubescens* L.), sessile oak and other broadleaves encroaching through natural regeneration over time. This represents a likely future scenario for many currently young conifer plantations undergoing stage 1 transformation (authors' observation). Finally, the high diversity of tree species (both coniferous and broadleaved) and current stand structure were considered a suitable test for the robustness of each protocol.

Equipment

Two instruments were used during the assessment of each inventory protocol. These were selected following advice from several forestry consultants and based on a review of papers relating to irregular stand inventory (Lejeune et al. 2005, Poore 2007, ISN 2017, Süsse et al. 2011). A Haglof Vertex telemeter (Haglöf Sweden AB, Långsele, Västernorrland, Sweden) was used to measure distances up to 30 metres and tree heights (m). A manual calipers was used to measure DBH (cm). A waterproofed Apple iPad tablet computer (Apple Inc., Cupertino, California, USA) was selected for fieldwork, running a MS Excel spreadsheet (Microsoft Corporation, Redmond,

Washington, USA) designed for the project. A purpose-built datalogger was too expensive for the scale of the study and would be unlikely to be used by most forest managers or private forest owners.

Baseline enumeration

The stand boundary was walked and marked with paint, and starting from the eastern corner, the DBH for each stem ≥17.5 cm was measured. Each tree was then marked with white chalk to avoid missing/re-measuring trees. A team of two, a measurer and booker, consisted of one to use the calipers and telemeter while the other entered data directly into the tablet spreadsheet.

Plot sampling design

This study used a randomised systematic sampling layout of permanent plots, as recommended for field surveying of irregular stands by many authors (Lejeune et al. 2005, Poore 2007, ISN 2017, Süsse et al. 2011). Ten plot centres were established, with each protocol being tested at each location to allow for each protocol to be directly comparable.

It was decided to use 10 measurement plots as this was considered the most compatible with all three protocol designs as they could be fitted comfortably within the stand area without causing any plot to partially fall outside the stand or for "double sampling" due to plot overlap. The plots centres were permanently marked to allow re-measuring. This is particularly important when using a point sampling approach. Trees were divided into the broad diameter classes described in Table 4. Stem quality classes and live crown classes were defined and assessed visually. Basal area factor (BAF) 2 was selected for all protocols as this was considered optimal to sample 15-20 trees per plot (stocking was estimated at c. 245 trees ha^{-1} for trees ≥17.5 cm DBH) (Forestry Commission 2015). For each protocol, the parameters measured included: species; DBH or DBH class; stem and crown class; height of dominant tree; seedlings ha^{-1}; saplings ha^{-1}; poles ha^{-1}; canopy cover %.

Table 4: *Broad tree classes used for the study (ISN 2017).*

	DBH (cm)	Height (m)
Seedling	-	<1.5
Sapling	<7.5	≥1.5
Pole	≥7.5 and <17.5	
Small tree	≥17.5 and <27.5	
Medium tree	≥27.5 and <47.5	
Large tree	≥47.5 and <67.5	
Very large tree	≥67.5	

Information about these parameters is essential to inform management to meet transformation objectives. Plot layout followed that suggested in the ISN protocol which offered the most detailed and clear execution instructions (ISN 2017). A uniform grid of permanent plot centres was overlaid on the stand map and located in the forest using a starting point. To make sure no plots overlapped or fell outside the stand area, plot centres were located at twice the limiting distance of the largest tree. Assuming 80 cm was the largest tree's DBH and the selection of BAF 2, the minimum distance between plot centres was set at 56 m, and a 28-m-minimum distance from boundaries. Plot centres were identified using several tie points taken along the middle of the forest road using a Walktax distance measurer, ranging poles and Suunto compass to measure azimuth. Metal bars were inserted below ground at plot centres to allow relocation using a map, Walktax, Suunto and metal detector. A similar methodology has been used by the AFI network where plots are routinely relocated with ease 5 years later (Süsse et al. 2011, authors' observation). The measurement protocol for FCIN45, VISUAL and ISN is presented in Table 2 and a diagram describing the layout of the ISN plot is shown in Figure 2.

Fieldwork

It took 2.5 hours for one operator to locate and permanently mark the 10 plot centres; approximately 15 minutes per point location. It took 7.5 hours for a team of two to

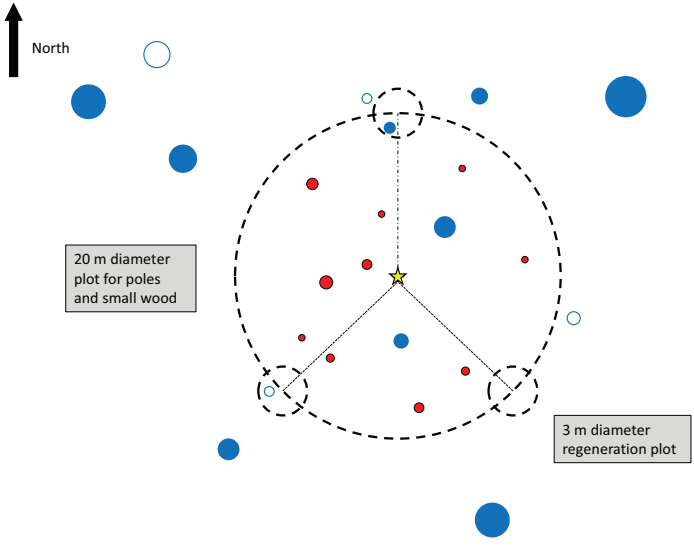

Figure 2: *Plot layout used for the ISN protocol. The red-filled circles represent small trees and poles measured within the 10-m fixed-radius plot, the blue-filled circle represent large/medium trees measured using a point-sampling approach. The three smaller plots were for surveying regeneration seedlings and saplings (ISN 2017).*

carry out enumeration. Complete enumeration was executed by two operators while the three sampling protocols were executed by one operator.

Statistical analysis

Three parameters were used to compare performance of the three protocols with results from 100% enumeration:

- stocking distribution for each broad diameter class for all species combined;
- basal area distribution for each broad diameter class for all species combined;
- variance of basal area between plots.

The first two parameters allowed the estimation of percentage deviation from true values (enumeration) by application of the Reynolds index (Re%; Equation 1). The third parameter allowed the calculation of plot variance and percentage error for the 10 plots and estimation of a likely total number of plots (N) needed to achieve precision of ±20% at 95% confidence level. This approach allowed direct comparisons of time-cost effectiveness between each protocol. Formulas for calculation of Reynold index and number of plots required for each protocol to achieve the same precision are presented below.

$$\text{Reynold index (Re\%)} = \frac{\text{sample estimate} - \text{enumeration measurement}}{\text{enumeration measurement}} \times 100 \quad [1]$$

$$\text{Number of plots required (N)} = \frac{t^2 \times CV\%^2}{E\%^2} \quad [2]$$

where:

$E\%$ = percentage error

t = statistical t (values of t are entered in an iterative process until N becomes stable)

$CV\%$ = coefficient of variation = $\frac{\sqrt{s^2}}{\text{mean}} \times 100$

s^2 = variance.

Results and Discussion

The study aimed to test three inventory protocols for assessing plantations at stage 2 transformation and to compare the cost effectiveness, ease of use and data outputs. It is the first study to address the needs of private forest owners engaged in transformation of planted forests to CCF in Ireland. Cost-effectiveness was measured as time-cost to deliver the same key inventory data, using the same permanent plot structure and with a precision of ±20%, at 95% confidence level. Summary of average execution time per plot for each protocol including plot centre location is presented in Table 5 and Figure 5. Results presented in Table 5 and 6 show that the VISUAL protocol was the most effective as it delivered the basic desired variables

Table 5: *Average execution times to complete a plot's measurement using each of the three protocols.*

Protocol	Plot centre location	Plot set up	DBH/ basal area	Crown & stem classes	Top height	Poles	Regeneration	Total
FCIN45	15min	2min 35s	4min 32s	3min 44s	2min 55s	3min 52s	4min 24s	37min 2s
VISUAL	15min	3min 42s	6min 55s	7min 39s	3min 7s	4min 2s	5min 30s	45min 57s
ISN	15min	5min 54s	30min 42s	7min 29s	3min 24s	14min 14s	4min 34s	81min 12s

Table 6*: Basal area distribution and stocking density results for each protocol showing Reynolds index (Re%) for each broad diameter classe and for total enumeration.*

	Small	Medium	Large	Very Large	Total
Basal area (m^2ha^{-1})					
ENUMERATION	**5.32**	**7.39**	**4.45**	**1.93**	**19.1**
FCIN45	**8.23**	**8.67**	**6.60**	**-**	**23.5**
Re%	*55*	*17*	*48*	*-100*	*23*
VISUAL	**6.8**	**8.3**	**3,6**	**1,3**	**20**
Re%	*28*	*12*	*-19*	*-33*	*4.7*
ISN	**6.8**	**7.1**	**4**	**1.2**	**19.2**
Re%	*28*	*-4*	*-10*	*-38*	*0.5*
Stocking ha^{-1}					
ENUMERATION	**148**	**75**	**18**	**4**	**245**
FCIN45	**240**	**70**	**25**	**-**	**335**
Re%	*62*	*-7*	*39*	*-100*	*37*
VISUAL	**170**	**75.4**	**13.8**	**2.8**	**262**
Re%	*15*	*1*	*-23*	*-30*	*7*
ISN	**193.9**	**74.8**	**17**	**2.7**	**288.4**
Re%	*31*	*0*	*-6*	*-33*	*18*

in the shortest time, with a low Reynold index of 4.7% and ease of execution. From Table 7 it can be seen that it would require c. 7 hours for one operator to carry out the VISUAL protocol with 9 permanent plots required to achieve a precision of ±20%, at 95% confidence level, in a highly variable stand with some challenging access (bramble patches). It is not envisaged that the typical private plantation in transformation will require more than 10 VISUAL plots (ISN 2017, Forestry Commission 2015, Sanchez 2017) or that it will present greater variability or a more challenging access than this study site. As a new inventory will be needed typically once every 4-6 years to instruct transformation management (Poore 2007, Süsse et al. 2011, Lejeane et al. 2005, Sanchez 2017), it is envisaged that the minimum time-cost for VISUAL would be in the region of 1 day for a trained operator for each felling cycle for the average private stand.

Table 7*: Plot statistics for the three mensuration protocols studied.*

	Plot	FCIN45	VISUAL	ISN
Basal area (m^2ha^{-1})	1	19	17	16
	2	10	18	14
	3	39	20	18
	4	42	17	15
	5	13	25	23
	6	34	30	31
	7	16	21	21
	8	17	10	10
	9	24	21	24
	10	21	21	20
	Average per ha	**23.5**	**20.0**	**19.2**
Variance		123.4	27.8	35.7
Standard deviation		11.1	5.3	6.0
CV %		47.3	26.4	31.1
E% (p=0.05)		34%	19%	22%
Plot number required at 20% error		24	9	11
Execution Time at 20% error		**14h 48min 48s**	**6h 53min 33s**	**14h 53min 12s**
Re %		*23*	*4.7*	*0.5*

100% Enumeration

Data were entered while in the forest into an Excel spreadsheet using the iPad. This approach (also adopted for FCIN45, VISUAL and ISN) provided an immediate graphic readout of the forest structure allowing for initial evaluation and saving of office time (Figure 3 and 4). It is of interest to note that the stand stocking histograms show, for the conifer portion, the typical DBH distribution expected for an even-aged plantation while, as a whole (naturally regenerating broadleaves and planted conifers together) the stand presents a "reverse J" curve DBH distribution associated with "equilibrium" irregular forests (Kerr 2002). Enumeration was only used to give baseline data and was not intended as an inventory protocol for testing. However, some consideration can still be made. Enumeration does not collect any essential information on natural regeneration, stem quality, crown classes, top height or canopy cover. It does prove to be effective and easy to execute for collecting very accurate data on species and DBH distribution. At approximately 15 man-hours to complete, it took twice the time needed for VISUAL and approximately the same as FCIN45 and ISN (Table 7) but produced a much-reduced data range. On the plus side it allowed the surveyor (in private management often the same person as the marker and forest manager) to "inspect" the site tree-by-tree and in this sense had a great stand-learning value. It is possible that for small sites (<5 ha) enumeration could be used as an inventory protocol as suggested by other authors (Poore 2004, ISN 2017) perhaps in association with transect sampling for collecting additional data.

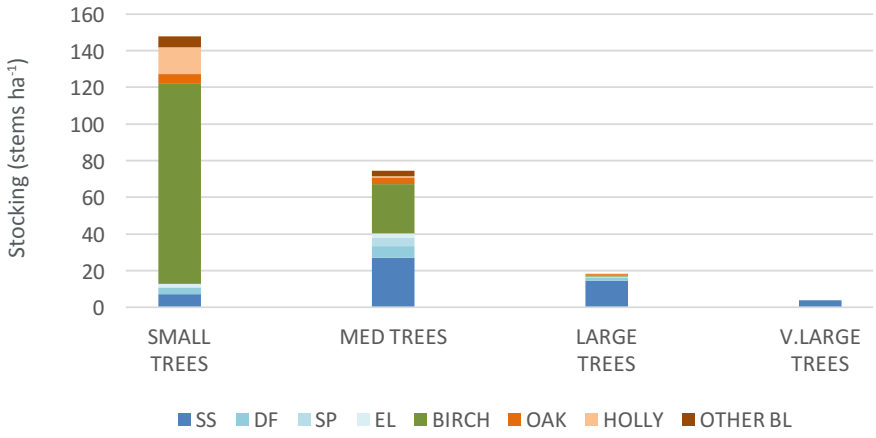

Figure 3: *Broad diameter classes distribution for the Raheen stand as measured by full enumeration.*

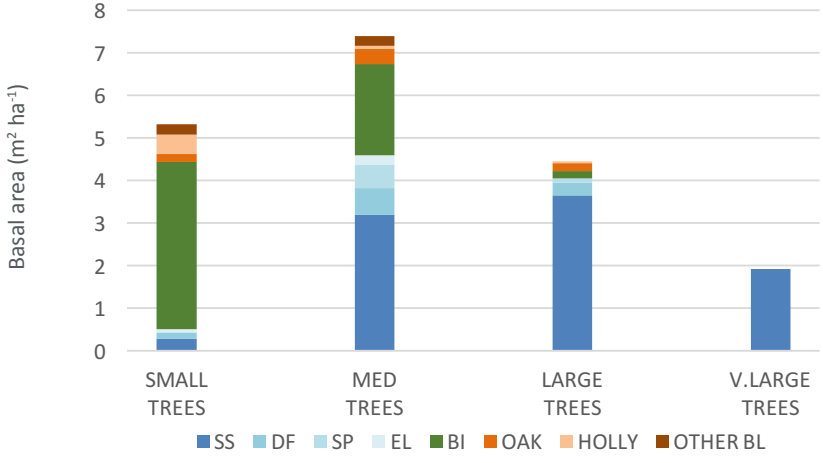

Figure 4: *Basal area distribution between broad DBH classes for the Raheen stand as measured by full enumeration.*

Protocol 1: FCIN45

Comparing execution time (at 20% error) in Table 7 and Reynold indexes in Table 6, it is evident that FCIN45 showed in this case poorer performance than VISUAL and ISN. This is probably because fixed-area plots proved less efficient at capturing irregular forest structure from stage 2 onward (Deffee 2015). In particular FCIN45 failed to capture any very large tree while it over-represented small trees in the stand (Reynold index 55%). Also, while having the same time-cost of ISN, FCIN45 offers less detailed information (no trees/poles bearing or distance from centre, one DBH

only for trees) and it currently does not allow for any financial valuation.

Protocol 2: VISUAL

As mentioned, this protocol proved the most time-efficient (lower Reynold index and execution time at 20% error) (Table 6 and 7) due to the use of a combination of point sampling/fixed plot approaches and due to the use of visual classes for quickly collecting stand data. It is important to note that VISUAL and ISN shared the same sample of trees for each plot in relation to basal area (VISUAL) and DBH (ISN) as both used the concept of limiting distance to select trees. In this sense VISUAL represents a quicker approximation of the true sample value measured by ISN. For comparison in this study the difference in Reynold index between ISN and VISUAL for broad diameter classes distribution is quite low (4.2%) and shows that, while there is a large time saving associated with the visual classes approach there is only a small difference in accuracy of results between the 2 systems. This is consistent with what has been found in previous trials (Lejeaune et al. 2005). However, the fact that VISUAL did not allow the estimation of 5-cm-DBH classes like ISN means that the economic analysis potential is greatly reduced especially in relation to value increment. Stand valuation and future economic performance analysis is not currently included in VISUAL and this represents a limitation. From an execution point of view, VISUAL proved to be the easiest to execute with the most challenging aspect being the adjudication required for borderline trees. However, while this method is not precise, the results show a good degree of accuracy when considering the broad diameter classes summary. It is expected that with experience visual selection of broad diameter classes will become increasingly more accurate.

Protocol 3: ISN

This protocol achieved good accuracy with low Reynold indexes for basal area (4%) and stocking (18%), but was the most time-costly. This is to be expected as it involves additional measurement compared to the other protocols. From Figure 5 it can be seen that much of the extra time-cost was accounted for in the collection of DBH and co-ordinates of trees and poles. It can be argued that this level of detail will be very useful in time for tracking each sample tree's growth for accurate calculation of increment and monitoring each tree's development. However, it will remain to be seen if, within the scope and scale of private plantation economics, such detailed monitoring will be affordable or necessary. Also, in relation to deriving accurate increment data over successive inventories it will be essential to store, over time, accurate records for each harvest removal and to ensure that DBH and other measurement conventions are adhered to over successive inventories. The ability of ISN software to provide stand valuation and future economic performance analysis

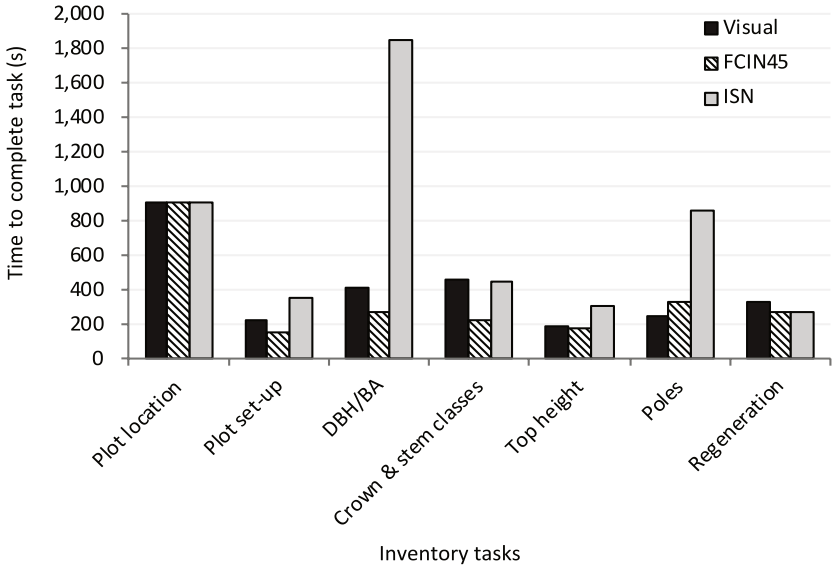

Figure 5: *Comparison of average execution time (in seconds) to locate, set up and measure a plot for each protocol.*

is certainly a very strong associated feature especially in respect of the ability to estimate annual value increment. However, this value relies at present on a number of productivity assumptions to be entered by the surveyor into the software and on single entry volume tables in use in continental Europe for irregular forest which will need further validation in Ireland. It will only be after repeat inventories that such assumptions can be verified, and a reliable value-increment figure could be produced for a range of CCF stands.

From an execution perspective ISN, as expected, was the most demanding especially for a single operator given the additional number of measurements involved. Ideally two operators would more comfortably carry out this protocol, but this would add further time-cost and reduce cost-effectiveness (Lejeaune et al. 2015, Sanchez 2017).

Conclusions

The VISUAL inventory protocol, due to the point sampling/fixed radius plot combination and the use of visual classes, resulted in the most time-efficient protocol which took the least amount of time to complete. This was estimated at 7 hours, for stage 2 to be inspected by one operator once every 4-6 years for inventory to monitor transformation of a typical privately-owned stand in Ireland. The methodology relied

on some simple electronic equipment and a semi-experienced operator. In its present form it lacks analytical software to process stand volume, increment, valuation and future economic performance. This could be developed with possible integration of the broader diameter classes distribution obtained in the VISUAL protocol into the ISN software to provide for volume, increment and economic parameter computing.

In summary, VISUAL in its current form is considered suitable to the scope, scale and budget of private forests in order to monitor transformation from the beginning of stage 2.

FCIN45 would be applicable up to late stage 1. As stand transformation progresses towards stage 3, each of the structural elements emerge (from seedlings, saplings, small-medium-large trees etc.) and the value of each timber harvest increases further, it is expected that ISN might become a more attractive protocol. It is also possible that ISN could be adopted at earlier stages if detailed information was required and where additional resources were available.

Over time, the development and use of these inventory protocols should help overcome a barrier to CCF transformation by providing detailed forest structure information that a forester can work with. This will help increase foresters' confidence in the "workability" of irregular forests. Ultimately, however, it will be the actual productivity performance of transformation management that will provide confidence to owners and saw millers.

The irregular silviculture of CCF has the potential to offer private forest owners an on-going steady flow of timber/income, increased stand resilience and the opportunity for adding value to their stands. As irregular silviculture is new to Ireland it is expected that an adaptive management approach will be required. With the regular application of cost-efficient monitoring protocols, it will be possible to monitor and review at each stage, to quickly learn from practice and progressively adjust management in order to achieve stable and diverse productive forests.

This study tested protocols in one stand only. This constitutes a limitation as tests carried out in a range of stands would provide more robust evidence to draw conclusions from. Therefore, further tests are recommended for greater validation.

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Recent findings on the native status and vegetation ecology of Scots pine in Ireland and their implications for forestry policy and management

Jenni R. Roche[a,b*]

Abstract

It has been generally accepted that Scots pine (*Pinus sylvestris* L.) became extinct in Ireland c. AD 400. The species was reintroduced in the mid-17th century and has been widely planted. It has been included in the Native Woodland Scheme, which provides grants to establish or restore native woodlands. However, its native status in Ireland has been disputed and the vegetation ecology and conservation value of Irish pinewoods have been poorly understood.

These knowledge gaps have been addressed using an approach combining vegetation ecology and palaeoecology. Vegetation surveys were conducted at eighteen pinewoods in Ireland and six in Scotland. Cluster analysis was used to evaluate the floristic similarity between plots and classify them into groups. One of the Irish pinewoods was of unknown origin (Rockforest, Co. Clare). To reconstruct its vegetation history, a sediment core was extracted from Rockforest Lough. Pollen, macrofossil and dating analyses were conducted.

Cluster analysis identified four groups, representing distinct pinewood vegetation types. The vegetation of certain Irish groups and sites exhibited similarities with that of extant native pinewoods elsewhere in oceanic north-west Europe or fossil assemblages from ancient Irish pinewoods. While the vegetation of Irish pinewoods did not correspond to that of typical Scottish Caledonian forests, Coronation Plantation and the bog pinewoods at Clonfinane and All Saints Bog exhibited strong similarities with other native Scottish pinewoods of high conservation value. Natural regeneration of *P. sylvestris* was poor overall.

The pollen diagram from Rockforest Lough showed a continuously high *Pinus* pollen frequency (38-51% of total terrestrial pollen) from c. AD 350 to the present. Macrofossil evidence demonstrated local presence of *P. sylvestris* around Rockforest Lough c. AD 840. The available historical sources indicated a long history of woodland cover at Rockforest. A separate analysis of a peat core from nearby Aughrim Swamp also showed a continuous *Pinus* signal from c. AD 350 to the present.

The findings of the vegetation analysis suggest that *P. sylvestris* woodlands are an important resource for Irish biodiversity, particularly given the country's low native woodland cover. The palaeoecological data indicate that native *P. sylvestris* persisted at Rockforest from c. AD 350 to the present. The hypothesis that *P. sylvestris* became extinct in Ireland is rejected.

[a] Department of Botany, Trinity College Dublin, College Green, Dublin 2.
[b] Present address: National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, 90 King Street North, Smithfield, Dublin 7.
[*] Corresponding author: Jenni.Roche@chg.gov.ie

These findings should inform evidence-based forest management and policy. They support the inclusion of *P. sylvestris* in the Native Woodland Scheme. In general, reintroduced *P. sylvestris* should be managed as a native species in Irish woodlands. The data presented should inform site and species selection.

The *P. sylvestris* population at Rockforest is of high conservation value but its rarity increases its extinction risk. It should be carefully managed and monitored and seed-sourcing must be compatible with the long-term viability of the population. Cooperation between forestry and nature conservation agencies is needed to ensure its continued survival and to develop opportunities for the restoration of native pinewoods in Ireland.

Keywords: Pinus sylvestris, *native status, vegetation ecology, palaeoecology, conservation.*

Introduction

Pinus sylvestris L. (Scots pine) is the most widely distributed pine species in the world (Vidaković 1991). Its native range covers c. 2,700 km north-south from northern Norway to southern Spain and 14,000 km east-west from Portugal to far eastern Russia (EUFORGEN 2009, Volosyanchuk 2002). *P. sylvestris* tolerates a very broad range of environmental conditions. It is found in many diverse habitats, forming stable vegetation communities on nutrient-deficient soils, indicating high competitive ability under these conditions. It acts as a pioneer species but is light-demanding and cannot tolerate heavy shade from other trees (Carlisle and Brown 1968). *P. sylvestris* forms habitats of high conservation value, including the Caledonian forests of Scotland, Boreal forests of the Western Taïga, lichen pine forests of Central Europe, Western Carpathian calcicolous pine forests of Eastern Europe and bog woodlands, which are all listed on Annex I of the Habitats Directive (92/43/EEC). It is one of the most commercially important forest trees (Volosyanchuk 2002), especially in northern Europe. Its timber is valued for its good strength to weight ratio. It is used particularly for construction and for furniture, pulp and paper (Houston Durrant et al. 2016).

Palaeoecological evidence indicates that *P. sylvestris* colonised Ireland by 10,500 cal BP (calibrated radiocarbon years before AD 1950)/8550 BC (Mitchell 2006), becoming an important component of certain habitats until a major decline began c. 4450 cal BP/2500 BC (Bradshaw and Browne 1987). It is believed to have been extirpated c. 1550 cal BP/AD 400 (McAulay and Watts 1961) and reintroduced in the mid-17th century (McCracken 1971). Earlier in the 20th century, extensive *P. sylvestris* plantations were established. More productive exotic species became favoured for commercial forestry after 1945 (O'Driscoll 1980). *P. sylvestris* now covers 7660 ha (1.1% of stocked forest area) (Forest Service 2017) and is naturalising.

Native pinewoods persisted in Scotland (Steven and Carlisle 1959). Some authors speculated that localised native *P. sylvestris* could persist in northern England (Edlin 1961, Turner and Hodgson 1981). Modelling indicates that this is bioclimatically plausible but further research is required (Manning et al. 2010). The apparent extinction of *P. sylvestris* in Ireland has long intrigued those with an interest in Ireland's natural history. As W.A. Watts (1984) stated,

> *Why a very widespread species living in many kinds of habitat from Algeria to north of the Arctic Circle should have failed to survive in Ireland is mysterious, especially as pine survives in Scotland in habitats similar to those from which it disappeared in Ireland. It is difficult to imagine any form of burning or exploitation which would cause complete extinction. Further, planted pines thrive today in Ireland and invade natural habitats readily. The problem is a challenging and interesting one deserving further study.*

Due to its extirpation and reintroduction, the native status of *P. sylvestris* in Ireland has been disputed. Relevant conservation and forest management policies are sometimes inconsistent. The Native Woodland Scheme (NWS) provides grants to plant *P. sylvestris* when establishing or restoring native woodland (Forest Service 2001) while the Irish Peatland Conservation Council considers it an invasive non-native species (Malone and O'Connell 2009). This highlights the need for clarification on the native status of *P. sylvestris* and the implications of its reintroduction for biodiversity conservation.

Recent research (McGeever and Mitchell 2016, Roche 2010, Roche et al. 2009, Roche et al. 2015, Roche et al. 2016, 2018) has partly addressed these knowledge gaps. This paper aims to provide a synthesis of this research on the vegetation ecology and native status of *P. sylvestris* in Ireland and to discuss implications for forest management and policy. Previously unpublished data on regeneration of *P. sylvestris* are presented.

Materials and methods

Vegetation ecology

Twenty stands were selected at eighteen Irish sites, comprising mature stands dominated or co-dominated by *P. sylvestris* and reasonably free of non-native or invasive species. Stands of planted, naturalised and unknown origin were included. For comparison, seven stands were selected at six native Scottish pinewood sites of high conservation value: five in Special Areas of Conservation (SACs) designated for the Annex I priority habitats Caledonian forest or Bog woodland and one in a Site

of Special Scientific Interest (Glen Loy) containing a distinct genetic mitotype of *P. sylvestris* (Sinclair et al. 1998) (Figure 1a, b, Table 1).

Sites were surveyed from May-September 2006 and April-August 2007, using the method described by Roche et al. (2009). A circular 400 m^2 plot was subjectively placed, using the relevé method, to represent each vegetation type. Slope, altitude and structural data (species, Diameter at Breast Height (DBH), height, crown position

Table 1: *Location (Figure 1) and cluster analysis group (Figure 3) of the 27 survey plots.*

Plot number	Plot name	County/Region	Country	Grid references
Group 1				
I1	Dale Wood	Kerry	Ireland	V 88181 80714
I5	Glengarriff	Cork	Ireland	V 90894 56831
I7	Glenfarne	Leitrim	Ireland	H 02059 39747
I10	Derrycrag I	Galway	Ireland	R 73616 99077
I11	Derrycrag II	Galway	Ireland	R 73652 99029
I14	Torc	Kerry	Ireland	V 96482 83719
I18	Vale of Clara	Wicklow	Ireland	T 17212 92127
Group 2				
I2	Clonfinane Bog	Tipperary	Ireland	M 98815 03715
I6	All Saints Bog	Offaly	Ireland	N 01203 11216
S22	Glen Loy	Highland	Scotland	NN 09495 84288
S23	Glen Affric	Highland	Scotland	NH 19283 22800
S24	Beinn Eighe	Highland	Scotland	NH 00351 64685
S25	Abernethy I	Highland	Scotland	NH 96226 17443
S26	Abernethy II	Highland	Scotland	NH 97612 17191
S27	Black Wood of Rannoch	Perth & Kinross	Scotland	NN 56968 56176
Group 3				
I3	Rockforest	Clare	Ireland	R 34755 95013
I8	The Scalp	Dublin	Ireland	O 21719 20093
I13	Rockvale	Clare	Ireland	R 38955 98090
I19	Ballykine I	Mayo	Ireland	M 10849 57328
I20	Ballykine II	Mayo	Ireland	M 10657 57113
Group 4				
I4	Priest's Leap	Cork	Ireland	V 98853 59132
I9	Coronation Plantation	Wicklow	Ireland	O 09708 12792
I15	Knockastakeen	Tipperary	Ireland	R 93807 27204
I16	Trooperstown	Wicklow	Ireland	T 15932 96721
I17	Derrybawn	Wicklow	Ireland	T 12365 96360
S21	Cona Glen	Highland	Scotland	NM 97238 71210
Excluded outlier				
I12	Portumna Forest Park	Galway	Ireland	M 82680 03320

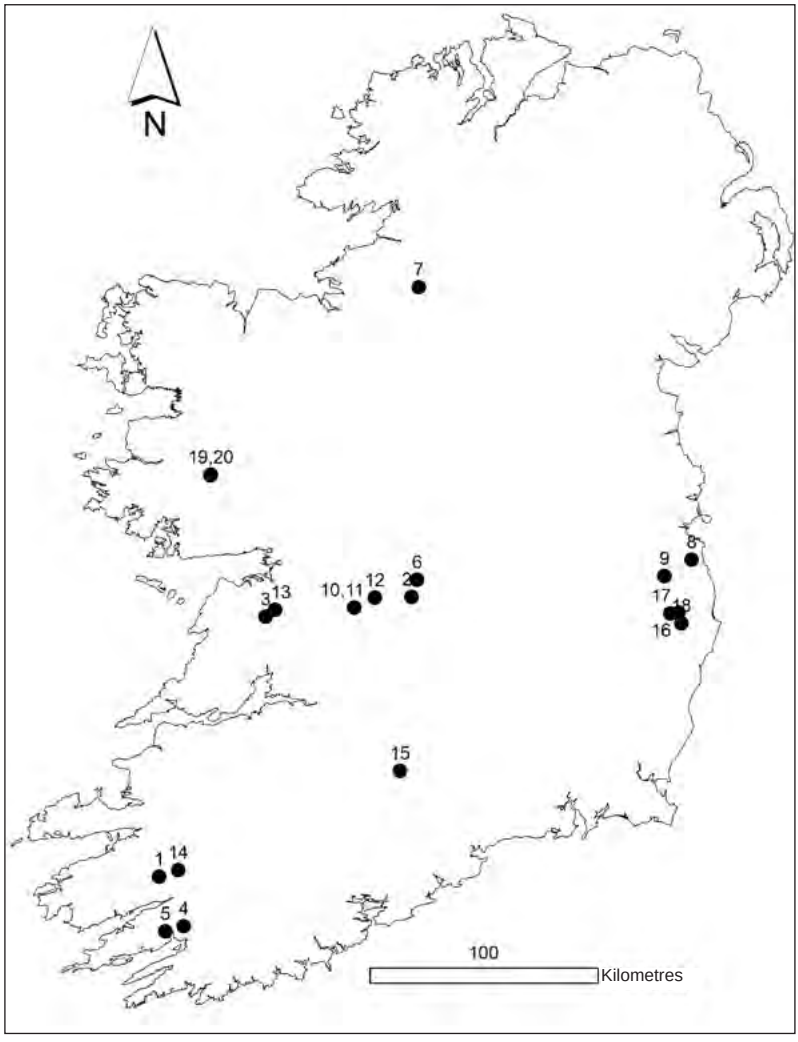

Figure 1a: *Location of the plots in Ireland (as listed in Table 1).*

and condition of trees of DBH ≥7 cm) were recorded. The species and number of stems of DBH <7 cm were recorded and categorised as follows: <25 cm (seedlings), 26-100 cm, 101-200 cm (saplings), 201-400 cm, >400 cm (poles). Grazing levels were assessed after Perrin et al. (2008). Five 2 m × 2 m quadrats were recorded, at the centre and cardinal points of the plot. Vascular plant cover was recorded on the Domin scale. Bryophyte data were recorded on a presence/absence basis. In total, 27 plots and 135 quadrats were recorded. Five 10 cm-deep soil samples were taken from each quadrat and bulked in the field. Soil pH was measured in the laboratory using a WTW pH 330 meter and combination electrode. Soil organic content was inferred from loss on ignition at 550 ºC using a Thermolyne Type 6000 furnace.

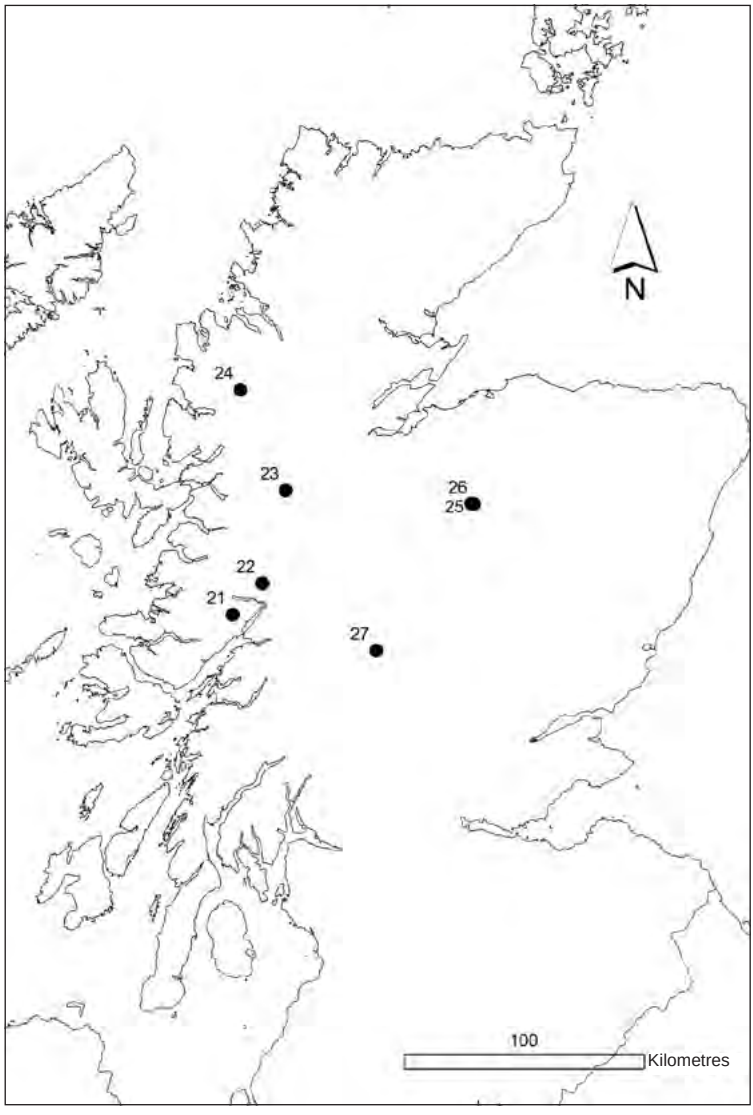

Figure 1b: *Location of the plots in Scotland (as listed in Table 1).*

Data preparation followed Roche et al. (2015). Multivariate analyses were conducted using PC-ORD 5 (McCune and Mefford 2005). Plot I12 (Portumna Forest Park) was identified as an outlier by Outlier Analysis and excluded from further analysis. Hierarchical, agglomerative, polythetic cluster analysis techniques were used for classification. Sørensen's (Bray-Curtis) distance measure was used with the Flexible Beta linkage method ($\beta = -0.25$). The similarity of plots was assessed by their grouping on the dendrogram. A Spearman Rank correlation was calculated

to determine if a statistically significant relationship existed between *P. sylvestris* regeneration levels and canopy cover or grazing levels.

Native status

Rockforest Lough (Irish Grid Reference R 356 953) is located 10 km north-east of Corofin in the Burren, Co. Clare (Figure 2). It is a permanent lake, c. 8 ha in area and lies at 16 m above sea level on karstic Carboniferous limestone. At Shannon Airport, Co. Clare, annual mean air temperature is 10 °C and mean rainfall is 1,400-1,600 mm (1981-2010). The prevailing winds (1946-2010) are south-westerly (Walsh 2012). Rockforest pinewood (site of plot I3) is located c. 500 m to the south-west and was formerly part of the Rockforest Estate. The woodland is located in the state-owned Burren National Park and the East Burren Special Area of Conservation, which is protected under the Habitats Directive.

Pollen, macrofossil and dating analyses were conducted on a core which was taken from Rockforest Lough on 18-19 June 2008 using the method described by Roche (2010) and Roche et al. (2018). Pollen extraction and identification followed standard methods (Moore et al. 1991). A minimum of 400 identifiable terrestrial pollen and spores were counted from each sample. A percentage pollen diagram

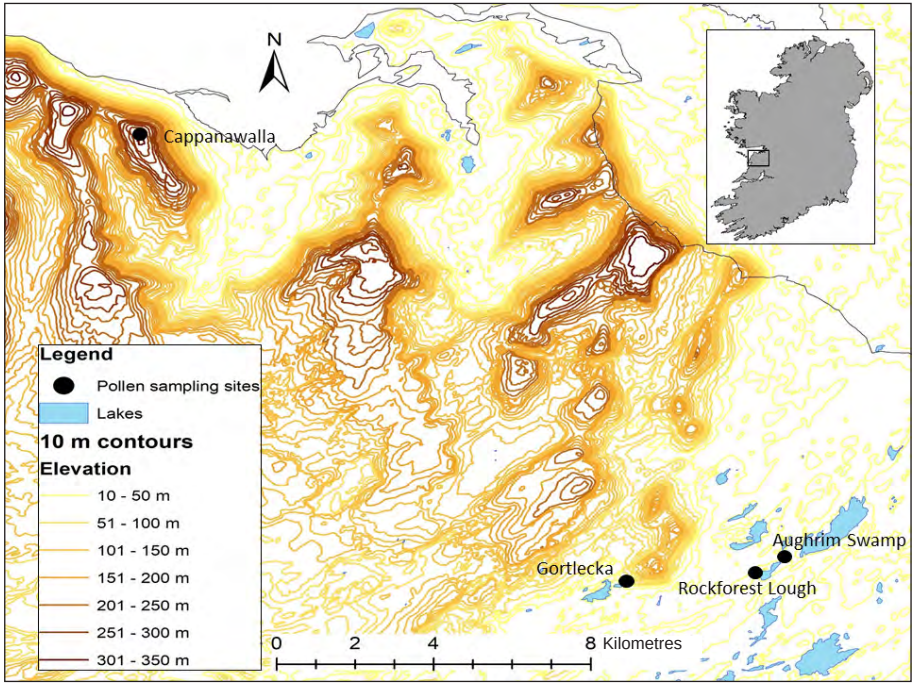

Figure 2: *Location of Rockforest Lough and other pollen sampling sites mentioned.*

was produced using TILIA V2.0.19 (Grimm 1991). The pollen sum calculation was total terrestrial pollen and spores, including indeterminate grains. The latter were included to reduce overestimation of *Pinus* abundance as, with its distinctive appearance, its pollen was unlikely to be indeterminate.

Terrestrial plant macrofossils were hand-picked or sieved from the sediment to avoid the hard-water effect i.e. overestimation of age when the material to be dated originates underwater and contains bicarbonate derived from old, inert sources e.g. limestone bedrock (Shotton 1972). Samples were radiocarbon-dated using accelerator mass spectrometry (AMS). Spheroidal Carbonaceous Particle (SCP) extraction followed a method adapted from Rose (1990, 1994). SCPs, produced from fossil fuel combustion and preserved in lake sediments, provide a historical record of atmospheric pollutant deposition. SCP concentration profiles are consistent and often regionally characteristic such that the main profile features can be used for sediment dating. A chronology was generated using Bchron (V3.1.4 with the IntCal13 calibration curve) (Haslett and Parnell 2008).

Results

Vegetation ecology

Cluster analysis produced four reasonably well-defined groups (Figure 3, Table 1). The dendrogram reveals the hierarchical structure of these groups and the level of floristic similarity among plots. Groups 1 and 3 contained Irish plots only,

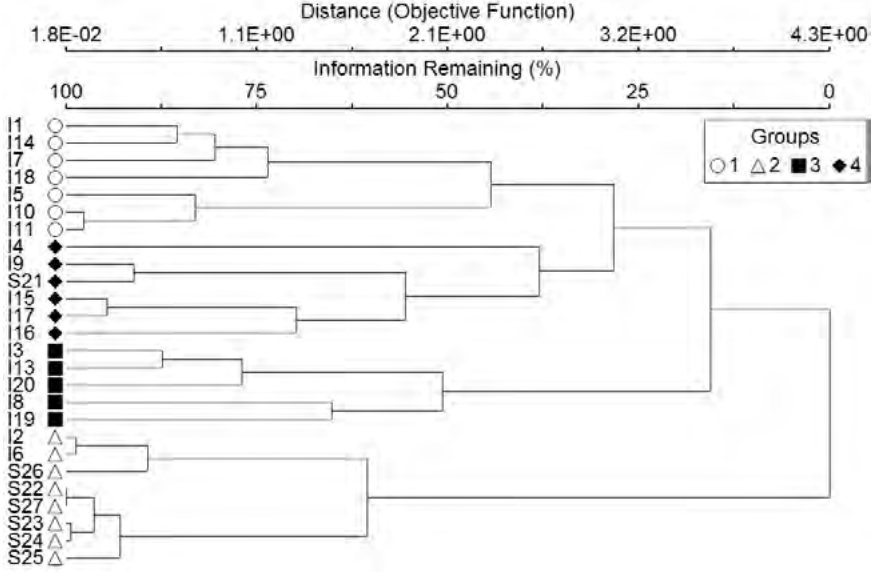

Figure 3: *Cluster dendrogram of the plots listed in Table 1, labelled with four groups.*

while Groups 2 and 4 contained both Irish and Scottish plots. The Irish plots I2 (Clonfinane Bog), I6 (All Saints Bog) and I9 (Coronation Plantation) showed the highest similarity to Scottish plots.

Table 2 summarises the environmental, structural and floristic characteristics of the groups. It follows the standard format of the British National Vegetation Classification (NVC; Rodwell 1991) with species frequency and abundance values arranged in columns. Frequency refers to how often a species is found across plots and is denoted by Roman numerals (I = 1-20%, II = 21-40%, III = 41-60%, IV = 61-80%, V = 81-100%). Abundance refers to the cover of a species within a plot. The range of abundance is denoted in brackets by values on the Domin scale (+ = <1%, 1 = 1-4% few individuals, 2 = 1-4% several individuals, 3 = 1-4% many individuals, 4 = 5-9%, 5= 10-24%, 6 = 25-32%, 7 = 33-49%, 8 = 50-74%, 9 = 75-94%, 10 = 95-100%). Species are sorted into blocks according to their pattern of occurrence among the groups. Constant species have an overall frequency of IV-V. General associates have an overall frequency of I-III with no marked affiliation to any group. Preferential species are more frequent in one group. Differential species are exclusive to one group. For brevity, species with low frequency and abundance (not exceeding I and 3, respectively, in any group) were omitted.

P. sylvestris regeneration (DBH <7 cm) occurred in only eight plots (29.6% of plots) (Table 3). *P. sylvestris* regeneration levels had no statistically significant correlation with canopy cover (r = -0.268) or grazing levels (r = -0.054).

Native status

The sediment core from Rockforest Lough comprised homogeneous brown algal mud. Macrofossils were scarce; a *P. sylvestris* needle and wood fragment were found at 66 and 153 cm depth respectively (Table 4). The SCP record began at 13 cm. A rapid increase and sub-surface peak appeared at 8 cm and 7 cm respectively (Figure 4). Based on mean dates from Irish SCP profiles (Rose et al. 1995), these features were assigned to the 1880s, 1960s and 1981 respectively (Table 4). A second rapid increase at 4 cm was assigned to 1985, when Moneypoint Power Station, c. 50 km to the south-west, was commissioned. The age-depth model excluded an anomalously old AMS date from bulked organic material at 72-74 cm. The chronology is well-constrained in the upper metre but less so below as fewer dates were obtainable (Table 4, Figure 5). Sediment accumulation was relatively constant in the upper metre (0.7 mm yr^{-1}) but much lower below (0.1 mm yr^{-1}). Pollen analysis was confined to the upper 112 cm due to increased uncertainty in the chronology below the AMS date at 104-107 cm.

Table 2: *Synoptic table of floristic, environmental and structural data (± standard deviation unless otherwise stated) for groups derived by cluster analysis (Figure 3).*

Groups	1		2		3		4		Overall	
Number of plots	7		8		5		6		26	
Mean species richness	28.7 ± 10.8		19.5 ± 4.9		47.2 ± 15.1		29.5 ± 8.0		29.6 ± 13.4	
Mean altitude (m)	89.9 ± 48.7		157.0 ± 95.5		45.8 ± 58.7		225.7 ± 81.9		133.4 ± 96.4	
Mean slope (degrees)	13.1 ± 11.3		5.5 ± 7.2		7.6 ± 12.5		15.5 ± 8.3		10.3 ± 10.1	
Mean soil pH (0-10 cm)	3.53		3.63		4.40		3.72		3.70	
Mean soil organic content (%)	67.3 ± 26.8		80.6 ± 29.6		47.7 ±22.1		51.5 ± 29.4		64.0 ± 30.4	
Mean stocking density (trees ha^{-1})	1042.9 ± 564.9		553.1 ± 396.7		585.0 ± 540.4		462.5 ± 275.6		670.2 ± 487.5	
Mean canopy height (m) ± SE	17.3 ± 4.3		13.9 ± 5.8		10.3 ± 7.0		15.7 ± 3.3		14.5 ± 5.5	
Mean canopy cover (%)	56.2 ± 10.5		43.5 ± 7.5		35.5 ± 14.9		44.8 ± 8.4		45.7 ± 12.1	
Constant species										
Pinus sylvestris	V	(5-8)	V	(6-8)	V	(4-7)	V	(7-8)	V	(4-8)
Vaccinium myrtillus	V	(1-7)	V	(2-8)			V	(4-8)	IV	(1-8)
Calluna vulgaris	III	(1-3)	V	(5-8)	III	(4-5)	IV	(+-5)	IV	(+-8)
Pteridium aquilinum	IV	(+-5)	II	(1-6)	III	(3-5)	V	(+-7)	IV	(+-7)
Sorbus aucuparia	V	(1-5)	III	(+-3)	II	(1-2)	V	(+-5)	IV	(+-5)
General associates										
Blechnum spicant	V	(+-4)	I	(1)			V	(+-3)	III	(+-4)
Oxalis acetosella	III	(2-4)			I	(5)	III	(2-4)	II	(2-5)
Deschampsia flexuosa			III	(+-3)	I	(1)	III	(4)	II	(+-4)
Quercus × rosacea	I	(5)					I	(6)	I	(5-6)
Hymenophyllum wilsonii	I	(3)					I	(3)	I	(3)
Quercus robur	II	(3-4)			II	(1-5)			I	(1-5)
Fagus sylvatica	I	(3)			I	(1)			I	(1-3)
Agrostis canina	I	(1)			II	(+)	II	(1-3)	I	(+-3)
GROUP 1										
Preferential species										
Ilex aquifolium	V	(1-8)			III	(1-5)	II	(1-2)	III	(1-8)
Quercus petraea	V	(+-6)			I	(4)			II	(+-6)
Betula pubescens	V	(+-5)	II	(5-6)	I	(5)	II	(+-4)	III	(+-6)
Luzula sylvatica	III	(3-7)					II	(+-1)	II	(+-7)
Polypodium vulgare	III	(+-1)			II	(+-1)			I	(+-1)
Dryopteris dilatata	II	(1-3)			I	(4)			I	(1-4)
Differential species										
Rhododendron ponticum	III	(+-2)							I	(+-2)
GROUP 2										
Differential species										
Vaccinium vitis-idaea			IV	(1-6)					II	(1-6)
Erica tetralix			IV	(+-4)					I	(+-4)
Empetrum nigrum			IV	(+-3)					I	(+-3)
Eriophorum vaginatum			II	(4-6)					I	(4-6)
Andromeda polifolia			II	(1)					I	(1)
Vaccinium oxycoccus			II	(1)					I	(1)

GROUP 3										
Preferential species										
Corylus avellana	I	(2)			V	(4-8)			II	(2-8)
Hedera helix	III	(+-4)	I	(+)	V	(3-5)	III	(+)	III	(+-5)
Lonicera periclymenum	III	(+-4)			V	(1-4)	I	(1)	II	(+-4)
Rubus fruticosus agg.	III	(+-4)	II	(+-1)	V	(1-4)	I	(1)	III	(+-4)
Festuca ovina	I	(1)	I	(+)	IV	(1-5)	II	(+-4)	II	(+-5)
Crataegus monogyna					IV	(+-5)	I	(+)	I	(+-5)
Anthoxanthum odoratum	I	(+)	I	(1)	IV	(+-2)	II	(1-7)	II	(+-7)
Viola riviniana/reichenbachiana	I	(2)			IV	(+-1)	II	(+-1)	II	(+-2)
Differential species										
Fraxinus excelsior					IV	(2-6)			I	(2-6)
Teucrium scorodonia					IV	(1-4)			I	(1-4)
Brachypodium sylvaticum					IV	(+-4)			I	(+-4)
Prunus spinosa					III	(2-4)			I	(2-4)
Fragaria vesca					III	(+-3)			I	(+-3)
Rosa spinosissima					III	(+-3)			I	(+-3)
Succisa pratensis					III	(+-2)			I	(+-2)
Sesleria caerulea					II	(4-5)			I	(4-5)
Rubus saxatilis					II	(4)			I	(4)
Geranium sanguineum					II	(2-3)			I	(2-3)
Geranium robertianum					II	(1)			I	(1)
Carex flacca					II	(1)			I	(1)
Thymus polytrichus					II	(+-3)			I	(+-3)
Lotus corniculatus					II	(+-2)			I	(+-2)
Hypochaeris radicata					II	(+-1)			I	(+-1)
Potentilla sterilis					II	(+-1)			I	(+-1)
Arum maculatum					II	(+)			I	(+)
Epipactis helleborine					II	(+)			I	(+)
Hypericum pulchrum					II	(+)			I	(+)
Taraxacum agg.					II	(+)			I	(+)
Filipendula ulmaria					I	(4)			I	(4)
GROUP 4										
Preferential species										
Galium saxatile	I	(+)					V	(+-4)	II	(+-4)
Molinia caerulea	II	(1-5)	II	(1-3)	I	(5)	III	(4-9)	II	(1-9)
Agrostis capillaris	II	(1)			II	(+-5)	III	(3-4)	II	(+-5)
Potentilla erecta	II	(+-1)	I	(+)	II	(1)	III	(1-3)	II	(+-3)
Betula pendula			I	(5)			II	(3-4)	I	(3-5)

Table 3: *Number of* Pinus sylvestris *stems of DBH <7 cm, where present in survey plots, categorised by height class (cm).*

Plot number	Site name	<25	26-100	101-200	201-400	>400	Total
Group 1							
I10	Derrycrag I					1	1
I11	Derrycrag II	1					1
Group 2							
I6	All Saints Bog		6	13	21	12	52
S25	Abernethy I		18	4	2	2	26
S26	Abernethy II	5					5
Group 3							
I3	Rockforest	1	1				2
I13	Rockvale				1		1
I20	Ballykine II	1	14	16	9	1	41

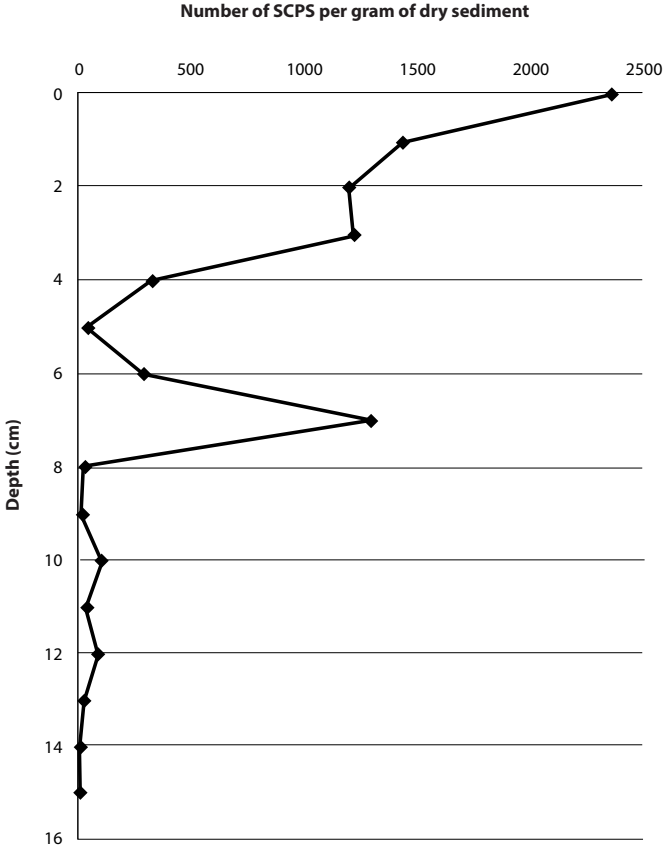

Figure 4: *Rockforest Lough Spheroidal Carbonaceous Particle (SCP) concentration profile.*

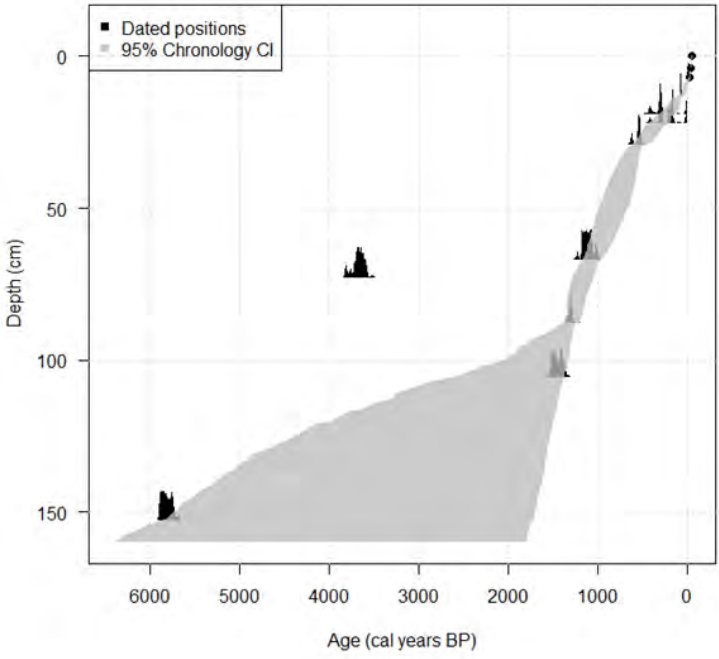

Figure 5: *Bchron age-depth model for Rockforest Lough, showing the 95% confidence interval, based on dates given in Table 4.*

The pollen diagram (Figure 6) spans from c. 1600 cal BP/AD 350 to the present. Arboreal pollen dominates throughout, ranging from 54.6-73.0%. The *Pinus* signal is continuously high, never less than 38.2%. Maximum values occur at the base of the profile (51.3%). *Corylus* is a significant component throughout. *Fagus* appears in the upper half of the profile. Gramineae dominate the non-arboreal component, gradually increasing from 3.5-10.3%. A discontinuous Cerealia signal is present. Common names of taxa are given in Figure 6.

Discussion

Vegetation ecology

Cluster analysis of the Scottish and Irish plots identified four distinct groups, which are summarised and discussed in relation to the NWS Framework (DAFM 2018). The vegetation of Irish pinewoods was described by Roche et al. (2009) and compared with native pinewoods elsewhere in oceanic north-west Europe by Roche et al. (2015).

Group 1 was composed entirely of Irish plots (Table 1) of planted origin. These were classified by Roche et al. (2009) as *Vaccinium myrtillus-Ilex aquifolium*, an acid pine-oak woodland type. They tended to occur on sloping terrain, on soils with a low mean pH (3.53) and reasonably high mean organic content (67.3%).

Table 4: *Spheroidal Carbonaceous Particle (SCP) and Accelerator Mass Spectrometer (AMS) dates from Rockforest Lough.*

Core	Depth (cm)	Laboratory reference	Sample description	^{14}C year BP[1]	Calendric age (AD)	IntCal 2.5% (cal year BP)	IntCal 50% (cal year BP)	IntCal 97.5% (cal year BP)
			SCPs					
RFB	4	-	2nd rapid increase	-	1985	−9	−37	−35
RFB	7	-	Sub-surface peak	-	1981 ± 2	−36	−30	−24
RFB	8	-	Rapid increase	-	1965 ± 5	−2	0	2
RFB	13	-	Start of record	-	1885 ± 5	92	10	108
			Macrofossils					
RFB	19	Beta-247933	Wood	240 ± 40	-	2	284	423
RFB	22	Beta-247934	Plant material	230 ± 40	-	2	264	418
RFB	29	Beta-247935	Wood	520 ± 40	-	508	538	631
RFB	66–68	Beta-252787	Plant material	1180 ± 40	-	989	1107	1229
RFC	72–74	Beta-252788	Organic material	3410 ± 50	-	3511	3662	3819
RFC	88	Beta-253480	Plant material	1380 ± 40	-	1198	1300	1359
RFC	104–107	Beta-252790	Plant material	1540 ± 40	-	1347	1438	1522
RFC	153	Beta-252791	*Pinus* wood	5050 ± 40	-	5676	5814	5898

Diversity was relatively low, with a mean species richness of 28.7. Typical species included *P. sylvestris, Quercus petraea, Betula pubescens, Sorbus aucuparia, Ilex aquifolium, Vaccinium myrtillus* and *Blechnum spicant*. The highly invasive non-native *Rhododendron ponticum* was a differential species, occurring exclusively within Group 1. Structurally, the plots were relatively tall and dense, with the highest mean stocking density (1042.9 trees per ha), canopy height (17.3 m) and canopy cover (56.2%) in the dataset (Table 2). *P. sylvestris* regeneration was poor; single individuals were recorded in I10 and I11 (Derrycrag I, II) (Table 3). *P. sylvestris* is light-demanding and sensitive to grazing and browsing (Carlisle and Brown 1968) so the statistically insignificant correlation between regeneration levels and canopy cover or grazing levels was unexpected. It may be due to the high proportion of zero values (70.5% of plots) in the regeneration data. As the plots were located beneath the canopy, shading may have impeded regeneration. Grazing and browsing may also have checked regeneration but the inconclusive correlation analysis prevented further exploration of the relationships between these variables.

Notwithstanding the dominance of *P. sylvestris* in the canopy, the vegetation of Group 1 is similar to the acidophilous oakwoods of the WL1 *Quercus petraea-Luzula sylvatica* group of the Irish Vegetation Classification, which corresponds to the Annex I habitat Old sessile oakwoods (NBDC 2019). Indeed, before 2000-1500 years ago certain Irish Atlantic oakwoods comprised mixed pine-oak woodland. High spatial

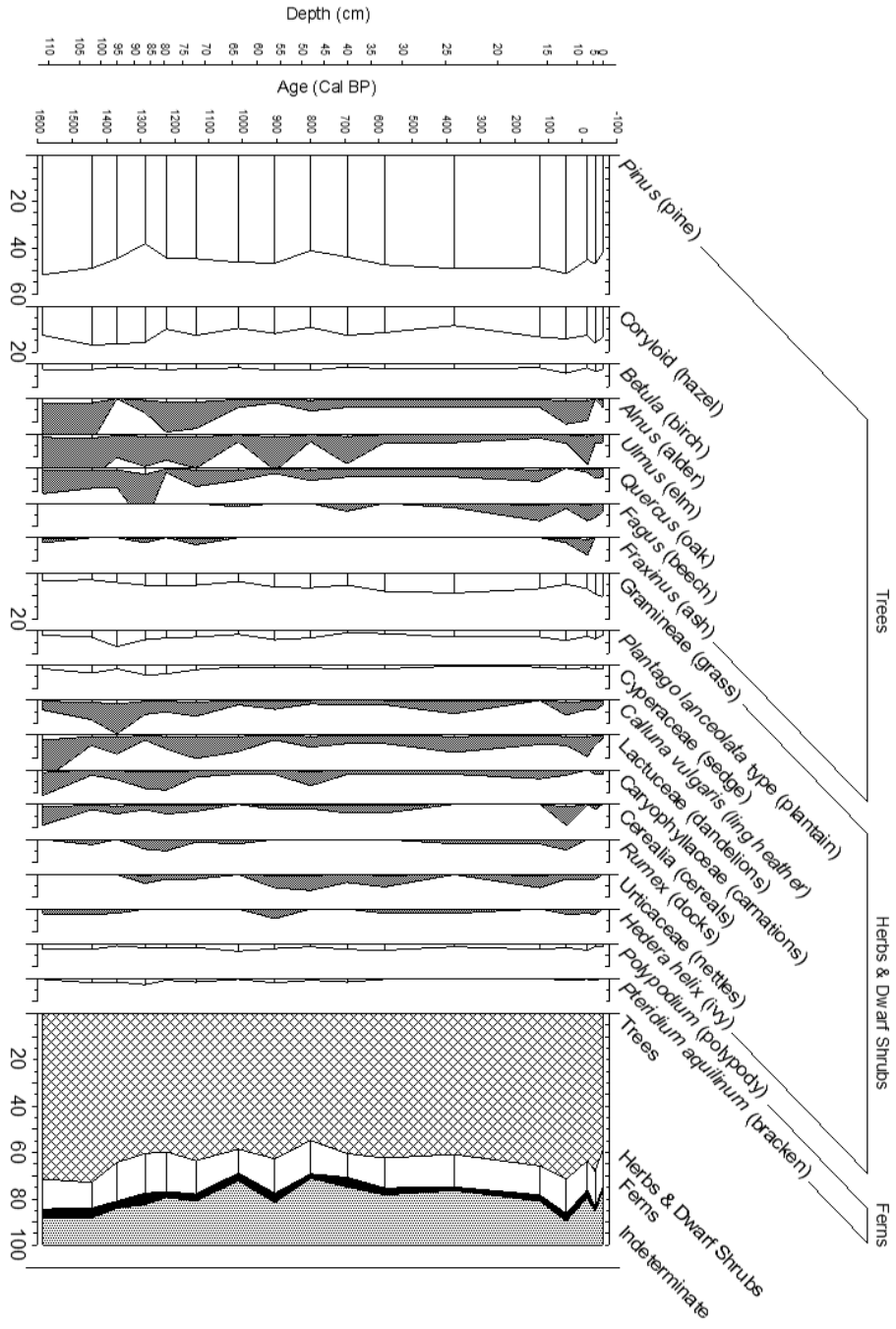

Figure 6: *Percentage pollen diagram of selected taxa from Rockforest Lough (shading = exaggeration × 10).*

resolution pollen analysis of samples taken from small hollows within woodlands, with a pollen source area within a 100 m radius, provides data on woodland dynamics at the stand scale. An analysis of long-term changes and drivers of biodiversity in these oakwoods identified the loss of *P. sylvestris* as one of the most significant changes in their biodiversity (Mitchell 2013). Though planted in origin, Group 1 is a modern analogue of these ancient pine-oak woodlands (Roche et al. 2015). It corresponds to Scenario 1 of the NWS Framework (DAFM 2018), which specifies a mix of 30% *Quercus petraea*, 30% *P. sylvestris*, 15% *Betula pubescens*, 15% *Sorbus aucuparia* and 10% *Ilex aquifolium* on upland valley sides and hillsides with free-draining slopes on podzolised soils.

Group 2 comprised two Irish and six Scottish plots (Table 1). They tended to occur on soils with a relatively low mean pH (3.63) and high mean organic content (80.6%). Diversity was low, with a mean species richness of 19.5. Structurally, the plots were moderately tall and relatively open, with a mean canopy height of 13.9 m and canopy cover of 43.5%. Group 2 contained two stable sub-groups, recognisable by their long stems in the dendrogram (Figure 3). One comprised the Irish plots I2 (Clonfinane Bog) and I6 (All Saints Bog) and the Scottish plot S26 (Abernethy II), indicating a direct correspondence between these reintroduced stands and a native stand of high conservation value. I2 and I6 were classified by Roche et al. (2009) as *Calluna vulgaris-Eriophorum vaginatum*, a pinewood type of relatively intact raised bogs. Inspection of the floristic data showed that *P. sylvestris* dominated the canopy. *Betula pubescens* was abundant in I2 and I6 but absent from S26. Typical species included *Calluna vulgaris, Vaccinium myrtillus, Erica tetralix* and *Empetrum nigrum*. Differential species included the bog species *Eriophorum vaginatum, Andromeda polifolia* and *Vaccinium oxycoccus* which, in this wooded setting, are strongly indicative of Bog woodland. This is a priority Annex I habitat of international conservation importance (EC 2013). Ireland hosts a significant proportion of the world's raised bogs, but woodlands on relatively intact raised bogs are rare even here (Fossitt 2000). *P. sylvestris* regeneration was relatively good. Five seedlings occurred in S26. I6 had the highest level of *P. sylvestris* regeneration in the dataset, with 52 saplings and poles. While no *P. sylvestris* regeneration occurred in plot I2, it was noted on open bog surrounding the woodland. Palaeoecological studies have shown that I2 and I6 are non-relict stands, which naturalised in the last 200 years (Heery 1993, O'Connell and Doyle 1990). However, they are modern analogues of the bog pinewoods which occurred sporadically on several midland raised bogs until medieval times (McNally and Doyle 1984, O'Connell 1988, Roche et al. 2015). As raised bog is a priority Annex I habitat and is unsuitable for afforestation, the NWS Framework is not applicable in this case. However, on cutover or cutaway bog or bog remnants which are unsuitable for bog restoration, pine-birch woodland may be an appropriate

rehabilitation target, especially where hydrological conditions are suitable for the development of bog woodland.

The second sub-group comprised five Scottish plots. They showed a high level of similarity (Figure 3). The canopy was wholly dominated by *P. sylvestris.* Typical species included *C. vulgaris, Vaccinium myrtillus* and *Deschampsia flexuosa. Vaccinium vitis-idea* was a differential species. These are constant species of the W18 *Pinus sylvestris-Hylocomium splendens* community of the British NVC (Rodwell 1991). W18 corresponds to the priority Annex I habitat Caledonian forest (EC 2013). The dendrogram indicates that the vegetation of the Irish plots does not directly correspond to the typical vegetation of Caledonian forest (Figure 3). Regeneration was poor even in the Caledonian forest plots, being absent from all but one (S25 Abernethy I).

Group 3 contained Irish plots only (Table 1). These were classified by Roche et al. (2009) as *Corylus avellana-Brachypodium sylvaticum*, a basiphilous pinewood type. They tended to occur on less acidic soils, with a mean pH of 4.40, and/or on rocky terrain. Substrates comprised limestone pavement (I3 Rockforest, I13 Rockvale, I20 Ballykine II), soil overlying limestone (I19 Ballykine I), and granite outcrops (I8 The Scalp). Soil organic content was relatively low (47.7%). With the exception of I8, they occurred on gentle slopes in the lowlands. Diversity was relatively high, with a mean species richness of 47.2. Typical species included *P. sylvestris, Corylus avellana, Crataegus monogyna, Hedera helix, Lonicera periclymenum* and *Rubus fruticosus* agg. Differential species include *Fraxinus excelsior, Prunus spinosa, Teucrium scorodonia* and *Brachypodium sylvaticum*. I19 comprised planted high forest; the remaining plots were apparently self-seeded, including one from a putatively native pinewood (I3 Rockforest) (McGeever and Mitchell 2016, Roche 2010, Roche et al. 2016, 2018) which is discussed in the following section. Structurally, the plots were generally relatively low and open, with the lowest mean canopy height (10.3 m) and canopy cover (35.5%) in the dataset (Table 2). *P. sylvestris* regeneration occurred only within the plots on limestone pavement. I13 and I3 contained one and two stems respectively, while I20 contained 41 stems, distributed across all height classes. This is likely due to the very open, scrubby structure of these plots, which exhibited moderate, low and no grazing respectively.

Roche et al. (2015) found that Group 3 had floristic similarities with Bjørndalen's (1985) basiphilous native pinewoods in oceanic south-west Norway. High proportions of Group 3 differential, preferential and constant species (74.4%, 80.0% and 100.0% respectively) also occurred in the Norwegian plots. Links with the NWS Framework (DAFM 2018) are limited to some similarities in species composition with Scenario 3 (oak-ash-hazel woodland). In any case, limestone pavement is a priority Annex I habitat and is unsuitable for afforestation.

Group 4 contained one Scottish plot and five Irish plots (Table 1), four of which were classified by Roche et al. (2009) as *Galium saxatile-Agrostis capillaris*, an upland pinewood vegetation type. The Irish plots were of planted origin. Group 4 tended to occur on relatively acidic soils and sloping ground in the uplands. Mean soil organic content was relatively low (51.5%). Diversity was relatively low, with a mean species richness of 29.5. The canopy was wholly dominated by *P. sylvestris.* Typical species included *Vaccinium myrtillus, Pteridium aquilinum, Sorbus aucuparia, Blechnum spicant* and *Calluna vulgaris*. The ground flora was grassy in character and, like many Irish upland habitats (Perrin et al. 2014), may have been highly modified by grazing. The species composition overlapped with that of Group 1, but Group 4 was differentiated by a lack of *Quercus petraea* and higher cover of *Galium saxatile, Molinia caerulea, Agrostis capillaris* and *Potentilla erecta*. Structurally, the plots were relatively tall and open, with a mean canopy height of 15.7 m and the lowest mean stocking density (462.5 trees per ha) in the dataset (Table 2). *P. sylvestris* regeneration was absent.

I9 (Coronation Plantation, planted AD 1831) showed relatively high similarity to S21 (Cona Glen) in western Scotland (Figure 3), indicating a direct correspondence between this reintroduced stand and a native stand of high conservation value. They differed from other plots in their high *Molinia caerulea* cover, exceeding 50%. Rodwell et al. (2000) noted that pinewoods with abundant *M. caerulea* are occasional in the Scottish Highlands. Coronation Plantation is of conservation value due not only to its similarity to a native Scottish pinewood type but also because it supports numerous species of conservation importance, particularly breeding birds (NPWS 2005). No regeneration occurred in the plot and active conservation management is needed to ensure the long-term viability of this site.

As the canopy of Group 4 plots generally contains pure *P. sylvestris*, this group does not correspond strongly to the mixed NWS Framework scenarios (DAFM 2018). However, Group 4 occurs in similar environmental conditions to Scenario 5A (Pioneer birch woodland on modified and improved, infertile upland acid brown earths and peaty podzols).

Native status

Pollen diagrams should be interpreted with an awareness of their methodological limitations. The pollen of some taxa can only be identified to genus or family level. Wind-pollinated plants, particularly trees, tend to be overrepresented in the pollen record. McGeever and Mitchell's (2016) study of modern pollen deposition in the Rockforest area concluded that a *Pinus* pollen value of 5% indicated local presence of *P. sylvestris*. *Pinus* macrofossils, if present, provide further and more definitive evidence of local presence (Froyd 2005). Pollen source area varies according to the

nature of the coring site. At c. 8 ha in size, Rockforest Lough probably samples pollen mainly from a source area of 300-800 m (after Sugita 1994). Pollen preservation quality varies amongst taxa and sampling sites. Sediment deposition rates may vary over time and statistical error is inherent in age-depth models (Figure 5). Despite these caveats, pollen analysis, particularly when combined with macrofossil analysis and high-resolution dating, can provide reliable evidence of the former presence and relative frequency of species, especially forest trees.

The Rockforest Lough pollen profile is relatively static. Arboreal pollen dominates throughout. The most significant feature is the continuously high *Pinus* signal, which fluctuates somewhat but never falls below 38.2%. *Corylus* was also frequent throughout. This indicates a pine-hazel woodland with an open structure, as *P. sylvestris* is light-demanding (Carlisle and Brown 1968). The rise in Gramineae from 1600 cal BP/AD 350 to the present indicates a gradual opening up of the woodland and expansion of open grassland. *Pinus* fell to a minimum (38.2%) c. 1300 cal BP/AD 650 but still dominated. A *P. sylvestris* needle found at 66 cm depth demonstrates that the species was locally present at 1110 cal BP/AD 840. The non-native *Fagus* peaks c. 125 cal BP/AD 1825. The Cerealia signal, though discontinuous, indicates arable farming in the surrounding area. The vegetation dynamics of the pollen profile are discussed in more detail in Roche (2010) and Roche et al. (2016, 2018).

Rockforest Wood is mentioned in historical sources with regard to woodland cover and human activity. Its ancient name was Coill Ó Flanchada. The Wars of Thomond affected County Clare in the 12th-14th century. A strategically important pass, Bealach an Fhiodhfail, then the main route from Clare to Galway, now the Corofin to Gort road, went through the wood (Frost 1893). In 1311 a battle was fought at the entrance to the wood to contest the pass. A defeated force fled through it in 1314 (MacCraith 1929). The Annals of the Four Masters record that in 1599 Red Hugh O'Donnell's army massed at the eastern edge and marched through the centre of Coill Ó Flanchada, via Bealach an Fhiodhfail (O'Donovan 1851). In 1655, the Down Survey showed that the only timber woods in this barony (Inchiquin) lay in this parish (Kilkeedy), occurring in nearly every townland. Covering 850 ha, they likely formed one of the county's largest woods (Westropp 1909). Henry Pelham's Grand Jury Map of County Clare (1787) depicts woodland at Rockforest but little in the surrounding area. Rockforest House was built in the late 18th century (Weir 1999). By 1808, over 30 ha of poor, rocky soil had been planted with *Acer, Alnus, Betula, Fagus, Fraxinus, Larix, Picea, Pinus pinaster, Pinus sylvestris, Quercus, Ulmus* and other species (Dutton 1808). A "finely planted demesne" extended almost a mile along the road (Lewis 1837). The Ordnance Survey six inch maps (1840, 1899) show the area as wooded (Roche 2010). Selective felling and scrub clearance occurred in the 20th century (J. Cunningham, pers. comm.). Though fragmentary in nature, the available historical sources imply

continuous presence of woodland cover at Rockforest despite ongoing human activity. These are usually dated with a high level of certainty, but dating of palaeoecological data is inferred from age-depth models, making it prone to statistical error. These data should be compared cautiously.

The consistently high arboreal pollen signal and available historical sources both suggest that Rockforest has a long history of woodland cover. This contrasts with patterns seen in contemporaneous Irish pollen profiles. Prior to the Great Famine of 1845, Ireland's population reached almost nine million, causing severe land-use pressure. Poorer land was cleared for agriculture over much of Ireland (Cole and Mitchell 2003). Elsewhere in the Burren, arboreal pollen frequencies were just 4% from 250-100 cal BP/AD 1700-1850 at Cappanawalla (Figure 2) (Feeser and O'Connell 2009). This contrast may relate to the management of the Rockforest Estate. Nationally, the woodland resource steadily diminished until the 20th century, excepting remnants within estates (Everett 2014). Rockforest appears to be one such estate.

The *Pinus* curve from Rockforest Lough is consistently high. Its minimum value (38.2%) greatly exceeds McGeever and Mitchell's (2016) 5% threshold, indicating that *P. sylvestris* was locally present as a significant component of the vegetation. Furthermore, macrofossil evidence demonstrates local presence of *P. sylvestris* around Rockforest Lough during the Neolithic at 5810 cal BP/3860 BC and the early medieval period at 1110 cal BP/AD 840. The latter is most significant as the species was presumed extinct in Ireland during that period (Bradshaw and Browne 1987). The later macrofossil (1110 ± 120 cal BP/AD 840) is contemporaneous with the last recorded *Pinus* macrofossils from Gortlecka (1050 ± 160 cal BP/AD 900) (Watts 1984), 3.3 km west of Rockforest Lough (Figure 2). Watts expressed concern that this date appeared too young but this new evidence suggests that it was accurate.

The later Rockforest macrofossil coincides with a *Pinus* pollen frequency of 45%. The subsequent *Pinus* signal remains high to the present. Though *Pinus* had been planted on the Rockforest Estate by 1808 (Dutton 1808), its pollen was previously strongly represented. Rockforest Wood, located 500 m upwind of the coring site, matches the vegetation recorded in the pollen profile and is the likely source of this signal. *P. sylvestris* appears to have persisted at Rockforest through the late Holocene to the present.

These findings are supported by McGeever and Mitchell's (2016) analysis of a radiocarbon-dated peat core from Aughrim Swamp, 650 m north-east of Rockforest Lough (Figure 2). It too shows a continuous *Pinus* signal from c. 1600 cal BP/AD 350 to the present. A decline began c. 1550 cal BP/AD 400, reaching c. 8% c. 1350 cal BP/AD 600 but *Pinus* recovered quickly, reaching sustained levels of c. 15-25%, before declining to c. 5% at the top of the core.

Substantial deforestation occurred in the Burren and *Pinus* declines there have been attributed to human activity (Feeser and O'Connell 2009) but the palaeoecological data and historical sources indicate that Rockforest was an exception to this pattern. The area was subject to continued human activity but the disturbance does not appear to have eradicated *P. sylvestris*.

Conclusions

The widely accepted hypothesis that *P. sylvestris* became extinct in Ireland has been rejected. At 8°57' W, Rockforest appears to be the western limit of the natural range of *P. sylvestris*, previously thought to be in Portugal at 8°09' W (EUFGIS 2019).

The Irish survey sites, excepting Rockforest, are thought to contain *P. sylvestris* of reintroduced origin. The vegetation of certain plots and groups resembled that of extant native pinewoods elsewhere or fossil assemblages from Ireland's ancient pinewoods. This suggests that reintroduced *P. sylvestris* woodlands are an important resource for Irish biodiversity, particularly given the country's low native woodland cover.

These findings should inform evidence-based forest management and policy. They provide support for the inclusion of *P. sylvestris* in the NWS and the retention of reintroduced *P. sylvestris* in woodlands managed for conservation. It is recommended that reintroduced *P. sylvestris* is managed as a native species in Irish woodlands. However, where woodland has colonised formerly open bog due to human-induced degradation (e.g. drainage), it may be removed to facilitate bog restoration (EC 2013). The floristic and environmental data presented should inform site and species selection. The data from the bog woodlands of Group 2 may be informative in setting rehabilitation targets for the after-use of cutaway bogs.

Natural regeneration of *P. sylvestris* was poor overall and requires further research in the Irish context. Exclosures within and, importantly, on the edges of *P. sylvestris* stands would permit an assessment of both vegetation change and regeneration under current climatic conditions in the absence of grazing. This would be most relevant to the upland pinewoods of Group 4 as regeneration was absent and the ground flora was grassy in nature, indicating that it has been heavily modified by grazing.

O Tuama (2017) questioned the omission of *P. sylvestris* woodland from a recent description of Irish native woodland types (Cross and Collins 2017). The Irish pinewood plots should be analysed using the ERICA tool (NBDC 2019) to quantify their level of similarity to the types defined by the Irish Vegetation Classification, put them in context among Irish native woodland types and clarify whether a separate *P. sylvestris* type is warranted.

It has been suggested that further evidence is required before the hypothesis that *P. sylvestris* survived to the present in Ireland is accepted (O'Connell and

Molloy 2019). Relevant palaeoecological research is ongoing (F.J.G. Mitchell, unpublished). Genetic research (C. Kelleher, unpublished) on the Irish *P. sylvestris* stands described here, including Rockforest, is anticipated to provide new insights into the genetic diversity of these populations.

Further research and conservation measures are needed at Rockforest. *P. sylvestris* has been placed on the waiting list of the Irish Red Data List, pending further research to enable assessment (Wyse Jackson et al. 2016). The population is of high conservation value but its rarity increases its extinction risk. Reintroduced *P. sylvestris* in the vicinity may threaten its genetic integrity. Rockforest should be carefully managed and monitored, particularly given the scarcity of *P. sylvestris* regeneration (Table 3). Off-site conservation has commenced; *P. sylvestris* propagated from Rockforest seed has been planted at two other sites by NPWS (S. Callaghan, pers. comm.). Rockforest has been listed as a genetic conservation unit (EUFGIS 2019) and a "source identified" seed stand for *P. sylvestris* by the Forest Service (B. Clifford, pers. comm.). Commercial seed collection is underway (B. Carey, pers. comm.). However, seed-sourcing must be compatible with the long-term viability of the population on-site. Coordinated action between forestry and conservation agencies is needed to ensure the continued survival of native *P. sylvestris* at Rockforest and to develop opportunities for the restoration of native pinewoods in Ireland.

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Forest Perspectives

Some modern-day "Sacred Trees" in Ireland

John Mc Loughlin[a*]

Trees are the longest living species on Earth and, consequently, have been seen by most cultures and societies as a link between the past, present and future, of being worthy of reverence and many have been held as sacred. Following my review of *Our Future in Nature: Trees, Spirituality and Ecology. Well-being and Peace* (elsewhere in this issue of *Irish Forestry*), I was intrigued by the apparent contradiction that, despite our largely secular society, we continue to hold a strong attachment to the many sacred trees scattered throughout the country. In Ireland, sacred trees were traditionally associated with a holy well. It is likely that this association arose when Christianity arrived in Ireland. Prior to that, the trees may have been part of pagan worship groves.

Here are some examples of modern-day "sacred trees" which remain in popular use today. The first is the Rag Tree at Clonfert Cathedral, Co. Galway. There was a well close by which was dedicated to St. Brendan. Though it was probably a native species such as ash or oak initially, a horse chestnut is used as a rag tree today and it is festooned with votive offerings (Figure 1). In the past this tree was reputed to possess a cure for warts, but nowadays it is used to cure sick children – which may help to explain the array of items there now.

The second example is the Money Tree at Clonenagh, Mountrath, Co. Laois (Figure 2). There was a holy well nearby which was dedicated to St. Fintan. However, many years ago, the farmer began preventing people from visiting St. Fintan's Well which was on his land, whereupon the well miraculously transformed into this tree. It became known as The Money Tree in later times because people would hammer coins into its bark having invoked St. Fintan's help in their troubles. Felled by a storm in 1994, it is small wonder that Laois County Council shied away from planting a replacement tree there during National Tree Week the following year! In hindsight, that was just as well because the tree suckered immediately and today, 25 years later, it is in rude good health and is back in business accepting coins.

[a] Business Editor, Society of Irish Foresters.
[*] Corresponding author: info@soif.ie

Figure 1: *The Rag Tree, Clonfert Cathedral, Co. Galway.*

Figure 2: *The Money Tree, Clonenagh, Mountrath, Co. Laois.*

Surely the oddest of all these trees is the Dodie Tree at Donadea Forest Park, Co. Kildare (Figure 3). Though established only twenty years ago, a tradition has developed of parents hanging their children's soothers/dummies/pacifiers on the tree in the belief that it would help wean the children off them. Today, the tree is so laden with soothers, bottles, etc. that the artefacts have now spread to a nearby tree. This is undoubtedly a sacred tree for the modern age! Initial attempts to remove the artefacts

Figure 3: *The Dodie Tree, Donadea Forest Park, Co. Kildare.*

proved fruitless as they were returned the following week. It just proves that you'll never beat a tradition… not even a recent one!

Finally, to UCD with its Resilience Tree which was transplanted close to the lake at the centre of the campus in 2019 (Figure 4). The plaque beside the tree explains: "This tree is a visual representation of positive mental health, hope and resilience. Trees are resilient to changing seasons and changing times, just as we are more resilient than

Figure 4: *The Resilience Tree, UCD, Dublin 4.*

we know, in challenging or in difficult times, we find strength and capacity within."

The Resilience Tree seeks to promote a dialogue about the positive things we do to look after our mental wellbeing. The coloured ribbons represent individual expressions of self-care, things we do to maintain perspective, express emotions, and to stay connected. There is a box of coloured ribbons nearby and one is asked to take one and share something you do to "mind your mental health" by writing it on the ribbon and tying it to the tree. It then advises, "Be kind to yourself". What more can be said?

While it is true to say that, in recent years, institutional religion has fallen out of favour as a mediating resource in the daily contract between us and the world we live in, trees, however, appear to renew our sense of wonder at the on-going interaction between the spirit, the earthly-pagan, and the pragmatic worlds. One has to wonder if there is a constant shadow of humanity that persists or whether the social norms and vulnerabilities that such trees serve are significantly different today.

Developing new hardwood markets for Irish timber – the Hardwood Focus group's study tour to Wales

Jonathan Spazzi[a*], Seán Garvey[b] and Ian Short[c]

Introduction

A discussion-group called Hardwood Focus (HF) was formed in Limerick in 2018 among broadleaf-forest owners in the region. This initiative is part of the Limerick Tipperary Woodland Owners (LTWO) Group and is facilitated by Jonathan Spazzi, the local Teagasc Forestry Development Officer. The group's initial aim was to provide a forum for sharing ideas and to help develop markets for hardwood material originating from intermediate thinning, additional to firewood. This is part of a wider discussion about the timber production potential of Ireland's broadleaf forest estate which has now reached 194,000 ha (29% of the total forest area), with a growing stock volume of 22.6 million m³ (19% of the total forest standing volume) (DAFM 2018). In 2018, Ireland imported 42,000 m³ of sawn hardwood with a value of €41.1 million, which included 13,000 m³ of tropical hardwoods. In contrast, in the same year only 5,000 m³ of commercial hardwood roundwood was reported as "available for processing" in Ireland. During the period 2014-2018, wooden furniture imports increased by 54% to a value of €243 million (O'Driscoll and Moore 2019).

One of the topics discussed by the group concerned the opportunities to substitute, in the coming years, some of these imports with finished goods made in Ireland from home-grown timber and in so doing facilitate the development of a local timber supply chain from growers to end users. Many of the participants in the group had applied Woodland Improvement thinning (a DAFM-funded scheme) to their forests, had managed trees in their plantations to good size and quality and are now looking to explore markets to add value (beyond that of firewood) to produce from future thinnings.

The volume of hardwood roundwood is projected to increase as the broadleaf growing stock resource matures and enters thinning cycles. Whilst the firewood market has been, and continues to be, of great importance as an enabler for broadleaf forest management, alternative markets should also be sought for the increasing tree sizes and volume of "small-diameter" hardwood logs that will be entering the market over the coming years.

[a] Teagasc Forestry Development Dept., The Pavilion, Austin Stack Park, Tralee, Co. Kerry.
[b] GMIT Letterfrack, National Centre for Excellence in Furniture Design and Technology. Letterfrack, Co. Galway.
[c] Teagasc Forestry Development Dept., Ashtown Research Centre, Dublin 15.
[*] Corresponding author: jonathan.spazzi@teagasc.ie

During various group discussions two general points were arrived at consistently:

- Growers wished to connect with other owners whose forests were at a more advanced development stage and to view/learn from existing small-diameter hardwood producers and processors. Hardwood marketing developments taking place in Wales were of particular interest.
- The importance of sharing findings and to co-ordinate with other Forest Owners' groups and other organisations in Ireland to explore possibilities for adding value to small diameter hardwood produce.

In this context the group successfully applied for support under the DAFM Forestry Promotional programme for 2019-2020 for a range of activities. These included the development of a dedicated webpage for the focus group (http://www.limerickandtipperarywoodlandowners.ie/hardwood-focus-project.html), a study trip to Wales to meet hardwood development agencies, a video production (Irish grower case studies) and a one-day seminar to be held in Limerick in autumn 2020. This short article describes the HF group's experience and findings from their tour to Wales.

The study tour to Wales

A delegation from the HF group, composed of LTWO forest owners John O'Connell, Jonathan Sykes, Martin O'Sullivan and Ned Liston, together with Mark Donnelly (forester/broadleaf specialist), Seán Garvey (GMIT Letterfrack lecturer in furniture design and manufacture) and Jonathan Spazzi (Teagasc Forestry Development Officer) travelled to Wales between 30th September and 4th October 2019. The group aimed to meet hardwood producers and development agencies to explore potential markets for Irish hardwood produce, specifically from intermediate thinnings. The group was also joined by Teagasc forestry researcher Dr Ian Short and Colin Marren, M.Sc. Walsh Scholar (both involved in small-diameter alder utilisation research), as well as Padraig O Tuama (forester/ProSilva Ireland) and John Sherlock (forest owner and chair of the North East Forestry Group).

Wood Lab Pren and Kenton Jones Ltd.

The first stop of the tour took place in Caerphilly near Cardiff where the group met Dylan Jones from Wood Lab Pren and formerly a project manager with Coed Cymru: a Welsh organisation established in 1985 to increase the economic value and performance of Welsh broadleaf woodlands. This includes research and development into new small diameter hardwood products. The Wood Lab Pren project continues Coed Cymru's work and is funded by the European Agricultural Fund for Rural Development and the Welsh Government until 2021. The project's aim is to facilitate the development of a local timber supply chain, from growers to end users, by sharing knowledge and research-and-development findings (Jones and Elvins 2019).

This stop (and the Welsh study tour in general) was an eye opener for many of the participants since very few had had many dealings with timber manufacturers or end users. According to Dylan Jones, the broadleaf forestry sectors in Wales and Ireland share many similar experiences. The Welsh firewood market is buoyant and most Welsh broadleaf forest owners tend to compete in this area and have a "limited understanding of the needs of designers and makers". Also, "furniture makers and designers do not generally connect with the forestry industry". Dylan described how he and his colleagues aim to apply furniture design-and-making to highlight how small-dimensioned hardwood, which is perceived as low value, can be made into high-value furniture products. He explained how developing a strong "design-led supply chain can pave the way to creating skilled jobs and innumerable environmental benefits resulting from well-managed forests producing financially sustainable materials."

The main product discussed with Dylan was the end-grain tile. The end grain tile is probably the most well-known product resulting from research and development by Coed Cymru (see Figure 1). It is intended for use as flooring or wall covering. End grain is exposed when timber is cut across the annual growth rings at 90 degrees (rather than the more usual longitudinal cutting along the length of a log). It has greater impact and wear resistance than that of conventional long grain. It has been utilised in the past for items like mallets, street cobbles and carriage brake pads, all of which take advantage of its wear resistant properties (Jones 2015). The main objective of Coed Cymru's end grain project was to develop a commercial resource from short-length small-diameter logs (in general between 20- and 40-cm mid diameter).

The project has since developed a suite of other products, all made from small-diameter logs. The tiles are made from timber from different species, and of varying thicknesses, sizes and shapes depending on customer preferences and whether they

Figure 1: *Dylan Jones discussing the Wood Lab Pren initiative and describing Coed Cymru range of products (left), including the alder end grain tiles (right).*

will be used indoors or outdoors. Together with other collaborators the project has carried out extensive research to be able to match the most suitable species for a specific product requirement (based on each species' inherent properties). The basic tile measures approximately 100 × 100 × 10 mm (length × breadth × height), but there are many variations on these measurements. Various species were used including ash (*Fraxinus excelsior* L.), oak (*Quercus* spp.), sycamore (*Acer pseudoplatanus* L.), beech (*Fagus sylvatica* L.), birch (*Betula* spp.), alder (*Alnus* spp.), poplar (*Populus* spp.) and larch (*Larix* spp.). Species with relatively low-density timber such as alder and birch perform very well in an end grain orientation.

Many alterations and versions of the tile have been made since the end grain project began. These include hexagonal versions (engineered to make boards of pre-glued tiles) and oblique rectangular tiles made by cutting the log at an angle rather than at 90 degrees.

From the description of the manufacturing process, including drying and fitting, it was clear that the end grain tile production required highly specialised and skilled operations and, as a commercial product, it was suitable for a niche but high-end market.

Other simpler products were viewed and discussed as viable alternatives, such as cross laminating narrow boards from small logs to create larger dimensioned and more valuable hardwood boards, the merits of the "inside out beam" (see Figure 2). Producing skirting board or architraves using narrow boards from small hardwood logs were also discussed.

Of particular importance when trying to develop new products, according to Dylan, "is getting the basics right in terms of understanding hardwood timber properties, sawmilling and drying skills" and not trying to compete with global markets. "It is important to consider the whole chain of supply from producers, processors, designers to end users; we need to first ask architects and end users what products they want/need before we start the design and product development process".

One of the companies which commercially developed the end grain tile in Wales is Kenton Jones Ltd. Designers and Makers. The group met Kenton, the company owner, at his factory workshop in Welshpool and he explained the process of producing end grain tiles and the engineered board (see Figure 3). The latter is a version where tiles are glued to a strip of birch plywood 1.2 m long. This results in a much quicker installation job as individual tiles are not being laid.

Kenton's company has fitted many floors with end grain tiles throughout the UK (e.g. Selfridges and Coach in London) and internationally. They continue to receive regular enquiries despite little advertisement or promotion. According to Kenton, since developing the end grain tile his company has been focusing on a range of new projects and hasn't fully developed the marketing side of this product. When asked if

Figure 2: *The "Inside-out beam" is a large-dimensioned beam derived from a small-diameter log. The process involves machine rounding the log, squaring the edges, sawing the log into four sections before gluing the rotated sections together again.*

Figure 3: *A range of products developed by Kenton Jones Ltd.; an engineered version of the oak end grain tile (top) an alder hexagonal tile (bottom left) and a floor tile made of sycamore (bottom right).*

he was open to collaboration with Irish producers, he seemed positive.

In terms of ease of production, alder and birch seem to fare best mainly because of stability but also because of their colour characteristics (see Figure 4).

Another variation of the end grain tile is the outdoor end grain cobble, measuring 100 × 100 × 100 mm, and is generally made from Welsh oak or larch. Kenton experimented with surface charring of the cobbles to reduce the slip potential of the flooring. They reported a marked improvement compared with uncharred material.

A large part of Kenton's work comprises bespoke kitchens where clients are strongly influenced by current fashions. Customers will often bring along a magazine and say "can you make this for me". The magazine photographs generally contain consistently coloured white oak. In such cases timber choice is usually French or Eastern European oak as Welsh and UK oak have darker brown colouration patterns and the colouring is generally not consistent. However, both Kenton and Dylan Jones were of the view that Welsh oak could be marketed as premium material because of the unique nature of the colour character. The Welsh poet, Clare E. Potter, makes the point eloquently in her poem Dendrochronology (in Jones and Elvins 2019), "In Wales, our trees have their own language – because of the hills, the rain, because of rain, growth, rapid growth of rings that out-tongue the English database, defy accurate dating. And

Figure 4: *An example of a flooring commission recently completed by Kenton Jones Ltd. using end grain birch tiles.*

what of it?" The HF group appreciated that if an indigenous market for hardwood timber is to be developed, that promotion among end-users and manufacturers will be necessary to turn such perceived weaknesses into strengths.

Whitney Sawmills

The group visited Whiney Sawmills (www.whitneysawmills.com/) to attend a specialist hardwood training course. Whitney Sawmills is a well-established and thriving hardwood sawmill based near Hay-on-Wye in Herefordshire, trading since the early 1990's. Since 2016 it has been run by Woodland Heritage (www.woodlandheritage.org/), a charity dedicated to support the productive development of British broadleaf woodlands. Whitney Sawmills supplies a range of different timbers, specialising in oak, although Douglas fir has become increasingly popular in recent years. Other hardwoods supplied include ash, elm, sycamore, sweet chestnut (*Castanea sativa* Mill.), cherry (*Prunus* spp.) and poplar, with walnut (*Juglans regia* L.), alder, lime (*Tilia* spp.) and maple (*Acer* sp.) occasionally available. Customers include joiners, cabinet makers, timber framers, builders, architects and DIY woodworkers. One of the selling points of Whitney Sawmills is the consistent quality of its service and the ability to deliver customised orders.

The course at the mill included two days intensive hands-on training in selecting, grading and valuing logs, in practical milling techniques (Figure 5) and one day in nearby forest stands viewing continuous cover forest management to produce quality hardwoods. This course was an exceptional experience and an eye opener for many in the group.

The course was extremely well designed and skilfully delivered by leading UK-based professionals such as Gavin Munro (hardwoods valuation and marketing expert), Will Bullough (expert sawmiller with decades of experience), Dermot Doyne (Whitney Sawmills manager), Ben Asson (carpenter and wood worker with expertise in sawmilling/wood preparation) and Graham Taylor (director of Pryor and Rickett, a silviculture and management company). The group were introduced to Mark Hilleard, representative of the Welsh Government, who took an interest in the HF initiative. The workshop served as a vehicle to ignite discussions between the diverse members of the group on future prospects for Irish hardwoods as well as offering the group the chance to learn a great deal about hardwood production and marketing.

Compared to Ireland, Wales appeared to have a more active hardwood market, much of which is based on oak. Douglas fir seems to have become an "honorary hardwood" and is growing in demand. Good markets also exist for ash, sycamore and elm but less so for cherry and sweet chestnut. There was little recent market interest in beech. Both Gavin Munro and Will Bullough agreed there was good potential for market expansion for Welsh-grown sycamore as a replacement for tulip

Figure 5: *The group training in log grading (left) and the use of a portable sawmill (right).*

wood (*Liriodendron tulipifera* L.) which is favoured by cabinet makers and currently imported. Given sufficient quality, the minimum dimension required for sycamore logs would be c. 40 cm mid-diameter.

The average log size in the majority of Irish private plantations is still below 30 cm diameter at breast height (DBH) due to their young age. The current lack of larger dimensioned material is clearly a problem for the immediate development of a hardwood processing sector. However, forest owners in the group remarked that, in comparison with ring width of logs on display at the mill, Irish trees' growth rate was reckoned to be greater, possibly suggesting a competitive advantage for decades to come.

An interesting new product viewed at the mill, with relevance to converting smaller dimensioned logs, was a new heat-treated exterior cladding product (Figure 6) developed by Vastern-Timber, a leading UK hardwood processor (www.vastern.co.uk). This could have application for marketing ash logs that might be harvested early by remedial silviculture for stands affected by ash dieback (*Hymenoscyphus fraxineus*). A similar product is also available made from poplar and sycamore.

Small sweet-chestnut logs have a local market for fencing (Figure 7) due to the timber's natural durability which is often greater than treated softwood fencing. This offers greater returns to the owner compared to firewood. The utilisation of oak fencing cut from small logs was also discussed but opportunities seem limited due to the high percentage of non-durable external sapwood present in young oak trees, thereby necessitating a greater log size.

One of the main products at the mill was oak beams to supply traditional oak framing house construction. In this market smaller logs seemed to be ideal for conversion into small beams for which there was strong demand. Small beams are produced effectively from smaller (30- to 40-cm mid-diameter) logs which command roadside prices well in excess of firewood rates. Quality standards for beams were

Figure 6: *Brimstone ash weather cladding – a new heat-treated exterior cladding board developed by Vastern Timber – placed on an untreated ash plank for comparison.*

not exceptional and 3-m lengths were sufficient. This could potentially be a profitable market for Irish intermediate oak thinnings in years to come as an export to Wales and UK, or indeed to supply oak framing construction in Ireland.

In relation to forest management the group visited Whitney Wood and the Duchy of Cornwall's Timberline and Mary Glover Wood, which were all under continuous

Figure 7: *Small logs of sweet chestnut (foreground) for production of split fencing (background) for general farm use.*

cover management. Following from many discussions, it was clear to all that without appropriate and sustained management, little timber value would arise from our own broadleaf resource. One early point discussed was the importance of designing, from planting stage, robust species mixtures that favour vigorous growth and natural pruning of selected timber species while also taking into account the operational needs of thinning operations and marketing opportunities for early and intermediate thinning materials.

We viewed an experimental group under-planting of wild service tree (*Sorbus torminalis* (L.) Crantz), a very high value species for specialist timber use. At the current rate of growth and given market dimension requirements of a minimum 30-cm log size, profitable harvesting is expected to commence at 40 years from planting. This could have applications, on suitable sites, for under-planting in ash plantations undergoing remedial silviculture. The advent of ash dieback and its likely impact, will likely intensify tending, thinning, and alternative silvicultural management options for ash stands (Short and Hawe 2018), as is also seen occurring in continental Europe.

The importance of efficient harvesting of intermediate thinnings was discussed. Given sufficient scale and access, mechanised early thinning has shown to work well with a combination of harvester/forwarder with assistance of a chainsaw operator. In this case the harvesting to roadside cost was estimated in the region of €30-35 m^{-3}. This approach has the potential to greatly enhance the profitability of early hardwood thinning. However, machinery with suitable harvesting heads combined with a small

Figure 8: *Practical training at Whitney Sawmill; the group practiced by converting an oak log (with a diameter of 35 cm) into a beam and assessing the resulting financial return in comparison to its firewood value*.

Figure 9: *Discussing harvesting and marketing of intermediate thinning material at Whitney Wood.*

(thinning-dedicated) forwarder with tree marking capabilities was required at least from the second intervention onwards. The importance of scale and availability of skilled contractors was also discussed. The group viewed a range of mature oak stands where profitable saw-log harvesting takes place every 7-10 years with replanting of oak mixtures in coupes of 0.2-0.4 ha. The general group feedback was that the system seemed robust and relatively simple to execute. A major problem however was the presence of grey squirrel causing extensive damage to young trees. Deer were also present but were a lesser problem because a combination of shooting and tree shelters were proving effective control measures.

Conclusions

The trip was very informative and inspirational. It revealed the many challenges ahead for Irish hardwood producers but also identified a number of opportunities including the possibility to collaborate and partner with a number of Welsh organisations. The purpose of the tour was to explore potential market developments for hardwood material from intermediate thinnings. It was also hoped that it would provide new insights and be a catalyst for further initiatives, ultimately leading to new collaborations with strategic stakeholders in Wales. Happily, all the organisations visited by the group have expressed interest in further collaboration with the HF group

Figure 10: *Discussing continuous cover management for oak saw-log production in the Duchy of Cornwall's Mary Glover Wood.*

and it is planned that Welsh/UK representatives will travel to Ireland in 2020 to attend a hardwood seminar. This will be open to Irish forest owners and timber processing and utilisation stakeholders and is scheduled for the autumn in Co. Limerick as part of the HF programme.

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Street tree planting in 19th and early 20th century Dublin

Mary Forrest[a*]

Introduction

Street trees have been part of the urban fabric of cities for centuries, from the streets of ancient Athens, the boulevards of Paris in the seventeenth century to the Thames Embankment in 1870s London. Mark Johnston, in his recent book *Street Trees*, has recorded the development of street tree planting in urban and suburban Victorian and Edwardian Britain (Johnson 2017). However, what of Ireland - Dublin in particular? The Dublin City Tree Strategy 2016 – 2020, published by Dublin City Council (2016), states that "In the historical development of the city, tree planting has been carried out to great effect and to the continued appreciation of its citizens and visitors. A review of older city maps and records indicates the use of tree planting in parks, streets and private lands". However, little information from these maps and records has been published. Drawing on minutes of the Municipal Council of the City of Dublin and Pembroke Urban District Council, Irish newspaper reports, English horticultural journals and archival records, this paper examines street tree planting in late 19th and early 20th century Dublin city and suburbs.

Figure 1: *A view along the London plane-lined North Circular Road towards the Phoenix Park c. 1915. Photograph courtesy of the Historical Picture Archive.*

[a] School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4.

[*] Corresponding author: Mary.Forrest@ucd.ie

Street Tree planting in Dublin city and north suburbs

A brief news item in the *Gardeners' Chronicle* of January 1874, noted that "the Corporation of the City of Dublin had undertaken to plant Sackville Street [O'Connell Street]." Alderman James W. Mackey, a former Lord Mayor and nurseryman in Westmoreland Street, "had done much to promote the planting of Sackville Street". Plane trees (*Platanus occidentalis* L.) were the species chosen and the work was entrusted by the Corporation to Mr. Thomas Moore, editor of the *Irish Gardeners' Record*, and sometime gardener. The purpose of the tree planting was the "ornamentation of that fine thoroughfare".[1] A writer in *The Garden* commented that "the addition of trees will render it one of the handsomest thoroughfares".[2] These short reports encapsulate the three main factors influencing the successful cultivation of street trees - advocacy, species selection and skilled staff.

Two years later a visitor to Dublin wrote "Sackville-street is very noble, and soon will be, when its plane trees grow a little, quite a boulevard".[3] However the trees were not a success and Sackville Street presented "the most unhappy example of municipal arboriculture in Europe."[4] Mr [Ninian] Niven of the Garden Farm (Drumcondra, Dublin) offered to supply trees for the street provided that they were planted in October - the costs of transport, fresh soil and labour were to be borne by the Corporation.[5]

At a meeting of the Municipal Council of the City of Dublin, held on February 12th 1883, the removal of trees in Sackville Street was discussed again.[6] Some twenty months later on 6th October 1884 the Council recommended that the trees be replanted.[7] After some years, work was to be undertaken by the Office of Public Works and a detailed minute[8] recorded how and where the trees were to be planted as follows:

> Sir Richard Sankey, chairman of the Board of Works to supply and plant trees in Sackville Street in October which is their last month, as follows:-
>
> At the Rotunda end to plant four Wytch [*sic*] Elms, i.e. one in the line of each of the side flagways as in Paris, and again one on each side out in the street, say twenty or twenty-five feet from each flagway:-

[1] Anon. 1874. A short time since. *The Gardeners' Chronicle* n.s. 1: 154.
[2] Anon. 1873. Notes of the week. *The Garden* IV: p 434.
[3] "A Traveller". 1876. From a letter to the Editor of *Freeman's Journal* 31: 3rd March 1876.
[4] Anon. 1878. Re-planting Sackville Street, Dublin. *The Garden* XIII: 23rd February 1878, p 172.
[5] Ibid.
[6] Item 66 in minutes of Municipal Council of the City of Dublin, 1883, p 59.
[7] Item 372 in minutes of Municipal Council of the City of Dublin, 1884, p 300.
[8] Meeting of Municipal Council of the City of Dublin held on 1st October 1894.

> At the south end of the street to plant four Western Plane trees:-
>
> In the three years' time trees (if ever) have fully established themselves and a selection can be made as to which tree to use to create an avenue the entire length.

They further stipulated that precautions be taken to "secure trees against the deleterious effects of gas and sewer water, more than likely to have caused failure of trees earlier and noted that "Mr Dick, the Park Bailiff, who is proposed should carry out the work is a thoroughly experienced forester".[9] Planting was not limited to Sackville Street. In December 1894, the Council recommended that the Paving Committee procure and plant suitable trees at each side of Lord Edward Street.[10]

While the City of Dublin planted trees in their administrative area (Figure 2), individuals also provided street trees for their locality. A donation of trees from Archbishop William Walsh, Archbishop of Dublin, received notice in the press. In 1890 a meeting of Drumcondra Town Commissioners was told that Archbishop Walsh would have "the slope opposite his new home planted with trees." The meeting thanked the Archbishop for his "kindness and generosity in giving a sufficient supply

Figure 2: *A view of Upper Sackville (O'Connell) Street in the early 1900s showing the recently established plane trees. The image comes from a black and white photograph hand-tinted for use as a postcard and is courtesy of the Historical Picture Archive.*

[9] Item 410 in minutes of Municipal Council of the City of Dublin 1894, pp 378-379.
[10] Item 527 in minutes of Municipal Council of the City of Dublin, 1894, p 504.

of healthy trees to plant both sides of Drumcondra Road" (Sheehy 2000). A generous supply of trees was purchased - an invoice from William Sheppard, a Landscape Gardener in Churchtown (Dundrum, Dublin), to Archbishop Walsh, dated 3rd April 1890 lists 100 *Platanus occidentalis* costing £30.[11] By this time Dublin Corporation had also planted thoroughfares nearby.

In 1902 the Drumcondra Labour Electoral Association wrote to the Municipal Council of the City of Dublin about the "necessity of protecting the trees and slopes on the Drumcondra Road."[12] The tender of Messrs. Brooks Thomas and Co. Ltd., for the sum of £37 7s 0d for the supply and erection of 83 red deal tree guards for the trees on Drumcondra slopes (being 9s per guard) was accepted by the Council.[13]

At a meeting of Municipal Council of the City of Dublin held in 11th December 1905, a letter submitted by Miss Harrison, 33 Harcourt Street, offering to the Corporation on behalf of a friend, 2,000 young trees to be planted along the streets and quays of the City "between the four bridges" was forwarded to the Paving Committee for their attention.[14] The Paving Committee replied:

> We had under consideration a letter forwarded by a Miss Harrison, offering on behalf of a person (who preferred to remain anonymous) a gift to the city of 2,000 trees. We obtained a report from the Engineer estimating the cost of planting at £5 10s. or £6 a tree. We are at present in correspondence with a Mr. Lane, who evinced a deep interest in the matter, and will report further in due course.[15] The Paving Committee considered the offer further.
>
> In connection with the planting of the trees offered by Mr. Lane (vide Report No, 260, 1906) and for which purpose an item of £200 is included in the current estimates, the Deputy Borough Surveyor reported that this sum would only permit the planting of 40 trees being planted this year, the cost, estimated by Mr. Dick (Phoenix Park, late Gardener) under whose supervision the trees will be planted, being £5 per tree. We gave instructions for the 40 trees to be planted in Hollybrook Road. Seventy-four

[11] Invoice dated 3rd April 1890. Dublin Diocesan Archives, Walsh Papers.
[12] Item 247 in minutes of Municipal Council of the City of Dublin 1902, p 165.
[13] Report of the Paving Committee Breviate for the Quarter ended 31st December 1907. Reports and Printed Documents of the Corporation of Dublin 1908 Vol. 1. Dublin: Cahill and Co., p 161.
[14] Item 638 in minutes of Municipal Council of the City of Dublin 1905, p 616.
[15] Report of the Paving Committee Breviate for the Quarter ended 30th September 1906. In *Reports and Printed Documents of the Corporation of Dublin* 1906, Vol. 111 Dublin: Cahill and Co. 1908, p 316.

> being were estimated for the road, but by planting them twice the distance apart, allowed for by Mr. Dick, the number available would permit of the whole road being planted.[16] [See Figure 3.]

The Miss Harrison mentioned was Sarah Cecilia Harrison (1863-1941). A portrait painter, social reformer, she was a member of Dublin Corporation from 1912-1915.[17] She was a friend of Hugh Lane (1875-1915) the art collector and dealer. Having organised an exhibition of Irish art in London in 1904, Lane began to plan the establishment of the Municipal Gallery of Modern Art which eventually opened in 17 Harcourt Street in 1908.[18] In offering to line the river Liffey with 2,000 trees, Lane may have already been considering a riverside location for this art gallery. In 1912 Sir Edwin Lutyen's design for a gallery at Wellington Bridge (Halfpenny Bridge) was rejected by Dublin Corporation.

As well as sanctioning tree planting funded by Lane, tree planting occurred on existing streets and on newly laid out roads. In 1907 the Council "ordered the planting of trees on O'Connell Street, Fairview Strand and Annesley Bridge Road in place of ones which had decayed." Permission was granted to Mrs. A. Butterly to plant trees on

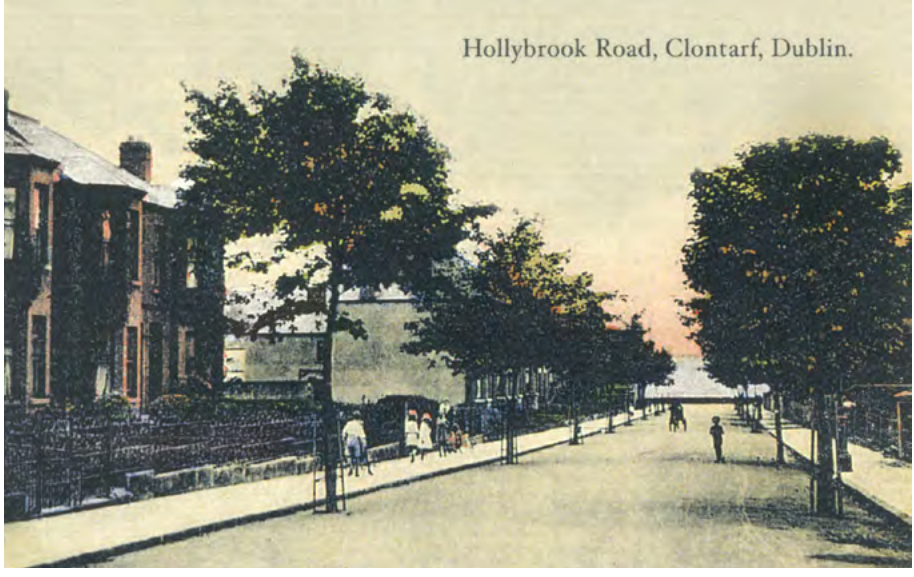

Figure 3: *A photograph of Hollybrook Road shows a tree-lined street where the trees were planted at the edge of the road rather than on the edge of the footpath. Photograph courtesy of the Historical Picture Archive.*

[16] Report of the Paving Committee Breviate for the Quarter ended 31st March 1907. In *Reports and Printed Documents of the Corporation of Dublin* 1907 Vol. 1. Dublin: Cahill and Co. 1908, p 869.
[17] *Dictionary of Irish Biography*. Available at dib.cambridge.org [Accessed November 2019].
[18] *Dictionary of Irish Biography.* Available at dib.cambridge.org [Accessed November 2019].

"the continuation of Home Farm Road [Drumcondra] and two new roads off same".[19]

In 1909 Dublin Corporation planted London Plane (*Platanus* × *hispanica*) of "substantial proportions" in "fresh soil" which "stand the smoke well by reason of the glabrous foliage". The trees were supplied by a local firm Watson and Sons, Clontarf Nurseries, Dublin. The locations selected were Foster Place, College Green and Upper Sackville Street. Though a brief report, it included interesting facts about tree planting practice at the time.[20]

In 1911, the *Irish Times* reported that tree planting took place on Lindsay Road, Glasnevin. The trees, again supplied by Watson's, were "Fine straight-stemmed specimens, with well-shaped heads, and should quickly prove effective".[21] In 1913 it reported that "the North side has taken the lead in tree planting" and the trees planted by Archbishop Walsh's residence were "presenting an agreeable picture to the advantage of the whole district" and also stated that "Citizens will be glad to learn that Dublin Corporation are taking steps to further improve in the matter of tree planting the appearance of the city and suburban thoroughfares under their control". The report continued that "people have the idea that trees do not thrive in cities but once properly planted and cared for in the first few years they become vigorous in growth." The Corporation decided to plant trees on the South Circular Road in November 1913 and the contract to plant London plane trees was to be given to Messrs. Sheppard and Son (Dublin). The Council also decided to plant trees on Ross Road, Bride Street and Nicholas Street where artisans' dwellings had been built. The newspaper commented that "the effect of such planting would naturally be to enhance the amenities and cheerfulness of the environment of the rehoused working classes".[22]

Unfortunately, by February 1914, the Secretary of the Paving Committee, City Hall, wrote to the Editor of the *Irish Times* regretting "malicious destruction to the trees on Ross Road, Bride Road and Eden Quay". The Paving Committee had been "endeavouring… to meet a public demand in the matter of improving the appearance of our streets by a gradual process of tree planting" and a reward for information was offered.[23] A later report stated that 120 trees were planted in four or five localities in the city. Five trees at Bride and Ross Roads near St. Patrick's Cathedral were ruined and two at Eden Quay damaged.[24] Photographs of recently-planted trees illustrate the practice of the time of planting tall specimen trees each with three stakes and supports at the top and bottom of the stem. A second photograph shows how the stake was used

[19] Report of the Paving Committee Breviate for the Quarter ended 31st March 1907. *Reports and Printed Documents of the Corporation of Dublin* 1907 Vol. 1. Dublin: Cahill and Co. 1908, p 869.
[20] Anon. 1909. Planting trees in leading Dublin streets, *The Irish Times*, 25th Mar 1909, p 5.
[21] Anon. 1911. Tree planting in Dublin streets, *The Irish Times*, 28th December 1911, p 7.
[22] Anon. 1913. Tree planting in Dublin, *The Irish Times*, 15th October 1913, p 6.
[23] Tobin. P. 1914. Letter to Editor re. damage to trees. *The Irish Times*, 27th February 1914, p 8.
[24] Anon. 1914. Injuring city trees. *Irish Independent*, 28th February 1914, p 6.

as a fulcrum and the tree was broken off at stake height.[25]

In March 1916 more London plane trees had been ordered from a Dublin nursery - street tree planting by Dublin Corporation was continuing quietly.[26] By 1919 a gardening columnist noted the advances made in street tree planting, particularly on the north side of the city where "youthful specimens of the London plane were now showing the beauty of shapeliness and luxuriant leafage" - a positive comment about the development of a tree-lined streetscape.[27]

Street tree planting in the south suburbs

While reports of street tree planting in the city centre and north suburbs provide information about tree planting and establishment, those from the south suburbs detail tree maintenance and costs of tree planting.

James M'Nab, Curator of the Royal Botanic Garden in Edinburgh, wrote in 1874 "All through the southern suburbs of Dublin, newly arranged for streets, trees have been extensively planted along the edges of footpaths". However, he noted that while the trees were in a "free growing healthy condition", because of a "lack of branch and stem pruning, they had assumed a wide-spread appearance" (M'Nab 1874). M'Nab was likely referring to Ballsbridge and environs, a suburb then under construction on lands of the Pembroke estate.

In 1903, Fane Vernon D.L. Agent of the Pembroke estate wrote to Pembroke Urban District Council stating that "Lord Pembroke was prepared to contribute two shillings per tree per annum in aid of costs and expenses of and incidental to, the maintenance and renewal of the road trees in the part of the Pembroke Urban District which is upon his Estate, such contribution to continue for five years and enclosed £75 being for first year's contribution for 750 trees."[28] At a meeting on 11th Sept 1903, the proposal that the Council take over the maintenance of the trees was adopted.[29] An examination of Ballsbridge and environs on 19th century maps shows the extent of street tree planting and housing. On Clyde Road, though few houses are shown on the map, both sides of the street were tree lined.[30]

A brief newspaper report in 1903 stated that the Roads Committee of Pembroke Urban District Council had placed orders for the purchase of plane and lime (*Tilia* spp.) trees to replace missing trees.[31] While Pembroke Urban District Council minutes

[25] Anon. 1914. Malicious injury to trees. *The Irish Times*, 11th April 1914, p 13.
[26] Anon. 1916. Gardening notes. *The Weekly Irish Times*, 4th March 1916, p 7.
[27] Anon. 1919. The garden. *The Irish Times*, 16th August 1919, p 7.
[28] Pembroke Urban District. Minutes of Council meeting, 13th July 1903, p 17.
[29] Ibid. Council meeting, 11th September 1903, p 35.
[30] Ordnance Survey Ireland. *19th Century Historical Maps* held by Ordnance Survey Ireland. © Public domain. Digital content: © Ordnance Survey Ireland, published by UCD Library, University College Dublin. Available at http://digital.ucd.ie/view/ucdlib:40377 [Accessed November 2019].
[31] Anon. 1903. Pembroke Urban Council. *The Irish Times*, 14th December 1903, p 6.

(1907-1909) record the costs of road tree planting £334 5 shillings and 3 pence in total - no details of species purchased or location of planting was given.[32]

Street tree planting by builders

Builders and landowners were also responsible for street tree planting. On land owned by the Earl of Howth, St. Lawrence Road, Clontarf, was developed from 1870 and was completed by 1898. In a history of Clontarf an extract from the 1907 Ordnance Survey map and an early 20th century photograph show a tree-lined road (Lennon 2014). Patrick Plunkett built houses in Rathmines and Ballsbridge, and by 1870 although only seventeen houses had been built, he had already planted trees on Palmerston Road in anticipation of the development (Figure 4) (Plunkett Dillon 2006).

Street tree planting in Dublin

Various sources, Council minutes, newspaper reports, maps and historical photographs provide information about tree planting in Dublin. Table 1 gives the location of planting and associated dates, where known, from written reports, maps and historical photographs.

In undertaking tree planting the City of Dublin drew on the expertise of contemporary experts like Mr Thomas Moore, Mr Ninian Niven and Mr. Wm. Dick, Bailiff of the Phoenix Park. In both the City of Dublin and Pembroke Urban District Council, the Pavement Committee and the Roads Committee, respectively, were responsible for tree

Figure 4: *The mature* Tilia *planted along Palmerston Road likely date to the 1882 planting.*

[32] Pembroke Urban District Council, Council Minute Book No 10. Dublin City Archives.

Table 1: *Street trees in 19th and early 20th century Dublin and suburbs. The final column lists whether the trees dating from the original plantings are likely still present.*

Location	Written report date	Map date	Historical photograph	Original trees present (2019)
Wellington Road		1865		
Clyde Road		1865	Several 1905	×
Raglan Road		1865		×
Pembroke Road		×	×	×
Northumberland Road		1888	×	×
Merrion Road			×	×
Morehampton Road			×	×
Park Avenue		1865	×	×
Sydney Parade Avenue		1865		×
St. Lawrence Road, Clontarf		1907	×	×
Hollybrook Road, Clontarf	1907		×	×
Hollybank Road, Drumcondra			×	×
Drumcondra	1890		×	×
Islandbridge			×	
North Circular Road near Phoenix Park			×	×
South Circular Road	1913			
Eden Quay	1913			
Nicholas Street	1913			
Ross Road	1913			
Bride Street	1913			
Lindsay Road, Glasnevin	1911			
Foster Place, College Green	1909			×
Fairview Strand	1907			
Annesley Bridge Road	1907			
Home Farm Road, Drumcondra	1907			×
Upper Sackville Street (O'Connell Street)	1874, 1876, 1894, 1907, 1909		×	
Lord Edward Street	1894		×	

planting. In doing so they sought to respond to the public's demand for trees. Individuals such as the Archbishop of Dublin and Mr Hugh Lane also financially supported tree planting. While builders and landowners planted or paid for tree maintenance, a financial return on houses may also have been a motive for their support.

The tree species selection was limited to Wych elm (*Ulmus glabra* Huds.), plane (*Platanus occidentalis* L.) and later London plane (*Platanus* × *hispanica*) and lime. Ningal et al. (2010) prepared an inventory of trees within the canals and found while

hornbeam (*Carpinus betulus* L.) was the most numerous tree species, plane and lime were also numerous and of an older age profile. While plane, lime and horse chestnut (*Aesculus hippocastanum* L.) were commonly used in Britain, the last-listed was not mentioned as a street tree in Dublin. The names of two tree suppliers were found. Wm. Watson and Sons ran a nursery at Strandville Avenue, Clontarf and were, as their catalogue described, "nurserymen and plant merchants". They supplied ornamental shrubs, roses, trees, and herbaceous plants to garden owners. Their catalogue for 1915 – 1916 stated that they "undertake contracts for the planting of private and public roads etc."[33] William Sheppard was a well-known landscape gardener who described himself as "Successor to the late Mr. Niven". He laid out private gardens and grounds, e.g. Glencormac, Co. Wicklow (1874); Archbishops House, Drumcondra, (1890); public parks at St Stephen's Green for Lord Ardilaun (1880), Harold's Cross Park (1893) and Palmerston Park (1892) for Rathmines and Rathgar Improvement Commissioners and street tree planting for the City of Dublin.

Though tree losses occurred, particularly on Sackville Street, attributed to incorrect time of planting, poor quality stock, or poor ground conditions, many trees grew to great stature. Success occurred as can be seen today on the tree-lined roads of Drumcondra Road, St. Alphonsus Road and Hollybank Road and in the suburbs of Ballsbridge, Rathgar (Figure 5) and Sandymount.

Figure 5: *Mature* Platanus × hispanica *(London plane) planted along Orwell Park in Rathgar.*

[33] Unpublished catalogue of Wm. Watson and Sons Ltd., Clontarf Nurseries, Dublin. List no. 84, Autumn 1915 – 1916.

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Trees, Woods and Literature – 43

Lady Gregory's "Tree Planting"

Anna Pilz

Reading through Lady Augusta Gregory's journals one is struck by the abundance of references to the planting of saplings of ash, beech, birch, larch, lime, oak, spruce, sycamore and yew.[1] A keen amateur planter, she held a life-long interest in forestry alongside an appreciation of the cultural value of the arboreal landscape. This dual regard is articulated in an article "Tree planting", one of her early works that was published in the *Irish Homestead* of February 1898.[2] By that time, she had taken charge of her marital home at Coole Park in County Galway with an eye to protecting and developing the family's legacy after the death of her husband, Sir William Gregory, in 1892. As custodian of the estate for her son Robert (1881-1918), Lady Gregory understood environmental stewardship as an integral part of estate management, spending both time and a significant proportion of her income on the upkeep of Coole's woodland.

While landownership and silviculture were considered a man's prerogative, Gregory crossed these gender boundaries as custodian and planter. In her perception of nature as both a material reality and a conceptual space, she engaged with and shaped the environs of the country house. In the 1890s, the family seat with its garden, greenhouses, orchard, and woods became the centre of her life. It was the arboreal landscape in particular that fostered an increasing attachment to place; as she remarked in her autobiography, "that love [for Coole] has grown through the long years of widowed life, when the woods especially became my occupation and delight."[3] For her 1898 article, she drew on her own experience alongside bookish knowledge of horticultural texts and treatise on husbandry, and she combined those with autobiography, reflections on improvement, class relations, and cautious political commentary.

Gregory's deeply felt connection to the arboreal landscape is articulated in what is

For an extended version of this article see Anna Pilz, "Lasting Monuments: Lady Gregory's Domesticated Landscape and Forestry", 2018. In Terence Dooley, Maeve O'Riordan and Christopher Ridgway (eds), *Women and the Country House in Ireland and Britain*, Dublin: Four Courts Press, pp. 170-185. Thanks to Four Courts Press for permission to reprint an excerpt; minor adjustments have been made. Thanks to Colin Smythe for allowing the reproduction of the photograph of Lady Gregory sitting under the catalpa tree at Coole Park.

[1] See, for instance, Niall OCarroll, 2011. Cultivation of Trees at Coole Park – Extracts from Lady Gregory's Diaries and Journals. *Irish Forestry* 68: 55-73.

[2] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 94-8. Originally, the article appeared on 12th and 19th February 1898 of the *Irish Homestead*, pp. 141-2 and p. 164, respectively.

[3] Lady Gregory, 1974. *Seventy Years*, ed. Colin Smythe. New York: Macmillan, pp. 25-6.

perhaps the most expressive passage in "Tree planting". She evokes a familiar bond with trees and woods in romantic terms but with clear cultural and political connotations:

> we find the little seedlings we had put down in faith are over our heads, and acting as our protectors. And even if we do not live to sit under their shade, yet none the less 'they will grow while we are sleeping' that long sleep in which we may so easily be forgotten, and we are not likely to have more lasting monuments put over us, and we cannot have more gracious ones than the living, rustling trees that we had planted and that we had loved.[4]

The politics of this passage can be understood via her three central metaphors: trees as "protectors" of status and power; trees as "lasting monuments" of tradition and family legacy, a living inheritance; and "gracious" trees as the aesthetic value of a place. Gregory implies that it is through her continuance of the family tradition of tree planting and through the works and writings of the Revivalists that the Gregory name will be forever linked to the woods of Coole (Figure 1). Thereby, Gregory's legacy transcends the confines of the domesticated landscape of the demesne to encompass both the literary and the natural landscape, the private and the public.

In "Tree planting", Gregory offered a cultural conceptualisation of the arboreal world that was wedded to its material reality. "[I]f woods, like friendships, are not kept in constant repair,' she warned her readers, 'the day will come when they will be but a memory."[5] She recalled that "Ireland, more than other countries, ought to be a country of trees, for the very letters of her alphabet are named after them." Here, she was explicitly gesturing toward the Gaelic League in musing, "Perhaps with the revival of her old language they will be better called to mind."[6] Appearing in the pages of the *Irish Homestead*, a weekly paper associated with Horace Plunkett's Irish Agricultural Organisation Society (IAOS), her article demonstrates her progressive views on agriculture. By linking Plunkett's self-help movement with Hyde's Gaelic League, Gregory proposed that re-afforestation and language revival went hand in hand. And she directly assisted the self-help movement by sharing her knowledge of silviculture and her thoughts on the present and future state of Irish forestry.

Rather than elaborating in a passive and observant manner on the aesthetic benefits of trees and woods as would have been expected from a female author, her article was instructive, practical, and ideological. While it was common for a woman to take part in horticultural pursuits, with gardening magazines and advice books by and for women

[4] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 94.
[5] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 94.
[6] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 94.

Figure 1: *Lady Gregory under the catalpa tree at Coole, 1927 (courtesy of Colin Smythe).*

proliferating during the Victorian era, literature about and the practice of silviculture were very male dominated.[7] Gregory entered the arboreal discourse with a remarkably confident tone and she aimed to educate by offering guidance on the best times for planting, what species were most suitable for what purposes, and alerted her readers to trees' needs with regards to different soil types. Her early diaries shed light on her planting activity at Coole, that was driven by a commitment to sustainable woodland management, and that she raised her son Gregory to be aware of the responsibilities of environmental stewardship. This is, for instance, apparent in her diary entry for January 1898 when she recorded the joint activity of mother and son: "Arranging tree planting – R. & I having marked 30 spruce for the people, & to leave gaps for the shooting, I am ordering 300 spruce, 300 larch, 100 silvers to take their place."[8]

A few weeks later, she sent off her article "to the Homestead".[9] Gregory approvingly opened "Tree planting" with reference to an earlier article from the *Irish Homestead* that reported on the fact that "the number of trees planted in Ireland last year was considerably larger than the number of trees cut down." Giving a brief list of timber use for building materials and roofing as well as for fuel, she cautioned that such harvesting would result in a fast depletion of woodland if not carefully managed. She recounted that when Robert cut down a tree as a young boy, she promptly "told him that he must never cut one down without planting two in its place."[10]

She also quickly reminded her readers that the beautification of the country as well as its environmental stewardship should be spearheaded by the landed class: "We can't all have woods," she notes at one point, "nor is it to be wished that pasture or tillage fields should be turned into forests."[11] Through the use of this inclusive "we", Lady Gregory places her own husbandry within a familiar and, until that point, patrimonial ascendancy tradition that had started with Robert Gregory in the eighteenth century. As evidence that she was aware of this tradition and the importance of continuing it, she noted in her journals that Arthur Young, who toured Ireland in the 1770s, complimented her husband's ancestors' "noble nursery, the plantations for which would change the face of the district", adding proudly that "those woods still remain."[12]

With "Tree planting" Gregory contributed to a long tradition of practical literature on

[7] Sarah Bilston, 2008. Queens of the garden: Victorian women gardeners and the rise of the gardening advice text. Victorian Literature and Culture 36(1): 1-19; Finola O'Kane, 2015. John Walker's "A Short Dissertation on Planting" for Lady Louisa Connolly. *Irish Architectural and Decorative Studies* XVIII: 152-160.

[8] Entry for 30 January 1898, in James Pethica (ed.), *Lady Gregory's Diaries 1892-1902* (Gerrards Cross: Colin Smythe, 1996), p. 165. Similarly, in April 1903, she noted that "2,500 little trees just arrived to supplement those we have cut." Lady Gregory, 1974. *Seventy Years*, ed. Colin Smythe. New York: Macmillan, p. 428.

[9] Entry for 10 February 1898, Lady Gregory's Diaries, p. 166.

[10] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 95.

[11] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 95.

[12] Entry for 23 April 1920, Lady Augusta Gregory, *Lady Gregory's Journals: Volume One, Books 1-29, 10 October 1916-24 February 1925*, ed. Daniel J. Murphy (Gerrards Cross: Colin Smythe, 1978), p. 148.

husbandry and silviculture that was, however, predominantly written by and for men. At Coole, she had access to a number of classic texts on the topic from the sixteenth to the nineteenth centuries. The holdings in the library gave testimony to the Gregorys' interest in landscape design, gardening, and forestry across generations, with titles from Richard Payne Knight, Humphrey Repton, John Claudius Loudon and William Pontey.[13] When given the choice of six books from the library of her marital home, Gregory counted John Evelyn's *Silva* to be one of them, 'with its beautiful coloured plates of larch and "Silver firr"'.[14] First published in 1664 under the auspices of the Royal Society, Evelyn's *Silva* is one of the most influential books on forestry. Gregory's reference is to the 1786 edition, edited with extensive notes by A. Hunter and featuring forty coloured plates.[15] Considering that Gregory held this book in such high regard, we can surmise that it was likely a constant companion, frequently consulted and re-read.

For Gregory, it was the inclusion of the story of Ulysses in Evelyn's *Silva* that prompted her to recognize how planting trees was a means of connecting past, present, and future as well as a way to insert herself within the family's legacy. She quotes from Evelyn's book:

> When Ulysses, after a ten years' absence, was returned from Troy, and coming home found his aged father in the field planting of trees, he asked him, 'Why, being now so advanced in years, he would put himself to the fatigue and labour of planting that of which he was never likely to enjoy the fruits?' The old man, taking him for a stranger, gently replied, 'I plant against my son Ulysses comes home'.[16]

As the passage indicates, the educational task of environmental stewardship was traditionally framed along paternal lines. Yet Gregory clearly associated herself in imaginative and practical terms with the father planting for his son's return and, irrespective of her gender, she considered it to be perfectly natural to take on that role. With subtlety, she draws on Evelyn's authority to argue for woman's equal (if not superior) role in environmental stewardship. '"Men seldom plant trees till they begin to be wise', says Evelyn"; having drawn attention to her conscientious tree planting and role as educator; Gregory – with the insertion of this quotation – was, in effect,

[13] *Catalogue of Printed Books Formerly in the Library at Coole* (London, 1972). Dates given are in reference to the respective edition held at Coole.

[14] Lady Gregory, 1971. *Coole*. ed. Colin Smythe, Dolmen Press, Dublin, p. 20.

[15] *Catalogue of printed books.*

[16] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 95. For the direct quotation see John Evelyn, 1801. *Silva: or, a Discourse of Forest-trees, and the Propagation of Timber in his Majesty's Dominions*, with notes by A. Hunter, 3rd ed., in two volumes, vol. I, York, p. 32.

proclaiming her own wisdom.[17] In confirming her intellectual and practical abilities, she simultaneously asserted her right to take on the duties expected of the landed class.

Like Evelyn's, Gregory's argument is situated within a national framework. She called for a nation-wide revolution of tree planting that would unite the oppositional groups of those who supported Ireland's constitutional status as per the Act of Union of 1800 and those who campaigned for either Home Rule or separation. In the very year in which Irish nationalists were marking the centenary of their most noteworthy attempt at staging a rebellion against British rule, she overtly expressed her wish "that every Nationalist would plant at least one tree in this year of '98, and every Unionist in 1900, and every waverer or indifferent person in the year that separates them".[18] For Gregory, environmental stewardship and ecological thought had thus the power to sidestep political division.

Whereas trees and woods enabled Gregory's entry into the established order, they equally offered the opportunity to negotiate class boundaries. After all, tree planting was a collaborative enterprise. Gregory acknowledged in *Coole* that she had not managed the woods on her own: "my companion and best helper an old man, now passed away. … He was an old master of the business, had loved it through his lifetime."[19] The old man was Gregory's wood-cutter, John Farrell. Having worked on the Coole estate for Sir William previously, Farrell was intimately acquainted with the demesne woods. He was listed as a "farm servant" on the census for 1901, aged seventy-nine at that time.[20] Gregory's description of Farrell proposes an ambivalent cross-class relation. Yet woodland management was not their only collaborative work.

In addition to looking after Coole's woods, Farrell also contributed to their mythologisation. He offered up folklore to both Gregory and W.B. Yeats, being, as he was, witness to "an unearthly sight in the woods."[21] This vision occurred to him while cutting timber in Inchy Wood at Coole; he thus channelled both the natural and supernatural of the arboreal environment. His stories were included in Yeats' and Gregory's publications, including an essay on "The Enchanted Woods" and *Visions and Beliefs in the West of Ireland*.[22] But despite his service to woodland management at Coole and to the Literary Revival through his folklore of the "Seven Woods", his name is not inscribed in the bark of the famous "autograph tree"; nor is any tree planted in his memory. His name does not cling to the arboreal landscape as do the names of others.

[17] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 96.

[18] Lady Gregory, 1976. Tree Planting. *Irish Forestry* 33(2): 95.

[19] Lady Gregory, 1971. *Coole*. ed. Colin Smythe, Dolmen Press, Dublin, p. 94.

[20] Available at http://www.census.nationalarchives.ie/pages/1901/Galway/Kiltartan/Coole_Demesne/1384414/. [Accessed September 2016].

[21] W.B. Yeats, 1902. *The Celtic Twilight*. London: A.H. Bullen, p. 103.

[22] Lady Gregory, 1920. *Visions and Beliefs in the West of Ireland Collected and Arranged by Lady Gregory: with Two Essays and Notes by W.B. Yeats.* New York & London: G.P. Putnam's Sons; W.B. Yeats, 1902. *The Celtic Twilight*. London: A.H. Bullen, pp. 101-3. I wish to express my warmest thanks to John Farrell's great-great granddaughter, Louise Stone, for drawing my attention to John's life and work.

Today's visitors continue to marvel at the autograph tree. The presence of the woods, with their associated names and stories, form a counterpart to the absence of the house. Here Gregory had inaugurated a literary landscape, and fostered and protected what is now a nature reserve. She regarded the demesne's trees and woods as a space where human intervention imbued nature with meaning, and in which gender distinctions could be negotiated and class boundaries fortified. While she was part of a tradition of landed women who actively shaped the landscape of the country house, her public contribution to the discourse of the country's re-afforestation via a piece of practical literature on silviculture was a more unusual if not to say bold endeavour for a woman. Her planting practice and conceptualisation of it highlight the interplay of private and public landscapes. With the house gone, the woods remain as her "lasting monument". Dating from 1927, the photograph in Figure 1 captures the imposing catalpa tree within the walled garden at Coole Park. Lady Gregory, in her mid-seventies at the time, sits under its protective shade, looking out over the wooden fence. This Indian bean tree was most likely planted in the latter half of the eighteenth century, when the Irish-born politician Robert Gregory returned from his service in the East India Company and acquired the estate. Although the specifics as to how this particular sapling took root in the soil at Coole are unknown, it is likely that it travelled all the way to County Galway via imperial networks. Indeed, it "was said to have been planted as a sapling in Coole, having been transported over desert on a camel's back wrapped in a hemp sack."[23]

Growing over more than a century to its mature magnificence, the catalpa became a well-loved tree in the grounds at Coole. Not only was it one of Lady Gregory's favourite trees, but it was acknowledged by later visitors as a significant touchstone in the natural and cultural landscape. Having fallen victim to a storm and further weakened after another, the tree was removed by the National Parks and Wildlife Service to ensure the safety of visitors in 2008.[24] A local of Gort wrote to the *Irish Times* in outrage at such a "wanton act of vandalism."[25] "The unconventional beauty of Coole has been violated", argued Mark Coen, "as has the notion that ordinary people might be stakeholders in our natural heritage."[26] Yet the stump of the catalpa tree was left as a reminder of that heritage,[27] and a new one had already been planted in 1995 by Lady Gregory's grand-daughters in her memory (Figure 2).

[23] Available at https://www.coolepark.ie/history/walled-garden/ [Accessed June 2019].

[24] Tim O'Connell, "Catalpa tree at Coole Park", *Irish Times* (12 June 2008). Available at https://www.irishtimes.com/opinion/letters/catalpa-tree-at-coole-park-1.1218300 [Accessed June 2019].

[25] Mark Coen, "Coole Park's Catalpa tree", *Irish Times* (2 June 2008). Available at https://www.irishtimes.com/opinion/letters/coole-park-s-catalpa-tree-1.1265860 [Accessed June 2019].

[26] Mark Coen, "Coole Park's Catalpa tree", *Irish Times* (2 June 2008). Available at https://www.irishtimes.com/opinion/letters/coole-park-s-catalpa-tree-1.1265860 [Accessed June 2019].

[27] "*Catalpa bignonioides*", Tree Register, Tree Council of Ireland, https://treecouncil.ie/treeregisterofireland/392.htm [Accessed June 2019].

Figure 2: *In 1995, Lady Gregory's granddaughters planted another catalpa tree to replace the earlier specimen. Photograph courtesy of Audrey Robitaillié.*

Anna Pilz
Rachel Carson Center for Environment and Society,
Ludwig-Maximilians-Universität

(a.pilz@outlook.com)

Book Reviews

A list of recently published books on trees and forestry which may be of interest to readers is provided below. Titles marked with an asterisk are reviewed in this section.

List of publications of interest to SIF members

Agroforestry for Sustainable Agriculture (Burleigh Dodds Series in Agricultural Science) by Prof. María Rosa Mosquera-Losada and Dr Ravi Prabhu (Eds.). Published by Burleigh Dodds Science Publishing. May 2019.

Amazon Men: The World's Greatest Forest that has Eluded and Deluded Explorers for 500 Years by Adam Courtenay. Published by Endeavour Media. June 2019.

Carving Out a Living on the Land: Lessons in Resourcefulness and Craft from an Unusual Christmas Tree Farm by Emmet Van Driesche. Published by Chelsea Green Publishing. June 2019.

Conversations with Trees: An Intimate Ecology by Stephanie Kaza. Published by Shambhala. April 2019.

Ecological Forest Management by Jerry F. Franklin, K. Norman Johnson and Debora L. Johnson. Published by Waveland Press, Inc. March 2018.

Energy Transitions and the Future of Gas in the EU: Subsidise or Decarbonise (Energy, Climate and the Environment) by Gökçe Mete. Published by Palgrave Macmillan. January 2020.

Farming for the Long Haul: Resilience and the Lost Art of Agricultural Inventiveness by Michael Foley. Published by Chelsea Green Publishing. January 2019.

Firestorm: How Wildfire Will Shape Our Future by Edward Struzik. Published by Island Press. September 2019.

Forest Measurements (6th ed.) by Harold E. Burkhart, Thomas Eugene Avery and Bronson P. Bullock. Published by Waveland Pr Inc. June 2019.

Forty Years a Forester (2nd ed.) by Elers Koch. Published by University of Nebraska Press. October 2019.

***Into the Forest: How Trees Can Help You Find Health and Happiness** by Dr Qing Li. Published by Penguin. June 2019.

New Flora of the British Isles by Clive A. Stace. Published by Cambridge University Press. February 2019.

Oregon's Ancient Forests: A Hiking Guide Paperback by Chandra LeGue and Oregon Wild. Published by Mountaineers Books. July 2019.

***Our Future in Nature - Trees, Spirituality and Ecology** by Edmund Barrow. Published by Balboa Press. May 2019.

Out of the Woods by Luke Turner. Published by W&N. September 2019.

Plant Your Money Tree: A Guide to Growing Your Wealth by Michele Schneider. Published by Rowman & Littlefield Publishers. May 2019.

Renewable Energy Finance: Theory and Practice by Santosh Raikar. Published by Academic Press. December 2019.

Shinrin-yoku: The Japanese Way of Forest Bathing for Health and Relaxation by Yoshifumi Miyazaki. Published by Aster. March 2018.

Silvopasture: A Guide to Managing Grazing Animals, Forage Crops and Trees in a Temperate Farm Ecosystem by Steve Gabriel. Published by Chelsea Green Publishing. June 2018.

Sprout Lands: Tending the Endless Gift of Trees by William Bryant Logan. Published by W.W. Norton & Company. March 2019.

The Architecture of Trees by Cesare Leonardi and Franca Stagi. Published by Princeton Architectural Press. March 2019.

The Chainsaw Safety System: Surefire Methods for Cooperative Tree Cutting in Any Situation by Chuck Oslund. Published by Chuck Oslund. June 2019.

The Garden Jungle: or Gardening to Save the Planet by Dave Goulson. Published by Jonathan Cape. July 2019.

The Magic and Mystery of Trees by Jen Green and Claire McElfatrick. Published by DK Children. March 2019

***The Practice of Silviculture: Applied Forest Ecology (10th ed.)** by Mark S. Ashton and Matthew J. Kelty. Published by Wiley. March 2018.

The Secret Wisdom of Nature: Trees, Animals, and the Extraordinary Balance of All Living Things - Stories from Science and Observation (The Mysteries of Nature Trilogy) by Peter Wohlleben and Jane Billinghurst. Published by Greystone Books. March 2019.

***The Silviculture of Trees Used in British Forestry** by Peter Savill. Published by Springer. April 2019.

The Songs of Trees: Stories from Nature's Great Connectors by David George Haskell. Published by Viking. April 2018.

The Tangled Tree: A Radical New History of Life by David Quammen. Published by Simon & Schuster. August 2018.

***The Tree Book: Superior Selections for Landscapes, Streetscapes, and Gardens** by Michael A. Dirr and Keith S. Warren. Published by Timber Press. April 2019.

Think like a Tree: The Natural Principles Guide to Life by Sarah Spencer. Published by Swarkestone Press. April 2019.

Treed: Walking in Canada's Urban Forests by Ariel Gordon. Published by Wolsak and Wynn. June 2019.

Trees of Life by Max Adams. Published by Apollo. November 2019.

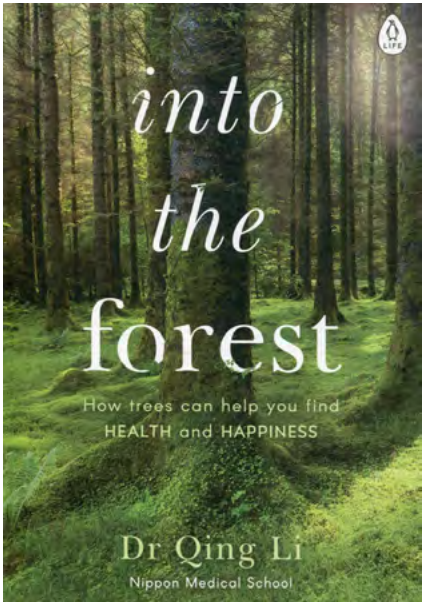
Trees of Power: Ten Essential Arboreal Allies by Akiva Silver and Samuel Thayer. Published by Chelsea Green Publishing. March 2019.

Trees: A Rooted History by Piotr Socha and Wojciech Grajkowski. Published by Harry N. Abrams. April 2019.

Wilding: The Return of Nature to a British Farm by Isabelle Tree. Published by Picador. May 2018.

Into the Forest: How Trees can help you find Health and Happiness

Quig Li
Penguin Pb. 2019
301 pages. Paperback. ISBN: 978-0-241-37759-8
€13



Dr Qing Li, one of the world's leading experts on forest bathing, is associate professor at the Nippon Medical School in Tokyo. In *Into the Forest*, Immunologist and Forest Medicine expert Dr Qing Li examines the unprecedented benefits of the world's largest natural health resource: the great outdoors. Humans are increasingly becoming an indoor species – we now spend 90 per cent of our life indoors. And, on average, we dedicate eight hours a day to staring at screens. Our increasingly sedentary lifestyle is creating significant adverse consequences for our health.

Applying cutting-edge research and emerging science, Dr Li explores the inherent connection between nature and improved wellbeing. This practical guide will help you overcome some of life's most problematic health issues, by reducing blood pressure; lowering stress; improving cardiovascular and metabolic health; lowering blood-sugar levels; improving concentration and memory; lifting depression; improving pain thresholds; improving energy; increasing anti-cancer protein production; improving energy levels; and boosting the immune system.

From mindful strolls in your local park to listening to the wind, from watching the sunset to walking barefoot in the grass, Dr Li reveals the life-improving advantages of spending time around trees, for a healthier and happier you.

Forest bathing is basically bathing the senses in the forest atmosphere. This is not exercise, or hiking, or jogging. It is simply being in nature, connecting with it through our sense of sight, hearing, taste, smell and touch. Indoors, we tend to use only two senses, our eyes and our ears. Outside, we can smell the flowers, taste the fresh air, look at the changing colours of the trees, hear the birds singing and feel the breeze on our skin. And when we open up our senses, we begin to connect fully with the natural world.

We are part of the natural world. Our rhythms are the rhythms of nature. As we walk slowly through the forest, seeing, listening, smelling, tasting and touching, we bring our rhythms into step with nature. Our nervous system can reset itself; our bodies and minds can go back to where they ought to be. No longer are we out of kilter with nature but once again in tune with it, we are refreshed and restored.

As we were many millennia ago, Japan is a forest civilization. The Japanese culture, philosophy and religion are carved out of the forests that blanket almost 70% of the country – not to mention all manner of everyday items, from houses and shrines to walking sticks and spoons. It may be one of the most densely populated countries but it is also the greenest, with a huge diversity of trees. Only Finland and Sweden have a similar cover of forest but they are far less densely populated. Apart from the multitude of flowering cherries from Japan, their most famous tree is *Cryptomeria* (Japanese cedar) and for Irish foresters, it has to be the Japanese larch.

By 2050, 75% of the world's population will live in cities. The World Health Organisation (WHO) has designated stress the health epidemic of the twenty first century. Finding ways of managing stress – not just for our own health but for the health of our communities, at home and in the workplace – is set to become the most significant health challenge of the future.

It is no secret that high levels of stress are directly linked to anger and irritability. Our modern day lives are exhausting – we are pulled in so many different directions at once. So, I wonder how you start the day after a night of not quite enough sleep. Is it standing at the kitchen counter with a cup of coffee? Is it rushing to catch a train or to get the children to school? Are there a million and one things you have to do as soon as you get into work – things which ought to have been done yesterday? How does that all make you feel – happy and relaxed, full of energy and enthusiasm for life? No indeed! Here are some of the emotions you have probably experienced: confusion; sadness; terror; guilt; lack of vigour; and exhaustion.

It is only walking in a forest environment that creates a positive effect on your vigour and fatigue. To achieve this benefit, you don't have to spend a lot of time in the

forest; two hours is sufficient. Interestingly, women's moods appear to be influenced to a greater degree by forest bathing than men's moods.

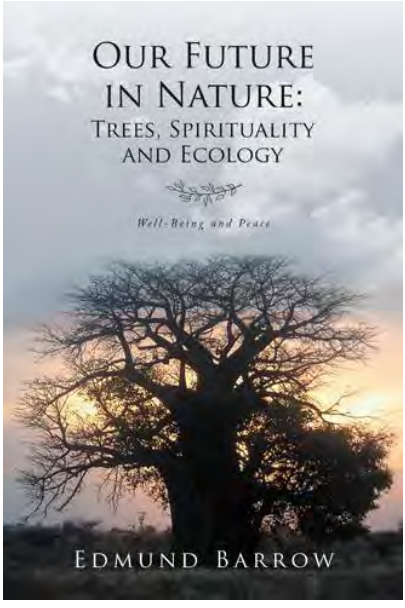
As more and more of us have migrated to the city, fewer and fewer of our children have the access to nature that we or their grandparents took for granted. Our children do not know the wide variety of experiences that were so commonplace up until recently and which are disappearing fast; think of blackberry picking, and do we ever hear of raiding orchards anymore? Nature is hugely beneficial for children's mental and physical development. If we take our children to the forest, they will become the adults who will protect it.

Dr Qing Li concludes with a list of forty of the world's most beautiful and beneficial forests to visit. Ireland has just one representative on this list: Killarney National Park. Whatever else we may think of this author, we must agree that he has discerning taste!

John Mc Loughlin

Our Future in Nature – Trees, Spirituality and Ecology

Edmund Barrow
Balboa Press. 2019
345 pages. Paperback. ISBN: 978-9822-2663-3
€22



The author, Edmund Barrow, grew up on an organic farm in Ireland and studied natural sciences in Trinity College, Dublin. He holds a Masters degree in Development. Edmund has worked for over 40 years, mainly in Africa, but also in Asia and the Americas, in more than 20 countries, focusing on how communities conserve and benefit from nature. He emphasises local learning in terms of governance, empowerment, benefit sharing, natural resource management, and the more spiritual aspects of nature. This includes the importance of local and indigenous knowledge. He has extensive experience with participatory approaches to environmental management, village-level land use planning at landscape levels and forest landscape restoration. Edmund has published widely, emphasising practical lessons to enable people benefit from conservation. He lives in Kenya and is an Associate member of the Society of Irish Foresters.

The central theme of this thought-provoking book is that humankind has held trees and woodlands in awe and reverence since the dawn of time. Who has not felt a

sense of awe, silence, stillness, and presence in an ancient forest or in front of a sacred tree? Perhaps this is because we depend on nature for the air we breathe, the water we drink, and the services nature provides. Sacred trees and sacred groves transcend race, colour, and creed. They are found everywhere on our fragile planet. This book will appeal to religious and spiritual traditions, to the conservation and environmental movements, and to those concerned with education, health and peace. He places great importance on Pope Francis's book, his second encyclical, *Laudato Si*: *On Care of Our Common Home*. Pope Francis draws all Christians into a dialogue with every person on the planet about our common home. We as human beings are united by the concern for our planet, and every living thing that dwells on it, especially the poorest and most vulnerable. Pope Francis's letter joins the body of the church's social and moral teaching, draws on the best scientific research, providing the foundation for the ethical and spiritual itinerary that follows. Edmund argues that while the pope has given great direction, action has not filtered down to the bishops, especially in Africa.

His book offers its readers the means to take better care of our fragile and only home – planet Earth. Often undervalued, unrecognised, or disrespected, sacred trees and groves are conserved against mind-boggling pressures. Sacred trees and groves can conserve unique biodiversity, which helps create or recreate connectivity in the landscape. As such, sacred trees and groves may be relict survivors of bygone ages and are a resource for restoring degraded natural landscapes.

The Society of Irish Foresters reprinted a seminal article first published in 1963 in the *Journal of the Cork Archaeological and Historical Society*, The *Sacred Trees of Ireland* by A.T. Lucas in 2017 (56 + viii pages. Paperback. ISBN 978-1-78808-864-0). The author, Anthony Lucas (1911-1986), was a very thorough researcher and combed through a great number of published historical sources from cover to cover, collecting references on index cards to many aspects of Irish life that he was interested in. Lucas's text on sacred trees deals with the subject under a number of headings starting with legendary trees mentioned in early Irish literature, then moving on to trees associated with churches and saints as mentioned in early sources and finally bringing the story up to the present day with rag bushes and trees at holy wells. The information is expertly contextualised and many references to such trees in all parts of Ireland are gathered together. It was never intended to be an exhaustive list and the author stated that clearly at the start. That said he did gather an extraordinary amount of information on the subject especially from the early sources and his text has been and will continue to be an essential starting point for anyone researching sacred trees in Ireland.

Edmund's book suggests ways for those involved with religion and spirituality and for those working with conservation and land use to jointly engage in repairing the damage we have done to Earth. Lessons and ideas from the book may help connect us as a powerful force for peace, respecting nature and the fragile Earth we inhabit.

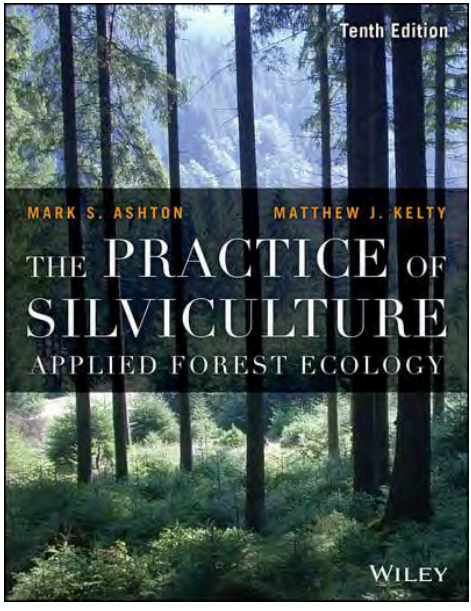
Few of us enjoy ready access to a formal sacred tree or sacred grove, but we can all have our own personal bit of sacred nature – in the park, a woodland, a riverbank, in our garden, even on our patio. He distinguishes between spirituality and religion arguing that spirituality is in the heart, but that religion concerns the rules that frame a particular religion.

The messages from this book may help you cope with the stresses of life, and in helping you, it will help nature and Mother Earth. It is worth bearing in mind that on this planet there are sufficient resources for everyone's need but these are unevenly distributed, as the author puts it, "there is enough for everyone's need but not for everyone's greed".

John Mc Loughlin

The Practice of Silviculture: Applied Forest Ecology

Mark S. Ashton and Matthew J. Kelty
Wiley-Blackwell. 2018
776 pages. Paperback. ISBN 978-1119270959
10th edition. €75



Currently, there is significant public debate about trees and forests. Climate change has been proclaimed an international emergency and tree planting is being promoted as one of the most attractive solutions. Politicians of all colours, stripes and nationalities have been falling over themselves to tout the number of trees they plan to plant, and initiatives such as the one trillion trees movement, coordinated by the World Economic Forum, are creating impact at the international policy level. However, the dialogue around tree planting refers to only one aspect of silviculture.

The uncomfortable truth for foresters is that silviculture is not a term in common language or usage. It is in many ways a Cinderella discipline, often overshadowed in university and government departments by ecology, environmental sciences, and natural heritage conservation. Given the scale of the changes required and the potential for forestry to serve as a solution, one could argue that silviculture is now one of the most relevant fields of our time.

For any discipline to have standing there needs to be an active programme of research, a body of literature and textbooks to synthesise the science and practice. In

this regard, the 10th edition of *The Practice of Silviculture: Applied Forest Ecology* is both vital and timely. Building on the legacy of previous editions, this latest incarnation is greatly expanded, modernised and re-structured in line with current demands for course textbooks.

In terms of the structure, the book is primarily composed as a series of building blocks, taking the reader from definitions and principles to applications and wider considerations. The introduction reviews the history and philosophy of silviculture and outlines its place in managing current forests and woodlands. Especially important are the six principles that govern the scope and application of silviculture. These include: imitating nature through silviculture; conservation of site productivity; control of stand structure and process; control of composition; control of stand density; and, control of rotation length. In the second part, the ecological foundations of silviculture are introduced, with an overview of ecological site classification, forest stand dynamics and the ecology of regeneration. The primacy of the forest stand as a management unit, and the link between the stand and landscape-scale planning are also addressed, helping to set out a framework for much of what follows.

The third part of the textbook focuses on methods of regeneration, introducing the major silvicultural systems, which are categorised as the clearcutting, seed-tree, shelterwood, irregular seed-tree and shelterwood, coppice, and selection methods. Each is described through the lens of natural regeneration of forest stands with the vast majority of examples drawn from North American scientific literature and forestry practice. Artificial regeneration practices are addressed separately, where some detail is provided on tree selection, genetic improvement and nursery practices.

The fourth section focuses on "post-establishment (intermediate) treatments", including tree growth in forest stands, changes in wood properties, and production. Post-establishment tools such as applications of herbicides, insecticides, fertilisers and prescribed burning are explained in detail. There are chapters on pruning, stand release from competition, and thinning. The thinning chapter outlines a range of options that would normally not be considered in Ireland, where low thinning is the standard approach. However, the emphasis is on biological and silvicultural matters; only in a very short section does the discourse focus explicitly on the economic aspects of thinning and yield.

In the final two sections we see the most significant developments from earlier editions of *The Practice of Silviculture*. Here the contemporary relevance of silviculture is made apparent. Promoting the wider values and purposes of forests, there are chapters on the role of silviculture in forest conservation, wildlife habitat, rehabilitation, and reclamation. Chapters on forest health and forest carbon in changing climates serve as brief overviews of topics that have global significance. Finally, there is reference to silviculture in the context of different land uses such as

multi-functional public forests, watersheds, timber production, agroforestry and urban forestry.

The book draws on an impressive body of literature, including many of the classic earlier publications as well as the latest research. Although there are examples from around the world, reflecting the experience of both authors, it is firmly rooted in the science and practice of forestry in the United States. From a European perspective, there are differences in emphasis that perhaps merit more comment. For example, the growing importance of close-to-nature forest management and continuous cover forestry are associated with major shifts in our thinking over the past 20-30 years. Moreover, what is considered a sustainable silvicultural practice in one jurisdiction may be politically unacceptable in another. Clearcutting, for example, is the standard regeneration method in many regions, but is barred elsewhere. In this regard, the interface between silviculturists and wider society could be given greater attention. Nonetheless, the book is unsurpassed in its comprehensive description of the major systems and practices. Furthermore, there is an attempt to promote a consistent terminology, as promulgated by the Society of American Foresters Silviculture Instructors Sub-Group (1994) and the Commonwealth Forestry Bureau (Ford-Robertson 1978).

Compared with the previous edition, the production quality is a step forward. Richly illustrated with diagrams and figures, there are also many colour images. Silviculture is a subject that calls out for visual and graphical explanations. There are also many small boxed items that present case-studies, drawing on the authors' experience during travel and research around the world. It is attractive and almost infinitely interesting to delve into this book; students will certainly find this an essential resource for term papers and references on the broad spectrum of silviculture topics.

Overall, *The Practice of Silviculture: Applied Forest Ecology* is an impressive publication and the authors are to be congratulated on this major contribution to forestry literature. It keeps the discipline of silviculture fresh and alive, and presents much relevant and new information in tune with current drivers for sustainable forestry. Clearly the target audience will be students, researchers and practitioners of silviculture and forest conservation. It would also be a useful reference for anyone working in forest ecology, landscape management and natural resources management.

Every forester knows that tree planting is the start of a long journey. Foresters think in terms of decades, and longer, when it comes to planning, establishing and managing woodland. The maxim that foresters and policy experts like to apply is "the right tree, in the right place, for the right reason". *The Practice of Silviculture: Applied Forest Ecology*, more than any other textbook I have encountered in forestry literature, re-enforces the diverse range of options, challenges and opportunities associated with the long-term management of forest ecosystems. It suggests a new mantra for our

times, where resilience and adaptation are central to silvicultural thinking: the right genes, of the right species, adopting the right system, on the right site and for the right reasons. For any student of silviculture, this magnificent new edition sets out the principles of forest stand and landscape management, and refreshes our framework of understanding. It inspires hope in our ability, as foresters, to tackle the many social and environmental challenges ahead.

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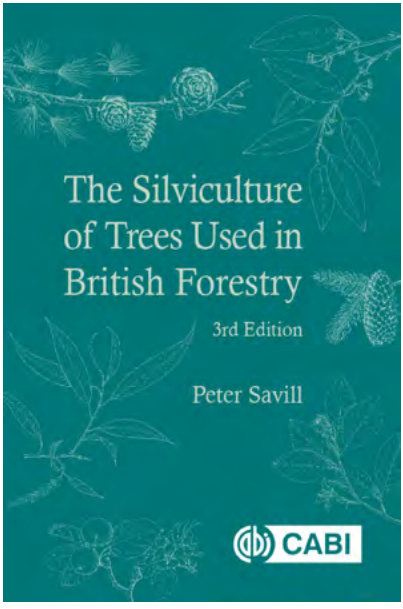
Society of American Foresters, Silvicultural Instructors Sub-Group. 1994. *Silviculture Terminology.* Society of American Foresters, Bethesda, MD. 14 pp.

Edward R. Wilson
Walsh Scholar in Silviculture, Teagasc Forestry Development Department and UCD Forestry

The Silviculture of Trees Used in British Forestry

Peter Savill
CABI. 2019
400 pages. Hardback. ISBN 978-1-78639-392-0
3rd edition. €125



The 3rd edition of this book authored by Peter Savill, former Reader in Silviculture at Oxford, has been fully updated to cover some 42 genera and 73 species of trees currently used in British forestry. It brings up to date the current state of knowledge on each of these species performance in Britain, drawing on experience derived from many years of observation, research and practice.

Following the Introduction, which discusses the importance of matching species to sites, provenances and climate change together with a brief commentary on British forestry, the remainder of the book deals with the chosen species in a more or less standard format. Information is provided about the origin and introduction (where applicable) of the species, climatic and soil requirements, other silvicultural characteristics, diseases, natural regeneration, provenance, seed production, nursery treatment, yield and timber characteristics and its place in British forestry. Species are listed alphabetically through the text by scientific name and those illustrated are readily identifiable in the line drawings by Rosemary Wise, which are clear and accurate. A simple field key for the identification of approximately half of the common forest

and woodland species covered in the book is also provided. There is an extensive bibliography of some 575 references to published literature on the species covered.

The book aims to provide a guide that can be used when selecting species and managing trees. It does not provide detailed botanical descriptions of trees nor has consideration been given to the relative economics of the different species: the main emphasis is upon the suitability of species to sites. This fully updated edition puts more emphasis on species suitable for changing climatic conditions, with accounts of several species that may become more prominent in the future such as silver firs, hickories, eucalyptus, poplars and wingnuts.

While the book is concerned with trees used in British forestry, most of the species listed occur in Ireland making it also relevant to Irish forestry.

The first and second editions, which this book will replace, have become standard textbooks on the subject in universities and colleges in both Britain and Ireland. It is a book for the reader who is reasonably well informed about the principles of forestry practice and is an essential resource for students, researchers and forestry professionals. In addition to its practicality, it is a valuable contribution to forestry literature in this part of the world and will remain relevant for many years to come.

Alistair Pfeifer

Sadly Dr Peter Savill passed away in November 2019. He will be missed by all in forestry.

Ed.

The Tree Book: Superior Selections for Landscapes, Streetscapes, and Gardens

Michael A. Dirr and Keith S. Warren
Timber Press. 2019
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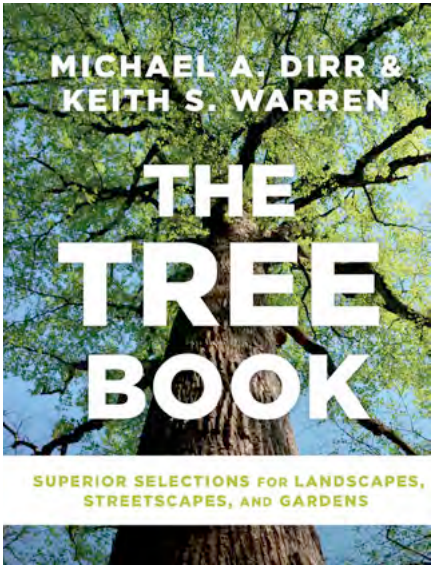


In truth this book should really be called the Big Tree Book for it is an enormous tome, comprising 939 A4 pages. It is certainly not a suitable or comfortable read in bed! *The Tree Book* is the go-to reference for more than 2,400 species and cultivars, from two of the biggest names in American horticulture – Michael A. Dirr, professor emeritus, horticulture, University of Georgia, who is widely acknowledged as one of the leading experts on trees and shrubs for landscapes and gardens, and Keith S. Warren, tree breeder and nurseryman, who has significantly reshaped the tree palette of the American landscape through the introduction and promotion of improved tree cultivars. From two of the foremost names in horticulture, comes the authoritative guide for the best tree species and cultivars for the diverse landscapes of today. The featured trees include those widely available in the nursery trade, some new and promising choices, and a selection of over-looked options that deserve renewed interest. Each tree profile includes the common and the botanical name along with details on: foliage; flowers, seeds, fruits, and cones; native range; adaptability; and

popular uses in landscapes. *The Tree Book* is a must-have resource for landscape architects, foresters, horticulturists, enthusiastic home gardeners and students in related fields.

Whilst being based in the USA, the authors point out that they have picked "trees that make up the currently available landscape tree palette for use in the temperate northern hemisphere...The best cultivars have spread across continents, and this book should be useful in all countries across temperate climates." Here in Ireland, we depend to a huge extent on trees from the USA, hence the relevance of this book.

The authors argue that the advance of our civilisation has been largely underpinned by a process of turning the wild environment into what is now called the "built environment". We have to admit that our apparent conquest of nature has given us tremendous creature comforts… but all this comes at a price, they argue. While we have urbanised our world, we still need to cherish nature and accept that we are ultimately subservient to it. While conquest has almost always been destructive, the authors argue that populations prosper best in climates where trees are present.

Research at Yale (2015)[1] estimated that the Earth holds six trillion trees, but the study also found that there has been a 46% loss of tree cover since the dawn of civilisation and that humans are the main drivers of that reduction. We need only look at the recent illegal forest fires in the Amazon to realise that humans continue to reduce the tree cover in order to provide more space for agriculture. Clearly, widespread reforestation is good for the planet but what we do for our cities is disproportionately important. Planting trees in human population zones, especially in cities, has a multiplier effect on its benefits. Urban and residential trees mitigate so many human-caused effects on the environment.

Trees, the authors say, benefit people psychologically too, in subtle ways that often go unnoticed. The presence of trees, the merest hint of a natural environment, somehow reduces stress, and stress reduction in turn improves health.

This comprehensive guide will appeal to professionals at the forefront of discussions around public green spaces, environmental justice, and urban planning in the age of rapid urbanisation and global warming, all subjects that Irish foresters will have to consider. With the advance of climate change this book is hugely relevant. It features 2,745 superb colour photographs, making tree identification much easier than it has been previously. The writing style is entertaining and compelling with its lively stylistic mix of technical, impressionistic, and, occasionally, irreverent approaches to tree selection.

Nowhere else can you get all this information in one place, a modern-day classic for tree lovers – professional or otherwise.

John Mc Loughlin

[1] Crowther, T., Glick, H., Covey, K. et al. 2015. Mapping tree density at a global scale. Nature 525: 201–205.

Society of Irish Foresters
75th Annual Study Tour to Lithuania

11th – 15th September 2018

On Tuesday, 11th September thirty-six members of the Society of Irish Foresters departed Dublin Airport on a late-night flight to Vilnius for the Society's 75th annual study tour and our first tour to Lithuania.

Lithuania is almost the same size as the Republic of Ireland, but it has a population of just 2.8 million – its population has declined substantially since joining the EU. It is situated along the south-eastern shore of the Baltic Sea, to the east of Sweden and Denmark. It is bordered by Latvia to the north, Belarus to the east and south, Poland to the south, and Kaliningrad (a Russian exclave) to the southwest.

Lithuania has 33% forest cover (2.1 million ha). This is substantially less than its Baltic neighbours Estonia and Latvia, each of which has almost 50% forest cover. Approximately 50% of Lithuania's forests are publicly owned, 40% are privately owned. The remaining 10% are reserved for possible future privatisation. Lithuania's private forest sector has 234,600 owners and the average forest size is 4.5 ha. Holdings with an area up to 3 ha account for 58% of all private forests in the country. About 55% of private forest owners live in rural areas. Generally, newly established private forest owners want to exploit the financial benefits of their holding and don't give much consideration to its management and maintenance. Recent surveys of private forest owners tend to indicate that the main problem identified by the forest owners themselves is a lack of knowledge and experience in forest management.

The dominant tree species are Scots pine (*Pinus sylvestris* L.; 42%) and Norway spruce (*Picea abies* (L.) H. Karst.; 23%). There are small percentages of alder (black and grey; *Alnus glutinosa* (L.) Gaertn and *A. incana* (L.) *Moench*), aspen (*Populus tremula* L.), ash (*Fraxinus excelsior* L.), birch (*Betula* spp.) and oak (*Quercus* spp.). The average age of forest stands is 53 years. Annual timber production is 7.0 million m^3. It is processed locally but pulpwood (20% of annual production) is exported, mainly to Scandinavian countries.

On arrival in Vilnius airport we were met by our guide, Aidas Pivoriūnas, who looked after our needs for the duration of the tour acting as our guide and interpreter. During the study tour we travelled extensively throughout Lithuania from Vilnius in the south east to Nida on the Baltic Sea and got an opportunity to see many different forest types.

Overnight: Hotel Air Inn, Vilnius Airport *John Mc Loughlin, Tour Convenor*

Wednesday, 12th September

We were accompanied for the duration of the tour by our host and guide, Aidas Pivoriūnas. A graduate of the Swedish Forestry College, he is the Managing Director of the Private Forest Owners Association in Lithuania. We departed Vilnius at 9.00 am and began a 120-km journey to Grūtas Park in southern Lithuania. On the outskirts of Vilnius we passed by a 120 MW district heating plant. Formerly this plant used oil and gas but is now fuelled exclusively by wood chips. Almost 40% of Lithuania's energy needs are now produced from wood chips. To meet the soaring demand for wood chips, Lithuanian producers are importing supplies from Ukraine and Belarus. However, it transpired that some of the Belarussian material was produced from Chernobyl-impacted forests and these chips are now quarantined.

As we travelled south to Grūtas Park, Aidas gave us a useful overview of forestry in Lithuania. Forest cover is now 33% of the land area – an impressive increase from 15% in 1921. This significant expansion in forest cover took place mainly after World War II, on the poorer lands in southern Lithuania bordering Poland and Belarus. Norway spruce and Scots pine were the main species used and they were frequently planted in pure stands. The most heavily forested areas are in eastern and southern Lithuania while the better agricultural land and larger farms are located mainly in the west and north.

Lithuania's forest estate is currently expanding by approximately 10,000 ha per annum. About half of this expansion is planned and supported by EU schemes while the remainder is the result of natural forest expansion onto abandoned agricultural land. Birch, oak, and pine/spruce mixtures are the main species which are creeping onto the abandoned land. The national forest estate is split 50:50 between private and state ownership. Approximately 10% of the private forest area is reserved for restitution to the former owners who were dispossessed during the Communist era. However, much of this category of the forest estate is poorly managed.

In Lithuania, forestry is a very sensitive topic. In spite of the obvious importance of the forest industry to Lithuania's national economy, forestry is frequently subject to adverse public opinion. Currently, there is an energetic social media campaign aimed at ending the practice of clearfelling completely. As a result many over-mature forest areas have had their felling dates extended by several years so that only just over half the annual increment is being harvested[1]. Continuous cover forestry practices are increasing rapidly.

Our first stop on Wednesday was at Grūtas Park outdoor museum. Located in a 20-ha forest, the Grūtas Park serves as a national reminder of the devastating impact of communism on Lithuania. More than 800,000 people, out of a 1940s population

[1] Annual increment in Lithuania is approximately 12 million m^3 but the annual harvest in only 7 million m^3.

of 4.1 million inhabitants, were exiled to Siberia. The museum includes an original train and wagons which were used to transport them to Siberia. Grūtas Park has an outdoor display of 84 very large sculptures; many of these are statues of Lenin, Stalin and other communist leaders (Figure 1). During the past 20 years more than 1.2 million Lithuanians have emigrated, mainly to other EU countries. This exodus of the young and better-educated Lithuanians has the potential to create considerable social and economic problems as a large segment of its economically active population has gone abroad.

We left Grūtas for our next stop at Marcinkonys, a distance of 38 km to the east. On our journey there Aidas discussed fire management in Lithuania. Forest fires are managed by foresters and not by the Fire Service. In the past, they relied on manned lookout towers to warn of fires. However, there is now a greater dependence on technology as sensors, cameras and drones are being deployed to monitor the forests for outbreaks of fire. Aidas also discussed other aspects of forest protection. *Dendroctonus pini* has caused widespread damage to pine stands and it now appears to be spreading to oak. Ash, though a minor species in Lithuania, is also suffering from ash dieback. There is also a problem with deer damage (from both red and roe species) to the forest. Wolves, a protected species, are increasing in numbers as the forest area increases. Wild boar population numbers have soared in recent years, so it is planned to reduce their numbers by almost 80% over the next seven years. Beavers

Figure 1: *Grūtas Park outdoor museum features an extensive display of statues and busts of communist leaders which were removed from Lithuanian towns and villages after independence in 1990.*

are also now causing major problems in some areas in the south of the country. The European black bear is also starting to make a comeback.

Near Degsné we saw a remarkably fine stand of European larch (*Larix decidua* Mill.) which was planted in 1856 and now carries 1,600 m^3 per ha (Figure 2). The tallest trees are over 50 m in height. European larch is not native to Lithuania and it has been decided to curtail future planting of this and other exotic species because of the potential impact on native trees.

We departed Degsné for our final stop at Dubravai, 120 km to the west. On the way Aidas explained that Lithuania is the fourth-largest supplier of wood products to IKEA. Although there are no pulp and paper plants in Lithuania, the country is home to five

Figure 2: *A fine European larch tree planted in 1856.*

large sawmills which produce 200,000 m^3 timber each. Production in southern Lithuania is generally exported to Poland while production in the north is largely exported to Latvia. All timber from state-owned forests is sold through an online auction system.

Our final stop of the day was at Dubravai which is 20 km south east of Kaunas, Lithuania's second city. This is a 500-ha plantation in a swamp area which has been left unmanaged for more than 200 years. The main species present were birch, Scots pine, Norway spruce, oak and aspen. The site is monitored to see how it will develop. Approximately one third of the forest at Dubravai is a protected site and harvesting of the surrounding area is determined by the age of the trees. In general in Lithuania, final felling cannot take place until the trees reach the following minimum ages: birch, 61 years; Scots pine, 100 years; Norway spruce, 70 years; oak, 150 years and aspen, 45 years.

We departed Dubravai and set out for our overnight accommodation at Hotel Vienkiemis on the Baltic Sea, 245 km to the north-west.

Overnight: Hotel Vienkiemis, Padvariai, Kretinga *Pacelli Breathnach*

Thursday, 13th September.

On our way to the port of Klaipėda, we passed through an area which our guide referred to as "Little Lithuania". It was formerly Prussian territory and during World War II the Germans and the Poles took possession of roughly one third each, so that only one third of it remained as part of Lithuania.

When we reached Klaipėda we took a short ferry trip across to the peninsula which in former times was completely treeless. In order to stabilise the shifting sands and also to provide some shelter, afforestation began in the early years of the 17th century. The main tree species used were Scots pine and *Pinus mugo* Turra. There are now 1,820 ha planted on this narrow 99-km-long peninsula. However, *Pinus mugo*, which has grown well since its introduction, is non-native and environmentalists and conservationists want to remove it from the area altogether. Thus, during the course of the past 15 years, large areas of *Pinus mugo* have been replaced with a mixture of *Scots pine* and birch. We saw some of these "replacement" stands as we passed in the bus. We then travelled north-west until we reached Neringa National Park. There are four villages within this park, the largest of which is Nida, about 50 km south of the park entrance. Aidas, our guide, told us that for the past few years the park has been under threat from a mystery arsonist who starts forest fires, usually during July or August when there are strong winds coming from the west in order to cause maximum damage. In 2016, almost 500 ha were destroyed. Extensive fire belts have been cut through the forests to help reduce the potential for fire spread. Prior to 2010 there was a forest office on the peninsula but not any longer so the foresters must now travel over and back on the ferry, as do the contractors who carry out all of the forest operations.

Our first stop of the day was at an area of Scots pine that has been severely damaged and many trees killed by the droppings of the large numbers of nesting cormorants! Cormorants are not native to Lithuania but a few unsuccessful attempts were made to introduce them since the 1960s by amateurs. In 2002 two enthusiasts brought cormorant eggs from Poland and raised and released the chicks which subsequently bred and spread at an alarming rate. They have spread even as far as the capital Vilnius; officials had believed that the bird would not spread beyond the peninsula. The current very large population of cormorants is a cause of major concern to both foresters and fishermen. However, the cormorant is on the IUCN Red List of Threatened Species and so it is heavily protected. We climbed to a high viewing platform which was built by the Department of Environment specifically to allow park visitors to survey the extent of the damage that has been caused. It is estimated that several hundred ha of Scots pine on the peninsula have been destroyed by the cormorant and the damage is continuing to spread. Appeals have been made to government officials to allow culling and/or eradication of this non-native bird.

On our journey to the village of Nida we passed a fine stand of black alder growing on good humus soil which our guide said is one of the most productive stands in the country. Nida is a very scenic area with a small harbour and marina which has become very popular with tourists. No new houses are allowed to be built within the confines of the national park. Only reconstruction and renovation of existing habitable

Figure 3: *A Scots pine stand which was severely damaged by nesting cormorants. This non-native bird was introduced in 2002 and the population has since increased at an alarming rate.*

houses is permitted. The houses are heated by firewood or wood chips from the local forests. At this stage, we were quite close to the border with Kaliningrad, a Russian exclave on the Baltic Sea, between Lithuania and Poland. Kaliningrad City (with a population of 431,000) is an important manufacturing base which was designated a Special Economic Zone in 1996. It is strategically important to the Russian Federation as it is the only Baltic sea port which remains ice free all year round. Kaliningrad hosted several games in the FIFA World Cup 2018.

In the afternoon we returned to the Lithuanian mainland and journeyed through central Lithuania which has vast expanses of flat, highly fertile agricultural land. An interesting feature of this otherwise flat landscape is the world-famous Hill of Crosses (Figure 4). During the 19th century a local custom developed of placing crosses and crucifixes on this hill to remember deceased family members. In 1900 it was estimated that there were 20,000 crosses here. During the Soviet occupation of Lithuania the authorities attempted to remove the crosses and destroyed large numbers of them with bulldozers. However, since Lithuania regained its independence in 1990, the custom has resumed. It is estimated that there are now 100,000 crosses there and that number is rising. The Hill of Crosses has become an important tourist destination and a place of pilgrimage which was visited by Pope John Paul II in 1993.

Overnight: Hotel Karpynė, Raseiniai *Eugene Griffin*

Figure 4: *Since the early 19th century, crosses and religious statues have been placed on this hill near the city of Šiauliai in memory of deceased family members.*

Friday, 14th September

The day began with a very informative presentation on forestry in Lithuania from our guide Aidas Pivoriūnas. Forest cover in Lithuania is 33%, the state owns 1,089,000 ha of forested land and a further 883,000 ha is privately owned. The main species are pine (41.6%), spruce (22.9%) and birch (22.2%). Each year almost 5,000 ha are afforested and 7.0 million m^3 of timber is harvested. Four million m^3 of the annual harvest comes from state owned forests and 3.0 million m^3 from privately owned forests. Most of these private forests are under managed as the owners are generally quite elderly. Even though Lithuania clearfells a large volume of timber annually it must still import timber because of widespread public opposition to current clearfelling practices. This is slowly changing in response to forestry promotion and public education campaigns.

During harvesting and extraction operations, brash mats are used to protect the forest floor, these are collected after and used for woodchip. In this area, a single furrow plough is used to prepare the site for reforestation and the trees are usually pit planted at variable spacing. While stocking rates vary for different species, it is 2,000-3,000 ha^{-1} for most conifers.

After this presentation we travelled via the A8 motorway to the Pašiliai European bison sanctuary in the region of Panevėžys. While travelling along this route we saw "fake hills" which are the remains of gypsum waste from a fertiliser factory near Kėdainiai. Pollution from the plant has damaged large areas of the surrounding pine forests.

The European bison sanctuary is located in Krekenava Regional Park which was established in 1992 in order to preserve the Nevėžios river landscape (Figure 5). The aim is to preserve and maintain the natural ecosystem and heritage value of the parkland and the region. The park has nearly 12,000 ha of meadows, forest and bogs which stretch across both sides of the Nevėžios valley. This park is home to 846 species of mammals, of which 52 have protection status. The bison are descendants of the aurochs, a large species of cattle which were once common in Europe but are now extinct. Up until the 16th century, bison were widespread in this part of Europe where they lived in sparse, mixed, broadleaf forests and mountain terrain. Deforestation, agricultural development and increased hunting forced the bison to seek refuge in forest types which did not suit them and this ultimately brought about their extinction. It is believed that no bison have lived in Lithuania since 1854 and the last bison in Europe was shot in 1919 in Belovezh forest. The 50-ha bison sanctuary was established in 1969 when two bison (male and female) from the Prioksko-Terrasny reserve in Russia were introduced. Shortly afterwards eight more bison were introduced and the first calf was born in 1971. In 1973 the first bison born in Lithuania were released into the Pašiliai forest. Since then they have

been allowed to roam freely and breed in the wild. The sanctuary is fenced in some areas but open in other areas so bison have been seen in the wild and in some cases seen mating with cows. In 2005 the Pašiliai bison sanctuary was transferred from the Krekenava Regional Park to the Panevėžys Regional Office of the State Forest Enterprise.

We then visited a birch plywood plant, Likmerė in Ukmergė, which is owned by a Latvian company, Latvijas Finieris. This factory, which opened in 2008, sells its entire veneer production to a sister company which is one of the largest plywood producers in the world. The sole purpose of this factory is to secure raw material and produce veneer for plywood manufacturing in the sister company. It produces 100,000 m^3 of birch veneer annually and 160,000 m^3 of high-quality birch timber is used annually (Figure 6). The 60,000 m^3 excess is chipped and sold as biofuel as the factory's power requirements are supplied with gas. Only local birch is used because of high transport costs and timber prices. Good quality birch sells for approximately €100 per m^3. Almost 60% of birch harvesting is carried out with motor manual labour in order to avoid damage to the birch bark by the measuring wheel on harvester heads. Timber is bought at private auctions and assessed in the forest by quality assessors before purchase. Birch comes into the yard in 3.2 m lengths with a small end diameter of 14 cm.

Figure 5: *The European bison sanctuary in Krekenava Regional Park was established in 1969 when bison calves from western Russia were introduced.*

Figure 6: *Debarked birch logs are prepared for veneer production at the plywood plant in Ukmergė.*

The production process begins with the birch logs being steam heated for 12 hours at 60-70 °C and then allowed to cool to 40 °C ahead of the next stage. This process is designed to increase the moisture content which facilitates easier cutting during production. The manufacturing process begins with a grading line and metal scanner; rejected logs are scanned again and if of bad quality they are used for firewood. After scanning the logs are debarked and scanned again before being cut to length. The cut-to-length specification is 2.4-3.4 m. The debarked logs are attached to a high speed lathe where a cutting knife peels the log to produce the thin sheets of veneer. The knives are changed every 20 m^3 and have to be sharpened by hand. The veneer is scanned, graded for quality and cut-to-length. It is then ready for packing and exporting. This factory employs 40 people and operates three shifts. Between four and six truck loads of veneer leave the factory every day and it reaches the plywood factory within 24 hours. The factory is profitable but, as mentioned earlier, its sole purpose is to source raw material and supply high quality veneer to its sister company.

Overnight: Hotel Nykščio namai, Anykščiai *Conor Dowling*

We spent Saturday, our final day, sightseeing in the medieval city of Vilnius (Figure 7) before a final dinner and another late-night flight home to Dublin.

Figure 7: *Looking east towards the "old town" in Vilnius, the capital city of Lithuania.*

Tour participants (36): Marie Aherne, Pacelli Breathnach, Colm Brophy, Neil Browne, Kevin Bourke, Philip Comer, Daniel Connaire, John Connelly, Bob Dagg, Conor Dowling, P.J. Fitzpatrick, Jerry Fleming, Gerhardt Gallagher, Tony Gallinagh, Eugene Griffin, Mark Hogan, Gordon Knaggs, Joss Lowry, Tony Mannion, John Mc Loughlin, Tom McDonald, John McGovern, Aiden McGuire, Jim McHugh, Declan Meehan, Kieran Moloney, Gerry Murphy, Liam Murphy, Frank Nugent, Benny O'Brien, Dermot O'Brien, P.J. O'Callaghan, Owen O'Neill, Tim O'Regan, Vincent Upton, Trevor Wilson.

Obituaries

Réamonn Criostóir (Ray) Ó Cinnéide
1942 – 2018

On 18th May 2018, just two days after his 76th birthday, Ray Ó Cinnéide passed away peacefully in Skibbereen Community Hospital, surrounded by his family.

The third of four children, Ray was born in Cork City on 16th May 1942 to Réamonn and Máire (née Lucey). He received his primary education at the Model School, Cork and his secondary education at Presentation College, Cork.

As a boy, and through into early adulthood, Ray was actively involved in the scouting movement and it is probably here that his deep interest and love of nature developed. He spent much time hunting and fly fishing in the hinterland of Cork City. He had a particular fondness for the area around Ballingeary, and during his youth he spent many long, contented summer days there fishing for "breac dearg" in the secluded lakes hidden amongst the hills above the town where he could indulge his love of fishing without interruption.

Ray spent the first two years of his forestry course at UCC where he studied General Agriculture. He then transferred to UCD to complete his forestry studies and graduated in 1965. Ray spent a year studying forestry in Norway and while there he immersed himself in the country's language and culture. He liked to joke that after the year there, his standard of spoken Norwegian had risen to that of a four year old. He remained interested in the country and its language throughout his life.

Ray was one of twelve students in the class of 1965. This was an unusually large number of students for the time. Only one member of the class emigrated, the majority of them worked in the public service in Ireland. Ray was the first member of that class to be appointed and he was assigned to the then Forestry Division of the Department of Lands, specifically to Research Branch, Dublin where he worked on the Census of Woodland (now known as inventory). The output of this census of woodlands was known as the "Red Book" – a familiar phrase among foresters of a certain age!

1970 was designated European Conservation Year by the Council of Europe, and Ray was transferred to the public information section of the project. Soon after, he was assigned to the mobile exhibition which toured Ireland visiting every county to spread

a message of the value of nature conservation. It was during one of these trips that he encountered George Burrows, a journalist who penned a nature column in the *Irish Times* in addition to presenting a daily "nature" slot on Radio Éireann. In one of his articles, Burrows had the misfortune to refer to him as Ray Kennedy - the anglicised version of Ray's name. This drew a swift response and culminated in Ray writing to Burrows asking him how he'd feel if he was referred to as George Rabbit-Holes!

In 1972 Ray was transferred as assistant district inspector to Castlebar where he worked with Tomás de Grúinéil, with whom he developed a lifelong friendship founded on their shared interest in the Irish language. Ray was committed to using his native language wherever possible and he translated all the forest names in the District to Irish.

Although he greatly enjoyed his time in Co. Mayo, the attraction of a return to Cork proved irresistible and in 1980 he transferred to Skibbereen as district inspector. Here he spent many blissful years in a location he really loved.

Following a restructuring in Coillte he was promoted to the post of Regional Environmental Officer. He relished the job in the environmental field and he made many new friends throughout the country. Reportedly he would visit forests in the extremely early hours, arriving before dawn to assess the songbird populations.

In 1997 Ray opted to avail of the voluntary severance scheme offered by Coillte and thereafter he enjoyed many contented years of fruitful retirement until his health began to fail.

He was a keen sea fisherman and spent many happy days on fishing expeditions with his family. Aside from his family, forestry remained Ray's main interest, and he frequently managed to combine both these interests, with family walks through the damp mossy woods.

When describing Ray, a word that immediately springs to mind is "Gentleman"for he was gracious, gentle and courteous. A superb raconteur, he possessed an impish sense of humour.

To his wife Hannah, his son Ray, daughters Denise and Aoife and his siblings Cáit, Donncha and Criostóir, his grandchildren James, Danny, Conor, Hazel and Jessica we offer our sincere sympathy.

Ar dheis Dé go raibh a anam

John Mc Loughlin

Gerry de Brit
1936 – 2019

Gerry de Brit passed away peacefully, after a short illness, on the 1st February 2019 at St, Vincent's Hospital, Dublin in his 83rd year after a long and distinguished career in Forestry.

He was born on the 22nd June 1936 to Thomas and Annie (neé Murphy), at Blackrock, Co. Dublin, the second youngest of four siblings, two boys and two girls. He attended Willow Park School and Blackrock College.

A city man, he made the somewhat surprising choice of studying Forestry at UCD and he graduated in 1962. Like many of us, Gerry was introduced to the elements of his future profession through the practical year, which was then an important component of the curriculum, in Glendalough, Co. Wicklow and at the forest nursery in Ballybofey, Co. Donegal. Following a period of study in Scandinavia, Gerry began his career in the nascent Research Branch of the then Forestry Division of the Department of Lands in 1963. Here he served on the team of the distinguished forester and later Chief Inspector Niall OCarroll. As a researcher he specialised in forest protection and the study of pests and diseases which posed a threat to the recently planted forests. He contributed to the early research reports and produced several review papers which were published in *Irish Forestry*. He was promoted to Section leader in 1969.

During the 1970s he was responsible for the forest legislation portfolio in the negotiations on forest health, as Ireland prepared to become a member of the European Economic Community. This necessitated frequent meetings in Brussels and much debate and discussion. Gerry relished this aspect of his work. In common with many in Research Section at that time, it was an opportunity for him to expand his knowledge of forestry as experienced through the close co-operation with the British Forestry Commission and other European Research organisations.

In 1978 he transferred to the Nurseries Section of the Forest Service, under Joe Deasy, where he was tasked with supplying planting stock to support the major state afforestation programmes of that period. His work involved production, management and supply issues from the main nurseries in Counties Carlow, Cork, Donegal, Longford, Mayo, Tipperary, Wexford and Wicklow. At a time of major restructuring of the nursery system, he was promoted to Grade I inspector in 1986 and initiated the development of the new nursery at Ballintemple, Co. Carlow. He maintained this position when Coillte was established in 1989 and he moved to Ballintemple as a

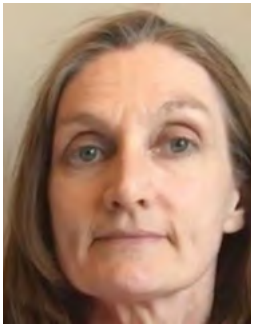
senior manager in 1992, responding to the expanded planting programme of Coillte's early days. Here he oversaw new developments in nursery practice such as cold storage of plants and producing improved species strains. He fostered the development of a cooperative atmosphere with the nursery staff and established good relations with the private nursery sector when both operations joined Irish Forest Industries Chain in the 1990s. He visited the major nurseries in the UK, France, Denmark and the Netherlands. Gerry retired from Coillte in 1998, but continued to live in his attractive riverside home near Bunclody, Co. Wexford.

Gerry had a wide range of cultural and sporting interests and was a dedicated music lover and reader. His musical interests extended from the modern jazz performers of the post war period such as Dave Brubeck to the classical composers. He played the drums and on one occasion caused a stir at a dance in Moneystown when he performed during the interval. His sporting interests and achievements were equally singular at the time, excelling in hockey on the Irish Universities team and cricket for Railway Union in Sandymount. He became a minor cricket celebrity while in Ballybofey, Co. Donegal and was in constant demand for local matches.

We mourn the passing and celebrate the life of a respected and genial colleague. To his wife, Colette, children Geraldine, Aisling, Brian and Rachel, his sisters Mary and Clare and his nine grandchildren, we offer our sincere sympathy.

Gerhardt Gallagher

Sue Middleton
1962 – 2019



It was with immense sadness and disbelief that we learned of Sue Middleton's death, at such an early age, on 8th February 2019. The affection for Sue and her popularity were reflected in the wide range of people from all her walks of life who attended her funeral service at Roselawn Crematorium, Belfast.

Originally from Norwich, where she was born on 30th June 1962, Sue worked in the Elveden Estate in Norfolk before going to Newton Rigg College, Cumbria in 1983 to study forestry. Her sandwich year was spent in Callander in Scotland with the Forestry Commission and she graduated from Newton Rigg in 1986.

Sue's employment with the Forest Service Northern Ireland began in 1987 with her posting as a Forester to Castlederg, West Tyrone where she assisted Jim Scott with the management of the newly opened Forest Service nursery. After a few years in Castlederg Nursery she moved offices within "Dartan House" in Castlederg to assist John Watson in the Killeter & Lough Bradan charge, West Tyrone. A short stint in Research in Belfast followed, after which she took a career break in 1991 to pursue other interests and to travel.

Sue returned to the Forest Service in 1997 and was posted to the Forest Education Branch based in Belvoir Forest, Belfast. A short spell here was followed by a couple of years as forester in charge of Florence Court, West Fermanagh. In 2000 Sue was transferred to the South Antrim-North Down charge, again based in Belvoir. Two years later Sue was transferred to Castlewellan where she worked alongside John Watson in a forest management planning role.

After five years in forest planning Sue was transferred to Dundonald House where she excelled in specialist forest management projects. Sue was promoted to Staff Officer shortly after this where she worked in the Property Development section up until her death.

Sue had lived in Edenderry, on the edge of Belfast, for almost 20 years. Outside of forestry Sue loved tennis and outdoor activities. She had a great love of sailing and enjoyed water-based activities whatever the weather! Sue spent long periods working on the "tall ships" and spend time on the Hebridean Princess sailing around the Scottish islands. When on dry land she worked in the retail sector with Marks & Spencer in Norwich. During her career break she also spent much time crewing on sailing ships and even working on cruise ships which enabled her to fulfil her

great desire to travel and see the world. Throughout these career breaks she always maintained her links with the Forest Service and her many friends in Northern Ireland.

She was a member of the Downshire Tennis Club for many years and was highly respected serving in many capacities within the club committee.

She has been described by her many friends in the Forest Service as full of fun, very kind and possessing an infectious laugh.

Sue was predeceased by her father in early 1981. To her mother Anne (Norfolk), her sister Jane (Leeds) and nephews Edward and Alec, we offer our sincere sympathy.

Ian Thompson

Kevin J. Hutchinson
1949 – 2019

Kevin J. Hutchinson, former President and PRO of the Society of Irish Foresters, passed away peacefully after a long illness, on 1st June 2019 at his home in Abbeyleix, Co. Laois.

Kevin, the older of their two boys, was born to Henry and Mary Hutchinson (née Keenan) in Kilkenny on 14th October 1949. He lived in Killamuck near Abbeyleix, Co. Laois where he attended Abbeyleix National School and later received his secondary education at Portlaoise CBS.

On completion of his secondary education, Kevin worked as a computer programmer in Dublin for two years, initially with Irish Life and then with P.J. Carroll & Company. But the call of forestry and the outdoors remained strong and, despite the attractions of a promising career "in computers", he still yearned for the outdoor life and a return to working amongst his beloved trees. Kevin often recounted how, on long summer days, he would gaze wistfully from the office window at the distant forests as they beckoned him from the foothills of the Dublin Mountains.

The lure of a career in forestry, his first love, eventually won out and he began his studies at UCD in October, 1970. Always a diligent and intelligent student, Kevin graduated with a first-class honours degree in forestry in 1975. While still at college, during the course of his practical year, he spent several months working in the forests of Bavaria. On graduating from UCD, Kevin was awarded a scholarship to study forestry at Yale. However, he declined this offer and opted instead to avail of a Norwegian Government scholarship to study for a year in Norway. On his return from Norway, he was appointed Assistant District Inspector in Sligo. In the midst of this hectic work schedule, Kevin found time to marry Catherine Whelan, his childhood sweet-heart, in March 1978. Their two children, Emma and Henry, were born while the family lived in Sligo.

In 1979 Kevin was appointed the first Executive Director of the Irish Timber Growers Association and here he performed a remarkably successful job in bringing together the many diverse groups that comprised the timber growers' family. Three years later, with a view to widening his experience, Kevin returned to work with the Forest and Wildlife Service where he was based in Sligo in the Work Study Section. In 1985 he was promoted as District Inspector in the Portlaoise District. This move carried the added attraction that he could return to live in Abbeyleix again.

When Coillte was established, 30 years ago this year, Kevin really flourished as he was afforded much greater opportunities for personal initiative, an attribute he possessed in abundance. In 1998 he was promoted to a Level I manager role in charge of "New Business" and, in an era of slogans, Kevin was quickly out of the traps with: "New Business is Everyone's Business". In 2008, he successfully completed the ABC Professional Diploma in Arboriculture in order to have another string to his bow when he retired.

Kevin dedicated much of his time to volunteering with several forestry organisations, none more so than the Society of Irish Foresters where he served in many roles including a two-year term as its president. He played a lead role in the publication of *Forest Images - Fr Browne's Woodland Photographs* which was published in 1992 to mark the 50th anniversary of the founding of the Society of Irish Foresters. This book was a lavish compendium of old forest photographs taken on the nearby Emo Estate, Co. Laois during in the 1930s.

Kevin's private collection of books was truly vast – especially its "Trees & Forestry" section. He served on the editorial committee of the project team which oversaw the publication of the facsimile edition of the *Trees of Great Britain and Ireland*. In addition, he regularly compiled a list of the latest books on forestry related topics for the Editor of the Society's journal, *Irish Forestry*. Even during his illness, Kevin continued to compile this list. Around this time, he discovered the convenience of online book buying and this new pastime continued to occupy and comfort him throughout his illness. Kevin also served as the PRO of the Society of Irish Foresters – a role in which he excelled.

Kevin also served as president of the Tree Council of Ireland. In fact, he was one of only three people who shared the distinction of being president of both the Society of Irish Foresters and the Tree Council of Ireland. As its president, Kevin had no end of ideas and schemes to advance the Tree Council of Ireland, however ill health prevented him from completing his term of office there.

Needless to say, Kevin was the official photographer for both these organisations. In this role, he would line people up and move them about until he was fully satisfied that the perfect composition had been captured for posterity. The highlight of his photographic career was undoubtedly having several of his images feature prominently in Aubrey Fennell's *Heritage Trees of Ireland* alongside the work of photographer Carsten Krieger.

Kevin was a keen sportsman. In his youth he played minor hurling for Laois but since his grandchildren are from Cork he tended to support that county in later years – just to please them! He was interested in all sports and was actively involved in several clubs in Abbeyleix, particularly the local Tennis Club and the Lions Club.

He was an exceptionally bright and intelligent person but these qualities sat easily on his shoulders. Ever the showman, he was witty and entertaining company –

especially when he had a receptive audience. A meeting with him was always a tonic. His positive attitude and enthusiasm for life were infectious and it always left you feeling better afterwards.

To his wife Catherine, daughter Emma, son Henry, brother Christy, son-in-law Darragh, granddaughters Sadhbh and Siún, nephews Darran and Aubrey and niece Yvette, we offer our sincere sympathy.

Ní bheidh a leithéid ann arís

Pat O'Sullivan

Anthony (Tony) O'Keeffe
1939 – 2019

Tony O'Keeffe passed away at his home in Carrabawn, Westport, after a brief illness, on 12th August, surrounded by his family.

He was born on 17th January 1939 to Michael and Maisie O'Keeffe (née O'Halloran), Crusheen, Co. Clare, the youngest of four siblings.

He received his primary education at Crusheen National School and his secondary education at St. Flannan's College, Ennis. He began his forestry training in 1958 at Kinnitty Castle and completed his studies at Shelton Abbey whereupon he was appointed to Killarney Forest in 1961.

He spent his early years as an assistant forester in Co. Kerry, where he worked in Sneem and Kenmare Forests. In 1968 he transferred to Cong, Co. Mayo and he remained in Co. Mayo until his retirement, managing Nephin Beg forest until he became forester in charge at Glenhest Forest in 1971. This was a momentous year for Tony as he married his wife Marie some months later.

A forester of great foresight, during the eighties and early nineties when timber market prices were depressed, he carried out low cost "thin to waste" operations which greatly benefited the plantations when they were felled and sold several years later.

In 1993 Tony was promoted as a Level 3 territorial forester. He always aimed at high standards in all his undertakings and expected the same from those around him. By conscientious adherence to silvicultural practices he established plantations with lucrative potential in West and North Mayo.

He could enjoy life and banter, good humour with the best, and he could drop a clanger and promote a bit of controversy. He loved the drama of debate at forest gatherings.

Tony always had a great love for Clare hurling, especially his home club, Crusheen. In his adopted county, he played an integral role in St. Patrick's GAA club in Westport, as an administrator, supporter and member. At his untimely death he was Vice-Chairman of the club. He was also involved in the re-establishment of the hurling club which had been dormant for many years. In later years he was active on the committee that oversaw the clearing of a large debt on the club's Astro-turf pitches. His unselfish service touched and enriched the lives of many players and mentors.

He was involved in the Westport Housing Co-Operative, an organisation formed to ease the desperate housing shortage for young couples and families. This project was completed within budget. As Chairman of Westport Tourism, he drew people together in the promotion of Westport as a tourist centre. In "Destination Westport" it was all about "*ní neart go chur le chéile*".

He was predeceased by his brother Fr. Jack, and his sister May. To his wife Marie, sons Michael and Diarmuid, daughters Aoife and Roisin, brother Cronan, daughters-in-law Audrey and Marie, sons-in-law Tony and Niall, we offer our sincere sympathy.

Kieran Mc Loughlin

Séamus Gavigan
1938 – 2019

Séamus Gavigan passed away peacefully, surrounded by his family, on 3rd November 2019 while under the care of the kind staff of Melview Nursing Home, Clonmel.

Séamus, the second of four siblings, was born to Jimmy and Molly Gavigan (née Kelly) on 29th November 1938 at Ballagh, Kilroosky, Co. Roscommon. He received his primary education at Ballagh National School and his secondary education at Roscommon CBS where he graduated in 1957. Séamus attended Agriculture College in Mountbellew, Co. Galway before beginning his career in forestry in 1958.

While growing up on his family's farm in rural Co. Roscommon, he developed a keen interest in the natural world around him – its animals, plants and trees. He credits his upbringing in this environment with leading him to a career in forestry – a career that would span 54 years. He began his formal forestry training in 1958 at Kinnitty Castle Forestry College, Co. Offaly and progressed to complete his training at Shelton Abbey Forestry College in Co. Wicklow.

On completion of his training in 1961, his first assignment was to Glenmalure Forest, Co. Wicklow as an Assistant Forester. While in Wicklow he had the good fortune to meet his future wife Maura – a neighbour from Co. Roscommon who was then working in Arklow. They were married in 1966. In 1967 he was transferred to Macroom Forest, Co. Cork and four years later in 1971 he was transferred again, this time to the Nier Forest, outside Ballymacarbry, Co. Waterford. They both fell in love with this beautiful part of the country and were very happy to call it their "home" for the remainder of his long forestry career. Although he was promoted to the rank of Forestry Inspector, Grade III in 1979 the attractions of this area proved so strong that Séamus and Maura decided to forego promotion and remain there. In 1993 Séamus availed of the voluntary severance scheme offered by Coillte and shortly afterwards, he began a long and fruitful employment with Green Belt. He enjoyed his new lease of life with Green Belt so much that he didn't retire fully until 2012 on reaching the venerable age of 74 years.

During his early years Séamus had two passions in life – his beloved Gaelic football and game shooting. He played full back for Roscommon CBS throughout his years at secondary school. On completing his secondary education, he joined Kilbride GAA Club. He later moved to St. Failtheachs GAA Club which was based in Ballyleague Co. Roscommon where he played full back for the St. Faithleachs team which won

the Roscommon Junior County Championship in 1963 – the year the club was formed. This team went on to win the Senior Championship in 1965, a fantastic achievement for the club and one Séamus was extremely proud of. St. Faithleachs Club always had a special place in his heart. While living in Wicklow, Séamus played senior football, as full back, with Laragh and in 1962 reached the Senior County Final.

Those who knew him knew a man of deep integrity who was always available to offer wise and measured council. He was a very competent forester and was always exacting in every task he undertook. His dedication earned him the respect of his colleagues at work and the members of the wider community where he lived.

Séamus was a kind, loving and caring family man. A loyal and trusted friend of many, he was always ready and willing to help those in need through his countless acts of discrete kindness and charity which were known to very few.

He was pre-deceased by his wife Maura and baby angel Maria. To his daughter Niamh, sons Declan and Barry, his sister Rita, brothers Noel and Joe, adoring granddaughters, son-in-law Donal, daughters-in-law Fionnuala and Stephanie, we offer our sincere sympathy.

Go n-éiri on bóthar leat, a Shéamuis

Mossie Ryan

John Phillips
1930 – 2019

John died unexpectedly at his home on the 28th December 2019. It was a great shock and sadness for all his family and friends. His wife, Paddy, had died only four months earlier in August.

John was born in Bangor, Co. Down on the 12th June 1930 and was the only child of Reggie and Mary Phillips. He was educated at Bangor Grammar School. His favourite subjects were Physics and Mathematics and he made arrangements to study these subjects at Queens University, Belfast. However, he was awarded a valuable scholarship by the Ministry of Agriculture to study Forestry at Aberdeen University, which he accepted. He graduated three years later in 1951 with a B.Sc. (Hons).

He joined the Forestry Division of the Ministry and his first postings were to Glenarm and Randalstown Forests in Co. Antrim. His next posting was in Co. Fermanagh as District Officer. When he heard the news, he said to a friend "Where is that?" The directions given were "Take the road to Portadown and keep going!"

The 1950s and 1960s were busy times for the Service as funds were available for purchase of large areas of marginal land for afforestation. John was very committed to ensure our state forests should be managed for multiple uses, and serve recreation, conservation and education, rather than just for timber production. To reduce unemployment in rural areas a "Relief Scheme" was introduced. This was mainly used to develop recreational facilities in forests. This was very popular with the public and a number of Forest Parks were developed.

John married Paddy in 1954 and at one time they lived in a bungalow at Killadeas with fine views of Lough Erne. Their two sons, Steven and Gary, were born in Enniskillen. John was a very keen sailor and he had a Fairy Class yacht which he sailed in competitions at Lough Erne Yacht Club. He served as Commodore and was also honoured to be appointed Admiral of the Club. His other passion was a love of nature. He was a very keen and knowledgeable naturalist, with a particular interest in bird life and was a keen supporter of the RSPB. John was also a keen Member of the Society of Irish Foresters and served as President from 1981-1983. He was also a member of the Royal Forestry Society.

John was promoted to Regional Forest Officer West and served in this position in the 1960s and 1970s. His office was in Omagh and his Region included all forests in the western half of Northern Ireland. In 1981 John was transferred to Forest Service

headquarters in Belfast and I know that he left Fermanagh with a very heavy heart as he had fallen under the spell of its lakes and wildlife. However, in 1983 he was promoted to Chief Forest Officer to replace Cecil Kilpatrick who had retired. Just two years later he was head hunted for the newly created post of Director of Conservation in the Department of the Environment. During his years in Fermanagh John had been Chairman of the Lough Erne Advisory Committee, a member of the Nature Reserves Committee and a council member of the Ulster Trust for Nature Conservation. This background enabled him to lay strong foundations in his new post and to develop a very professional and sustainable Conservation Service within the Government. He also had the talent to inspire and encourage his staff. John retired in the early 1990s.

John enjoyed an active retirement. He continued sailing on Lough Erne as he kept a caravan at the Yacht Club. He also retained his membership of the Belfast Naturalists Field Club and the Botanical Society of the British Isles.

It is obvious that John had a rich and varied life and career. He also had a quiet, unassuming nature and was one of life's gentlemen. He will not be forgotten by all those who enjoyed his friendship. To his sons, Steven and Gary, and to his four grandchildren, we offer our sincere sympathy.

Bill Wright

Letters to the Editor

Agri-Food and Biosciences Institute,
Belfast,
Northern Ireland.

The Editor, *Irish Forestry*

Re. Plant biosecurity in New Zealand – setting the standard

Dear Sir,

I recently took a working visit to the Plant Protection section of the New Zealand research institute Scion to examine biosecurity for the pine pathogen *Fusarium circinatum* (the causal agent of pitch canker of pine). During this time I also attended the Biosecurity conference, which is co-organised by the Ministry for Primary Industries (MPI; a government department) and the Forest Owners Association (FOA). As anyone who has travelled to New Zealand can attest, biosecurity is taken very seriously, and rigorous checks of passenger baggage and footwear are routine at airport international arrivals halls.

The conference, which is in its seventeenth year, has grown to include many sectors other than forestry, with kiwi fruit, vine, horticulture and other grower's groups also represented. I was struck by the level of planning and collaboration involved in how New Zealand manages its plant biosecurity. In this letter I will outline some of the points I noted which undoubtedly contribute to maintaining the high standards of biosecurity and plant health enjoyed by the country.

1. Working in partnership

The conference was organised, planned and run in a shared fashion between the MPI and the largest forest industry group, the FOA. The conference included sessions where the MPI detailed what they have been doing to protect the industry's biosecurity, and then what they need the industry to help with. In another session the FOA presented the work they had commissioned, and then provided the MPI with what they needed to take on board. This format seemed to work very well, with the MPI and industry being on good working terms due to their history of shared responsibility and working.

The background to this shared working is enshrined in the Government Industry Agreement Deed (GIA). Under the GIA, signatories share the decision-making,

responsibilities and costs of preparing for – and responding to – biosecurity incursions. The number of signatories to the GIA has expanded rapidly since its inception, with 18 industry partners from the forestry, fruit, vegetable, and dairy and livestock sectors all signing up. A key function of the GIA is to provide a rapid and comprehensive response to plant health emergencies. Having the right people (government, scientists and other stakeholders) in the room in an emergency can lead to a quicker and more comprehensive evidence-based response, and hopefully result in pest eradication. Australia also has an Emergency Plant Pest Response Deed, while the Biosecurity plan for Britain identifies a similar need for more collaboration between government and stakeholders[1].

2. Ambitious plans

New Zealand recently published its very ambitious Biosecurity 2025 strategy[2], which is a partnership between the public, industry, Māori, and government. It has five strategic directions:

- A biosecurity team of 4.7 million people;
- A toolbox for tomorrow (employing the latest in scientific and technological development);
- Smart, free-flowing information (i.e. data and information technologies);
- Effective leadership and governance; and
- Tomorrow's skills and assets (a capable and sustainable workforce and world-class infrastructure).

I particularly like the first direction and am excited by the prospect of having every person in New Zealand on the lookout for potential pests and pathogens. This should certainly increase the chances of early detection and successful eradication of any new threats. The strategy is backed up by the very effective media campaign "Ko Tātou" (English translation "This is Us"), which seeks to even further ingrain biosecurity principles into the New Zealand way of life. Indeed, the requirement for anyone suspecting a new plant-health pest in New Zealand to report it to government is enshrined in the Biosecurity act. In Ireland and Northern Ireland there are statutory requirements for persons who discover a regulated organism to bring it to the attention of the minister (i.e. via DAFM or DAERA). In New Zealand, the public understanding and awareness of biosecurity is already high, with the baseline survey for the Biosecurity 2025 report indicating that over 50% of New Zealanders have a good understanding of biosecurity and regularly take actions to prevent the spread of pests and pathogens. This is better than the situation in Northern Ireland, with just

[1] DEFRA (2014). Protecting Plant Health: A Plant Biosecurity Strategy for Great Britain.
[2] Available at https://www.biosecurity.govt.nz/protection-and-response/biosecurity/biosecurity-2025/

30% of people involved in outdoor activities engaged in good biosecurity practices (Diane Burgess, AFBI unpublished data). The Biosecurity 2025 plan aims to increase the number of people practicing biosecurity even further, to 80% of the population.

The MPI and the FOA fund forest health surveys across New Zealand. The MPI high risk site surveillance scheme is based on surveying almost 500 high risk sites (often near ports or built-up areas) where pests are often known to first invade. Eradications are more effective when implemented before a pest is allowed an opportunity to spread. There was also an impressive presentation by MPI on the annual number of responses they launch into suspect biosecurity concerns. New Zealand uses a single point of contact, a 24/7-available biosecurity hotline phone number, for reporting all biosecurity concerns. In fact, one of the audience members at the conference was "on duty" managing the biosecurity hotline mobile phone on the day of the conference and had several phone calls to respond to during the day. Of the 15,000+ calls received to the hotline in 2018, over 5,000 were related to plant health concerns. These were all examined in detail to exclude non-risks. A total of eight risks were ranked at the highest level and invoked specific official biosecurity responses in 2018. During my time in New Zealand, government and industry were in the process of responding to an outbreak of the Queensland fruit fly in Auckland. At the time of writing (June 2019), there was an awareness-raising campaign running for the brown marmorated stink bug.

We have a lot to learn from the New Zealanders with regard to our own biosecurity. As an island, forests in Ireland and Northern Ireland have a natural defence against pests and pathogens from Britain and mainland Europe. The weak link in our island forest health protection is the human aspect, with plants and plant products that are moved in trade and for personal use presenting an ever-present risk of bringing a new pest or pathogen with them. The DAERA and DAFM websites both contain useful resources to help foresters protect forests from pests. The Observatree website (www.observatree.org.uk) also contains impressive plant pest guides. However, we should make distinct efforts to ensure a much greater proportion of our population realises its own responsibility and is empowered and harnessed to protect our future plant security. This is especially timely as 2020 is the International Year of Plant Health. The aim of this initiative is to raise global awareness on how protecting plant health can help end hunger, reduce poverty, protect the environment, and boost economic development.

Sincerely,

Richard O'Hanlon

The Editor, *Irish Forestry*

Re. Creating an archive of Irish forestry

Dear Sir,

Forestry, as a national effort, can trace its origins back to the Department of Agriculture and Technical Instruction when it established Avondale Forest, Rathdrum in Co. Wicklow as "Forest Number 1" and the training school for the fledgling Forest Service. Since then the foresters of the early Forestry Division and its successors, in both public and private forests, have established an estate that now covers eleven percent of the country and delivers many benefits to society.

Although their work can be seen in every district of the country, the story of the men and women who worked on this great national project is not widely known or appreciated. In the mid-century period "the forestry" employed thousands of people, often providing the only sustainable employment in remote areas where employment opportunities were limited. Some of this work was recorded in a series of photographs, dating back to the 1930s showing the people, the work practices, the machinery and the landscapes they transformed, and will now form the basis of a forestry collection to be digitised and made available through the National Folklore Collection.

With impetus from this collection of photographs, the National Folklore Collection, based in UCD, is now setting out to document and preserve an account of this effort by assembling and copying any surviving photographs, diaries or relevant correspondence of men and women involved in forestry in the past. We feel it is timely and important to record as many individual accounts of the challenges and work practices that led to the creation of the national forest estate.

If you wish to contribute documents, photographs, or if you would like your own personal memories of your own contribution to Ireland's national forest estate to be recorded and preserved, please contact either of us.

- Críostóir Mac Cárthaigh, phone: (01) 716 8481, email: criostoir.maccarthaigh@ucd.ie
- Bill Murphy, phone: (086) 259 1518, email: william.murphy1@ucdconnect.ie

Yours faithfully,

Dr. Críostóir Mac Cárthaigh[1] and Bill Murphy[2]

[1] Director, National Folklore Collection, Newman Building, University College Dublin.
[2] School of Environmental Policy, University College Dublin, formerly Coillte, Dublin Road, Newtown Mt. Kennedy, Co. Wicklow.

Irish Forestry

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