Native Woodland Scheme 2001 - 2017: Case Studies

Authors: **Declan Little, (Woodlands of Ireland) and Kevin Collins, Forestry Inspector (Forest Service, Department of Agriculture, Food & the Marine)**

Edited by: **Declan Little, Joe Gowran & Trevor Seery (Woodlands of Ireland)**

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The Native Woodland Scheme (NWS) was introduced in 2001 by the Forest Service (now of the Department of Agriculture, Food and the Marine). Since its inception, approximately 6,000 hectares have come into management in the public and private sectors, under NWS Conservation (of existing old, ancient and young emerging woodland) and through the creation of new native woodlands under NWS Establishment. Its overriding objective is biodiversity enhancement and the protection of conservation values. Secondary objectives may include, wood production, recreation, education and the provision of other ecosystem services.

Since the inception of the NWS, Woodlands of Ireland has worked closely with the forest sector (including landowners, foresters, ecologists and woodland contractors), to monitor and assess the implementation of the Scheme and act as a feedback loop to the Forest Service. To this end, Woodlands of Ireland co-ordinated visits to a selection of woodlands managed and established under the NWS commencing in the period 2001 to 2012 to assess how these woodlands were progressing and to feedback recommendations to the Forest Service in order to improve the NWS. This has resulted in changes to the Scheme on an ongoing basis.

At the outset, it was unknown how woodlands would develop, especially with respect to wood quality potential. In many cases, this was not even a secondary objective, especially on more marginal, upland sites. The outcome of these site tours are presented in order to inform future management and landowners interested in applying the NWS on their properties.

It is recommended that flexibility regarding the NWS Management Plans be adopted at many of the sites visited as wood production potential under Continuous Cover Forestry clearly has a future role to play, especially regarding pioneer tree species on marginal sites. If applied sensitively, silvicultural management will not compromise biodiversity values and indeed, may even enhance it, by creating a mosaic of uneven-aged stands within the extant forest area. The application of the Woodland Improvement Scheme in order to thin and shape trees where quality wood is possible is recommended at intervals throughout the rotation of the stands.

Wood production requires skilled forest management, training and the development of downstream products and end-uses co-incident with appropriate processing facilities.

INTRODUCTION

The Native Woodland Scheme (NWS) was introduced by the Forest Service, Department of Agriculture, Food and the Marine in 2001 and contains a package of measures to conserve, restore, enhance and expand Ireland's native woodland resource and its associated biodiversity (Forest Service, 2015a.). The primary ecosystem service provided by the NWS is biodiversity, however there are other associated and important services including water quality protection and enhancement (from protective riparian woodland), carbon sequestration, recreation and education (especially under the NWS/ Neighbour Wood measure) and wood production, using appropriate close-to-nature silviculture under Continuous Cover Forestry (CCF). The latter is most often promoted on fertile soils under NWS Establishment, where new native woodlands are created on greenfield sites. Wood production is also possible under NWS Conservation, which targets existing 'old, ancient and emerging (scrub)' woodland, however the overriding objective of biodiversity conservation and enhancement must not be compromised.

Woodlands of Ireland (WoI) has provided technical support throughout the development and implementation of the NWS and hence, a considerable amount of knowledge and expertise has been generated over the past twenty years or so. To improve and fine-tune the NWS, WoI generates feedback from NWS practitioners (foresters, ecologists, woodland contractors Forest Service Inspectors and National Parks and Wildlife Service (NPWS) Rangers) and land/woodland owners through onsite visits to assess progress. Several fact-finding excursions to NWS Conservation and Establishment woodlands have been organised involving these key personnel, i.e. in 2002, 2010 and most recently in the spring of 2017.

The purpose of this Information Note is to provide guidance on issues such as wood production and conservation management from observations made during these excursions. For example, in the early years the medium and long-term objectives and vision for many NWS sites outlined in the NWS Management Plans were purely focussed on biodiversity enhancement as:

- in the case of NWS Establishment, the sites/soils generally, were considered too poor to have any wood production potential, or
- in the case of NWS Conservation, many sites have very high conservation value and are designated as Specific Areas of Conservation (SAC) and/or Natural Heritage Area (NHA).

The following case studies from the 2017 excursion, are a current snapshot of how these sites have developed under the NWS, how they diverged from what was expected at the outset, future opportunities and the necessity to be flexible in terms of altering future management objectives and plans.

Case Study 1: Deputy's Pass, Glenealy, Co. Wicklow (NWS Conservation)

Visited: May 24th, 2017

BACKGROUND

The focus of this project is a 6 hectare (ha) birch woodland at Deputy's Pass, Glenealy, Co. Wicklow, located within 47 ha of oak-dominated secondary woodland of coppice origin, owned and managed by the National Parks and Wildlife Service (NPWS). The entire woodland is designated as a Special Area of Conservation (SAC) (Site Code 000717) and Nature Reserve, and immediately adjoins a mixed 41 ha woodland managed by Coillte. The site is located approximately 10 km from the Clara Vale, Co. Wicklow, which contains the second largest area of native woodland in Ireland.

NPWS applied under NWS Conservation in 2003 to manage a mix of mature, abandoned oak coppice and an area of naturally regenerated birch-dominated, secondary, wet riparian woodland adjoining the Potters river, an important sea trout habitat. In the latter area, adjacent to the aquatic zone it was notable from very early on that the quality, form and vigour of the emerging downy birch (*Betula pubescens*) indicated significant wood production potential (Doyle & Dunne, 2003). Through discussions with NPWS, a NWS Forester and Woodlands of Ireland, a proposal was agreed to respace and thin to maximise timber quality, in such a manner that would have minimum impact on biodiversity (Fig. 1.). NPWS agreed to trial this approach on this relatively small area, i.e. on ca. 0.5 ha of the 6 ha. In 2003, there were approximately 5,000 trees/ha and three plots were set

Fig. 1: Marking birch trees in advance of thinning operation in 2017, Deputy's Pass, Glenealy, Co. Wicklow.

aside for assessment, i.e. Plot 1: thinned with removal of shrub layer; Plot 2: thinned with retention of shrub layer and Plot 3: unthinned (Appendix 1, Fig. 1). Respacing was carried out by Coillte in 2006, and a light crown thinning was undertaken by a private forestry contractor and member of Prosilva, in 2011. The unthinned birch plots retained act as a control, to provide useful information on how management impacts woodland development over time, i.e. self-thinning versus silvicultural thinning.

In addition, a soil survey was carried out to provide baseline data and to monitor vegetation change throughout the forest cycle. An initial soil identification survey in 2003 was followed up in 2017 with a detailed walkover survey that included soil transects in the thinned and unthinned birch plots (Appendix 1, Table 1). In addition to the walkover vegetation survey as part of the NWS Ecological Survey & Management Plan, detailed vegetation surveys in two 10 m x 10 m quadrats were carried out in 2003 and 2016, one each in a thinned and unthinned plot (Appendix 1, Fig. 1).

VEGETATION CLASSIFICATION AND WOOD QUALITY

The NWS Ecological Survey was carried out in 2003 and the woodland is classified as follows:

BM2 Bilberry-woodrush *(Vaccinium myrtillus-Luzula sylvatica),* which equates to F3 Birch woodland and specifically, F1(ii) Dry birch woodland under the previous NWS classification system (Cross et al., 2010). Under the current NWS Framework, this woodland equates to Scenario 5 (DAFM, 2018). This woodland appears to be a permanent, successional phase in the riparian zone due to the fluctuating water table.

QL1 Bilberry-holly *(Vaccinium myrtillus-Ilex aquifolium)* woodland, which equates to A1 Oak-birch-holly (see Cross et al., 2010) and Scenario 1 under the current NWS Framework (DAFM, 2018). A small amount of this woodland occurs in the study area on iron podzols, with increasing distance from the aquatic zone.

Fig. 2: A view of the unthinned control birch stand in 2017, Deputy's Pass, Co. Wicklow.

A comparison of the vegetation in Quadrat 1 (control, unthinned) between 2003 and 2016 (McKenna, 2016) suggests that the shrub layer is more characteristic of QL1 Bilberry-holly than BM2 Bilberry-woodrush, as it contains more holly, rowan, hazel, bilberry, woodrush, hard fern, buckler ferns and abundant bryophytes (especially *Thuidium tamariscinum*) (Fig. 2). Between 2003 and 2016, there was a decrease in the canopy layer from 90% to 70%, and a corresponding increase in shrub layer from 10% to 40%. The ground flora layer increased from 50% to 80%. Litter cover decreased from 90% to 70%. Regarding species diversity and abundance, *Hedera helix* increased from 0% to 20%, *Ilex aquifolium* from 0% to 30%, and *Luzula sylvatica* from absent to 5%. There was also an increase of *Quercus petraea* from absent to 20%. There is a notable decrease of *Dryopteris dilatata,* from 30% to 10%. New species present in the quadrats in 2016 include *Luzula sylvatica* (Quadrats 1 & 2), *Vaccinium myrtillus* and *Hookeria lucens* (Quadrat 2 only), while species that were present in 2003 but absent in 2016 include *Lonicera periclymen* (Quadrat 1), *Juncus effuses* and *Agrostis stolonifera* (Quadrat 2 only).

Comparing vegetation in Quadrat 2 (thinned 2006 - Plot 1) between 2006 and 2016, there was an increase in the shrub layer from 10% to 25%. Canopy, field and ground flora layers were similar to that when assessed in 2003. Regarding species diversity and abundance, there was an increase in the presence of holly from 1% to 20%. *H. helix* increased from 5% to 25%, and *L. sylvatica* from absent to 20%. There was a decrease of *D. dilatata* from 20% to 5% (Mckenna, 2016).

These results indicated that the reduction in the number of *B. pubescens* stems as the stand ages resulted on this site in an increase in the abundance of other species within the stand, which presumably spread in from the adjacent old woodland. This could be aided by the increase of sunlight reaching the ground layer, due to the thinning and self-thinning of the canopy (and possibly the drying out of soil). This indicates that the ageing of

this pioneer birch stand, coupled with self-thinning and silvicultural thinning, provide for the natural regeneration of other species. Increasing light levels as the canopy opens will almost certainly have profound impacts on species succession over time.

To date, vegetation monitoring indicates that thinning the stand is having a minimal impact on the development of the woodland.

Currently, due to the two separate silvicultural interventions to date (in 2006 - Fig. 3, and 2011), marked birch stems within the thinned section of the stand have increased diameter and are of excellent quality, with significant timber potential. The original plan for thinning the birch was on a 5-year cycle, removing approximately 400 stems/ha per thinning, to retain 300 stems/ha as the final crop trees (Appendix 1, Table 2). However, more frequent thinning was not applied in the early years of the stand cycle (between 2003 and 2011), and it could be argued that even better final crop trees may have resulted if a more frequent thinning regime had been applied in the early years of stand development. There is a greater diversity of woodland species within the thinned sections compared to the unthinned section, possibly due to increased light levels and canopy openings after thinning, and also possibly due to soil variability.

In 2027 when mature, quality birch is removed, the objective is to retain any native trees present, such as oak, willow, alder and hazel, and supplement with natural regeneration. Birch will be encouraged to regrow from coppiced stumps (Doyle & Dunne, 2003). As woodland succession progresses, it is expected that an uneven-aged and mixed native woodland stand will emerge, comprising mainly birch and holly, with some oak, willow, holly, ash, cherry and rowan. It will be interesting to see if birch continues to dominate in future within the riparian zone adjoining the watercourse, given the mostly-wet soil conditions (Appendix 1, Table 2 & Fig. 1).

Fig. 3: The birch stand after thinning in 2006, Deputy's Pass, Co. Wicklow. The shrub and ground flora was retained as much as was possible.

Fig. 4: The dominant soil type in the birch stand, a stagno-humic gley characterised by an organic-rich topsoil (dark brown-black), underlain by a very wet silty alluvium (grey) with typical mottling (yellow-brown) in the subsoil layers, Deputy's Pass, Co. Wicklow.

FUTURE MANAGEMENT

Two further light crown thinnings are envisaged between now and the harvesting of the marked 'final crop' birch stems, i.e. in 2019 and 2024. In addition, sessile oak planted in tree guards should be released during the next thinning in 2019 as they are now over-topped by regenerating birch. Timber measurements should be carried out annually after the next thinning, to establish annual increment.

Other issues to note for the future are listed below:

- Rhododendron (*Rhododendron ponticum*), Cherry laurel (*Prunus laurocerasus*) and beech (*Fagus sylvatica*) will have to be managed and controlled to ensure that these species do not become firmly

established.

- Vigilance regarding deer populations is also imperative, as deer are clearly present. Management will be required to ensure that overgrazing, browsing and bark stripping do not result in excessive seedling mortality, bole damage and the loss of sensitive ground flora species.
- Deadwood comprising fallen trees, branches and stumps are frequent throughout the plot and will be retained to optimise invertebrate biodiversity.
- Within the wider woodland area, which is dominated by mature, abandoned oak coppice, it is recommended that the even-aged oak canopy be broken up into areas greater than 5 ha via small coupes (no greater than 0.2 ha) to allow for greater diversification in both species and age structure (Cross & Collins, 2017). Some of the resultant deadwood should be left on the forest floor.

CONCLUSIONS

The birch stand at Deputy's Pass is somewhat unusual in a national context as it contains a relatively rare riparian woodland type (Perrin, et al., 2008), that has excellent wood production potential throughout. Although the stand is located within an old woodland of considerable conservation value, this should not preclude the co-objective of management to produce quality wood. This can be pursued sensitively under CCF, with minimal impact on biodiversity value or natural successional processes. Care is required to ensure that soil damage through compaction is avoided, as the area is naturally poorly-drained. Manual harvesting by chainsaw and extraction with low impact, all-terrain machinery are essential to protect the site. By allowing birch coppice to regrow from the stumps after removing quality birch and retaining other native trees and shrubs that colonise gaps, biodiversity and woodland successional processes will be encouraged while also enabling wood production to continue as a management co-objective. Revenue from wood production can be used to offset the costs of managing the woodland in future. Therefore, the original management plan - which envisaged conservation management only on most of the woodland - should be modified to address quality birch production (and possibly oak elsewhere in the woodland) under CCF.

These stands should be considered for submission under the Woodland Improvement Scheme: Element 1 – Thinning & Tending (Forest Service, 2015a), to fund subsequent thinning to further realise their wood production potential.

Fig. 5: Garryknock, Co. Wicklow prior to afforestation in 2009. Over half of the site was dominated by bracken (*P. aquilinum*) before planting.

Case Study 2: Garryknock, Lacken, Co. Wicklow (NWS Establishment)

Visited: May 24th, 2017

BACKGROUND

This 5.9 ha privately-owned NWS Establishment site is located in the townland of Lacken in Co. Wicklow. Situated at an elevation of 300 to 370 m, it is mostly enclosed and sheltered. It lies at the lower limit of an upland / montane blanket bog complex (Wicklow mountains SAC (Site Code 002122) and SPA (Site Code: 001750), and within 3 km of the pNHA at 'Oakwood' located adjacent Ballinagee Bridge NHA (Site Code 001750). The site was improved historically, perhaps as far back as the 18th century, and it is almost certain that organic amendments and lime were added. Land-use was generally extensive, marginal grazing pasture. It contains the ruins of an old habitation dating to the 18th Century as well as paddock / enclosure that may have been used in pre-Famine times for booleying (Doyle & Little, 2008).

Prior to the afforestation on the site with native woodland under NWS Establishment, it was dominated by dense bracken (*Pteridium aquilinum*) (Fig. 5) and semi-improved dry-humid acid grassland, with gorse (*Ulex europaeus*), non-calcareous springs and poor fen and flush habitats. The moderately sloping terrain ensures that the site drains reasonably quickly, though occasional springs and flushes result in saturated conditions locally.

The predominance of bracken and gorse indicated low ecological value in terms of vegetation species and diversity. Furthermore, non-bracken areas were subject to appreciable grazing pressure. The site was deemed suitable for native 'pioneer' woodland, as it would almost certainly develop into low-lying woodland comprising of native species, if the grazing pressure was removed, with the possibility of further succession into high forest woodland.

Soils are leached but are of moderate to locally-poor fertility, due to historical amendments / inputs and de-stoning. They are dominated by improved / modified acid brown earths that are shallow (20-50 cm deep) and free-draining, and improved / modified peaty podzols (Fig. 6), with the occurrence very locally of saturated peats and peaty gleys (c.15% of total area) where poor fen and flushes occur.

Fig. 6: The acid, peaty topsoil ca. 20cm deep, from a peaty podzol soil profile, Garrykock, Co. Wicklow.

OBJECTIVES

The owner's, Richard and Margaret Sinnott, were keen to establish a native woodland, primarily for biodiversity and recreation purposes. Based on the climatic, site and soil factors described above, three native woodland types were promoted on the site, as follows.

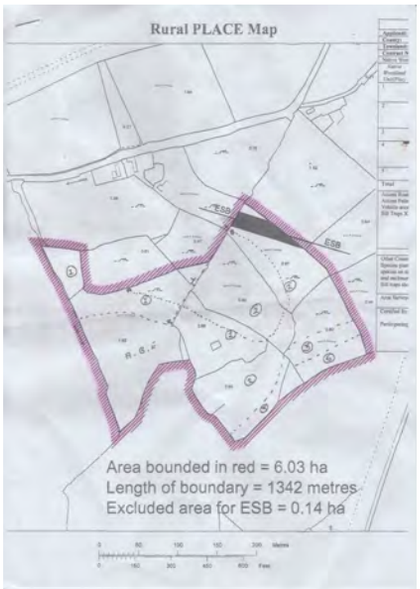
BM1 Bramble-broad-buckler fern *(Rubus fruticosus-Dryopertis dilatata),* which equates to F1. Dry birch woodland in the previous NWS classification system (Cross et al., 2010) and Scenario 5B under the current NWS Framework (Forest Service, 2015a). This represents the early stages in the development of QL1 *Vaccinium-Ilex,* which equates to A1. Species-poor oak-holly-birch woodland (Cross et al., 2010) (Fig. 7, Plot 1).

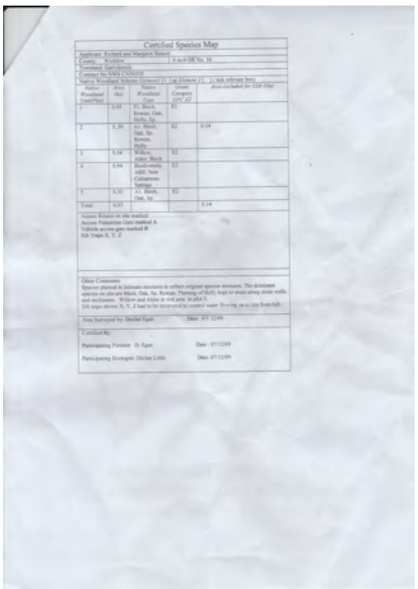
QL1 Bilberry-holly *(Vaccinium myrtillus-Ilex aquifolium),* which equates to A1. Species-poor oak-holly-birch woodland (Cross et al., 2010) and Scenario 1 under the current NWS Framework (Forest Service, 2015a) (Fig. 7, Plots 2 & 5).

AF3 Grey willow-water horsetail *(Salix cinerea-Equisetum fluviatile)* (which equates to E1. Willow-alder carr adjacent fen and flush, and Scenario 4 under the current NWS Framework (Forest Service, 2015a) (Fig 7., Plot 3).

By Year 50, it is expected that the development of a predominantly open QL1 *Vaccinium-Ilex* woodland (i.e. A1 Species poor oak-holly-birch) will be established, dominated by birch (*B. pubescens* & *B. pendula*) and rowan (*Sorbus aucuparia*), with some oak (*Quercus petraea*), holly (*Ilex aquifolium*) and Scots pine (*Pinus sylvestris*). Willow-dominated carr woodland (*Salix aurita* & *S. cinerea*) with some common alder

Fig. 7: Site map and species list, Garryknock, Co. Wicklow, NWS Establishment, 2009. Plot 1 is BM1 woodland; Plots 2 & 5 are QL1 woodland; Plot 3 is AF3 woodland and Plot 4 is unplanted (due to the presence of a non-calcareous spring, i.e. Area for Biodiversity Enhancement (ABE).





(*Alnus glutinosa*) are envisaged within adjacent flushed areas.

The Sika deer population is very high in this area and protective fencing was essential to ensure that the establishing woodland was not compromised by grazing / browsing. As the site was improved and is surrounded by upland blanket bog and conifer plantation, it is a very suitable habitat for hares, which subsequently caused significant damage, in particular, to planted sessile oak. Subsequent filling-in focussed mainly on Scots pine and downy birch, which were not targeted by the hares to any great extent. The bracken cover required ongoing control within the first 5 years until the newly-planted trees were well-established. Initially, the site was spot sprayed with Azulox (a herbicide now restricted for emergency use only between July and September only, and represents a considerable challenge for future large NWS Establishment projects where bracken dominates). The gorse also required control through cutting. However, small isolated pockets were retained, as it has some ecological value, especially for bird life. Ongoing management will be required, though, as it is also a fire hazard.

PLANNING & MANAGEMENT

This site was assessed and recommended for NWS Establishment by Woodlands of Ireland in 2008, to test the scheme's application at the upper limit of acceptability, i.e. a marginal, upland site approaching the altitudinal limit for native woodland, with a high deer and hare population. It was recognised that woodland establishment on this site would require a very high standard of management, especially during the initial 5 years, including the control of grass, bracken and gorse, filling-in due to hare damage, and vigilance (including regular fence inspections and follow-up repair) to ensure that deer were completely excluded. Significant losses were suffered due to snow and hare damage during the harsh winter of 2010-11. However, such losses were overcome by replanting with a focus on pioneer species and Scots pine. This was achieved and at the time of visiting in 2017, the site was fully stocked with a vigorous, vibrant native woodland clearly emerging.

It is recommended that slower growing species, especially sessile oak and Scots pine, are released by removing competing birch. This can be achieved through halo-thinning around those trees to be retained. If this is not done in the next two years, it is almost certain that many of the oak and Scots pine will be over-topped and subsequently lost due to competition.

Wood production was not envisaged at the outset and yet, even on this marginal upland site, appreciable numbers of very good quality birch are now evident throughout the woodland, which is overstocked in many places. It is recommended that a respacing operation is carried out within the next two years, favouring stems marked for retention beforehand. If the birch continues to show wood quality potential, further thinnings should be carried out every 5 to 7 years until year 35, at which point, quality trees can be removed in small groups and single stems using CCF. Coppice regrowth from the resultant birch stumps will ensure an uneven aged structure beyond this birch harvest cycle.

The site has research and educational potential, and should at least be monitored to see how this woodland community evolves, especially given the site's altitude.

CONCLUSIONS

Given the experience the NWS Forester had in establishing this site, the emphasis of NWS Establishment on similar upland areas should be to establish pioneer woodland with less oak (which is slow growing, especially on challenging, upland sites, and is susceptible to exposure, hare damage and being over-topped by surrounding pioneer tree species). A greater amount of Scots pine in the planting mixture would compensate for the loss of oak in the resultant canopy. In effect, this is now catered for under the recently-introduced Scenario 5, as set out in the NWS Framework (Forest Service, 2015a).

Although the woodland is located in an area of high deer density, the deer fence provided sufficient protection for the woodland, almost certainly due the relatively small area fenced, i.e. 6 ha, and the very high standard of installation and subsequent monitoring. The fence was erected following the standard specifications for deer fencings, as set out in the Forestry Standards Manual (Forest Service, 2015b). However, a deer management plan developed with the local Deer Management Group in Wicklow is also recommended - see Native Woodland Information Note No. 7: *The Managment of Deer in Native Woodlands* (Höna et al., 2018).

In addition, comparable pioneer-dominated sites should be monitored after establishment (between the 2nd grant instalment has been paid in Year 4 and Year 8) to assess the potential for wood production. If there is, relevant operations such as ongoing formative shaping and early respacing should be scheduled in a thinning and felling plan (under CCF) developed before Year 10, with subsequent thinnings undertaken to favour pre-selected stems to ensure optimum wood quality. The owner should also consider applying under the Woodland Improvement Scheme (WIS) Tending & Thinning Scheme (Forest Service, 2015a), for support to undertake these interventions. The revenue derived from wood production may be used for future management operations, e.g. deer control and path maintenance.

Case Study 3: Charleville Estate, Co. Offaly (NWS Conservation)

Visited: May 24th, 2017

BACKGROUND

Charleville Estate, located outside the town of Tullamore, was one of the first Native Woodland Conservation projects approved in 2003 as a 'multi-annual' project. The primary objective of the owner, as set out in the submitted 'Ecological Survey / Management Plan (Bosbeer & Hawe, 2003) is to ensure that this relatively large and very valuable ancient lowland woodland site should be managed to ensure adequate recruitment of native trees and shrubs, and to control non-native and exotic invasives, especially sycamore, beech and rhododendron. Other exotic shrubs, such as snowberry, are also present within the understorey and requires monitoring to ensure they do not spread. Fallow deer numbers have been at unsustainable levels for many years and need to be adequately controlled.

A considerable portion of the initial capital funding provided under NWS Conservation was for deer fencing of the entire 106.7 ha woodland area. Thereafter, multi-annual claims were based on the delivery of the work programme outlined in the original Ecological Survey / Management Plan produced in 2003 (Hawe & Bosbeer, 2003).

The following woodland types are present in this site (see Figure 1).

FH2 Pedunculate oak-bramble in Native Woodland Unit 1(NWU1) *(Quercus robur-Rubus fruticosus),* which equates to B1. Oak-ash-hazel woodland on relatively deep soils under the previous NWS classification system (Cross et al., 2010).

AF6 Alder-tussock sedge in NWU2 *(Alnus glutinosa-Carex paniculata),* which equates to E3. Wet ash-alder remote sedge woodland where calcareous soils are flooded in winter (Cross et al., 2010).

BM 1 Bramble-broad buckler-fern in NWU3 *(Rubus fruticosus-Dryopteris dilitata),* which equates to F1. Birch woodland on flushed peat) (Cross et al., 2010).

AF5 Birch-water mint in NWU4 *(Betula pubescens-Mentha aquatic)*, which equates to E1. Willow-alder carr on fen peat, with a small area of alder carr with tussock sedge (AF7/E2) woodland (Cross et al., 2010).

(Under the current NWS Framework (Forest Service, 2015a), Scenario 3: Brown Earths (Oak-Ash-Hazel Woodland) would encapsulate FH2 Pedunculate oak-bramble, and Scenario 4: Gleys (Alder-Oak-Ash Woodland) would encapsulate the other woodland types listed above.)

The primary focus of the NWS Conservation work programme within Charleville was the removal of exotic species and woodland regeneration with native species. In total, works carried out on 87 ha have been completed and funded under NWS Conservation. The entire woodland area has now been worked over regarding exotic species removal, with the exception of:

- localised stands of veteran beech (and occasional mature larch), which will be retained for their cultural, landscape and biodiversity value; and
- localised exotic regowth / regeneration, which is addressed in the following revised maintenance programme to be implemented in 2017/18 (Purser & Burkitt, 2016).

The area funded under NWS Conservation to date is now being maintained by the owner.

While enrichment planting was scheduled and carried out within the first phase of the works, it was anticipated that – with successful deer control – the principle means of woodland regeneration would be through natural regeneration, primarily from self-seeding. From the outset however, the perimeter deer

Fig. 8: Ancient woodland on the island at Charleville Demesne, Co. Offaly, in springtime. This is the dominant woodland type present in the estate, i.e. FH2 Pedunculate oak-bramble (oak-ash-hazel).

fence - which encloses a very large area - has been subject to ongoing vandalism allowing deer to enter at a number of locations. Unfortunately, given that Charleville Estate is very much a recreational woodland resource for the Tullamore area, it is subject to a myriad of interests and pressures, which in many cases, are impossible for the owner to control. Ongoing deer pressure has required additional unscheduled works, and enrichment planting has had to be protected internally from deer browsing, primarily through the use of deer tubes. The existing deer culling programme has resulted in some areas of natural regeneration. It is felt, however, that the culling programme needs to be stepped up to secure additional regeneration of native species and to protect additional enrichment planting specified within a revised maintenance programme outlined below.

REVISED MAINTENANCE PROGRAMME

The following elements comprise the revised maintenance programme devised for the woodland (Purser & Burkitt, 2016):

- Deer control: Establish current deer densities and activity, via a professional deer survey in 2016 that will establish the Effective Deer Utilisation (EDU) of the woodland. An initial deer density survey has been carried out and will be repeated at end of March 2017.

  Based on this survey, commence a cull programme to reduce deer densities to ca. 5 deer / km^2. This will involve culling under Section 42 (which allows for an out-of-season shooting license) and will be an extensive programme, professionally implemented.

- Fence-line maintenance: To assist in the deer management programme, the existing external deer fence and associated gates will be restored. While this is not expected to be 100% effective due to the very large area within the fence (and will probably be subject to future damage), it will provide a window for effective deer management and the recruitment of natural regeneration and enrichment planting.

- Removal of exotic regeneration / regrowth: This operation will also include Sitka spruce (*Picea sitchensis*) and rhododendron.

- Removal of pole stage Sitka spruce regeneration: This will be undertaken by cutting-to-waste.

- Further removal of pole stage and semi-mature sycamore and beech, to create and improve conditions for enrichment planting of oak. This will require a General Felling Licence.

- Existing protective tube maintenance: This will include re-staking planted trees using new, heavy-duty stakes, tube recycling and new tubes.

- Scrap mounding and enrichment planting of birch in open sections in the south of the property.

- Enrichment planting of local provenance oak in small canopy gaps throughout the woodland, with tubing / staking (as above).

- Additional silvicultural thinning of areas of pure ash, to improve crown development.

FURTHER NOTES

Other follow on operations that compliment the above are as follows:

- Young regenerating beech in some areas should be left as a nurse to native species and as a means of overcoming extensive bramble in open areas generated through the felling of exotics during the first phase of work in mid 2000s. These beech trees are to be removed in future operations before they commence seed production.

- Follow up maintenance work on new planting to be conducted in 2017-2020, funded by NWS premium payments to owner.

- Deer management work to continue with the objective of maintaining densities to less than 5 animals / km^2.

- Implementation of revised programme to be completed in 2017.

Once agreement regarding the maintenance programme has been secured with the owner and the DAFM, the following tasks will be undertaken in chronological order:

- Check availability of local provenance oak;

- Apply for General Felling licence;

- Carry out the initial deer survey;

Fig. 9: Naturally regenerated pole-stage ash woodland that has devloped subsequent to felling of mature oak, Charleville demense, Co. Offaly.

- Apply for Section 42 out-of-season shooting licence;
- Apply thinning work;
- Undertake all digger work (fence-line, rhododendron, scrap mounding);
- Undertake chainsaw work / respacing work;
- Undertake planting with tubes;
- Deer cull to be undertake through all of the above, from time of Section 42 receipt.

CONCLUSIONS

As the principal threat to this woodland is deer damage, especially the browsing of seedlings, it is clear that management must integrate deer control on an ongoing basis. This entails deer density surveys, culling, fencing and the protection of trees using tubes. It is clear that deer fencing such a large area, i.e. 87 ha, is both very expensive and ineffective, particularly where there is public access and a negative perception toward the need for effective deer management. A deer fence is only as strong as its weakest point and unfortunately, the fence has being cut in places, apparently by 'animal welfare activists' who regard the fence as a measure that is cruel as it excludes deer from the woodland. It is also clear that deer gain access by going under the fence at intervals. As a general comment, perimeter-only deer fencing becomes increasingly ineffective as the area it protects increases, and that projects greater than 10-12 ha (undertaken by NWS or otherwise) should rely on a range of control measures, including the fencing of key, vulnerable areas, perimeter fencing, internal fencing, survey-informed culling, and the protection of smaller areas, using exclusions and individual tree shelters. (For further information, see Woodlands of Ireland Information Note No. 7: *The Management of Deer in Native Woodlands* (Höna et al., 2018).

In addition, non-native species such as beech and sycamore (*Acer pseodoplatanus*), and invasive species such as rhododendron, may never be completely eradicated, but should be effectively controlled. Veteran beech trees are being retained for their biodiversity and cultural value, while rhododendron and sycamore will continue to seed into the woodland from adjacent properties. A programme of ongoing control is therefore the optimum management approach, followed by the natural regeneration and enrichment planting of native trees and shrubs. Once rhododendron is under control, it should not be allowed to re-seed from regenerating stumps or from newly-seeded plants. This requires a sweep of the woodland every four years. Similarly, beech and sycamore seedlings should be strimmed before they become firmly-established, and this operation should be undertaken in tandem with the control of regenerating rhododendron. (For further information, see Section 7 of *Management Guidelines for Ireland's Native Woodlands* (Cross & Collins, 2017) and Woodlands of Ireland Information Note No. 3: *The Control of Rhododendron in Native Woodlands* (Barron, 2007).

Where wood production in native woodland areas is applicable and appropriate, felling and coppicing in small groups or single stems is desirable in order to diversify and stagger age class. Tubes can be used to protect the resulting coppice shoots and planted trees. Consideration should also be given to thinning existing areas of beech and sycamore within large native woodlands under the WIS (Forest Service, 2015a) and should include the control of natural regeneration of these species. Several small (<2ha) conifer blocks were present at the time when the Native Woodland Scheme was being applied for, and consideration should be given to allowing these to continue to the end of the rotation before conversion to native woodland. This would generate revenue for future woodland management and result in age class diversity to the overall woodland area. In large native woodlands like Charleville, this would result in a mosaic of working woodland ranging from high biodiversity grade conservation woodland (with ancient woodland conservation reserves), to wood production in native and non-native woodland areas.

Case Study 4: Ballyvary, Co. Mayo (NWS Conservation & Establishment)

Visited: May 25th, 2017

BACKGROUND

Ballyvary, near Castlebar in Co. Mayo, comprising 6.9 ha of NWS Establishment (2003) and 0.5 ha NWS Conservation, was the first NWS project approved by the Forest Service in 2001. Therefore, it has the longest management history of any NWS site. Comprising both elements of NWS, the objectives in the (then-titled) Ecological Survey / Management Plan for the application addressed the overriding native woodland biodiversity objective, while allowing for site management for wood production, primarily hazel coppicing. The plan states: "This is a good site, although a small one, for a hazel coppice silvicultural system. The proposed woodland expansion on adjacent grassland will strengthen the economic viability of the stand, by allowing annual harvesting and coupe sizes to be expanded gradually. An increase in the diversity of woody species, particularly birch, ash and willow is expected as a result of this management system (Gowran & O'Reilly, 2001)."

Therefore, the entire land parcel was planned with native woodland as the principal long-term land use, extending

the hazel-dominated woodland and applying a rotating coppice silvicultural system.

OBJECTIVES

NWS Conservation

The site contains a small hazel woodland on rocky outcrop of c.0.5ha, which has been under coppice management since 2001. The initial coppice restoration operations were funded under NWS Conservation.

The key silvicultural objectives are:

- to develop a systematic hazel coppice regime to allow variation in light intensity on a cyclical basis, which creates a shifting pattern of habitat niches conducive to maintaining or enhancing species diversity; and
- to position 4 coupes adjacent to areas in transition from pasture to scrub woodland establishment

The predominant woodland type present onsite is:

FH3 Hazel-wood sorrel (*Corylus avellana-Oxalis acetosella*) subtype, especially hazel scrub / mature woodland on shallow, rocky limestone soils. This equates to B2. Oak-ash-hazel woodland under the former NWS classification system (see Cross et al., 2010), and Scenario 3 under the current Native Woodland Scheme Framework (Forest Service, 2015a).

NWS Establishment

In 2003, NWS Establishment was applied for and approved on ca. 6.9 ha, primarily to expand the hazel woodland and extend hazel coppicing from the area restored in 2001 under NWS Conservation. The site identified for woodland establishment straddles the townlands of Toormore West and Laghtavary) near the village of Ballyvary, Castlebar, Co. Mayo. Much of the proposed NWS Establishment site was improved (Fig. 10) and unimproved

Fig. 10: A view of hazel-dominated woodland on the drumlin and the floodplain adjacent the Toormore River (NWS Establishment) prior to management and establishment in 2001-3, Ballyvary, Co. Mayo.

grassland, open scrub (dominated by scattered blackthorn) and bracken. Part of the site comprises a riparian zone adjoining the Toormore River, a tributary of the River Moy, which is an SAC for *inter alia* Atlantic salmon (*Salmo salar*). The Toormore River is also an important nursery stream for Atlantic salmon. The 1st edition OS Map indicates that there was no woodland on the site ca.1840.

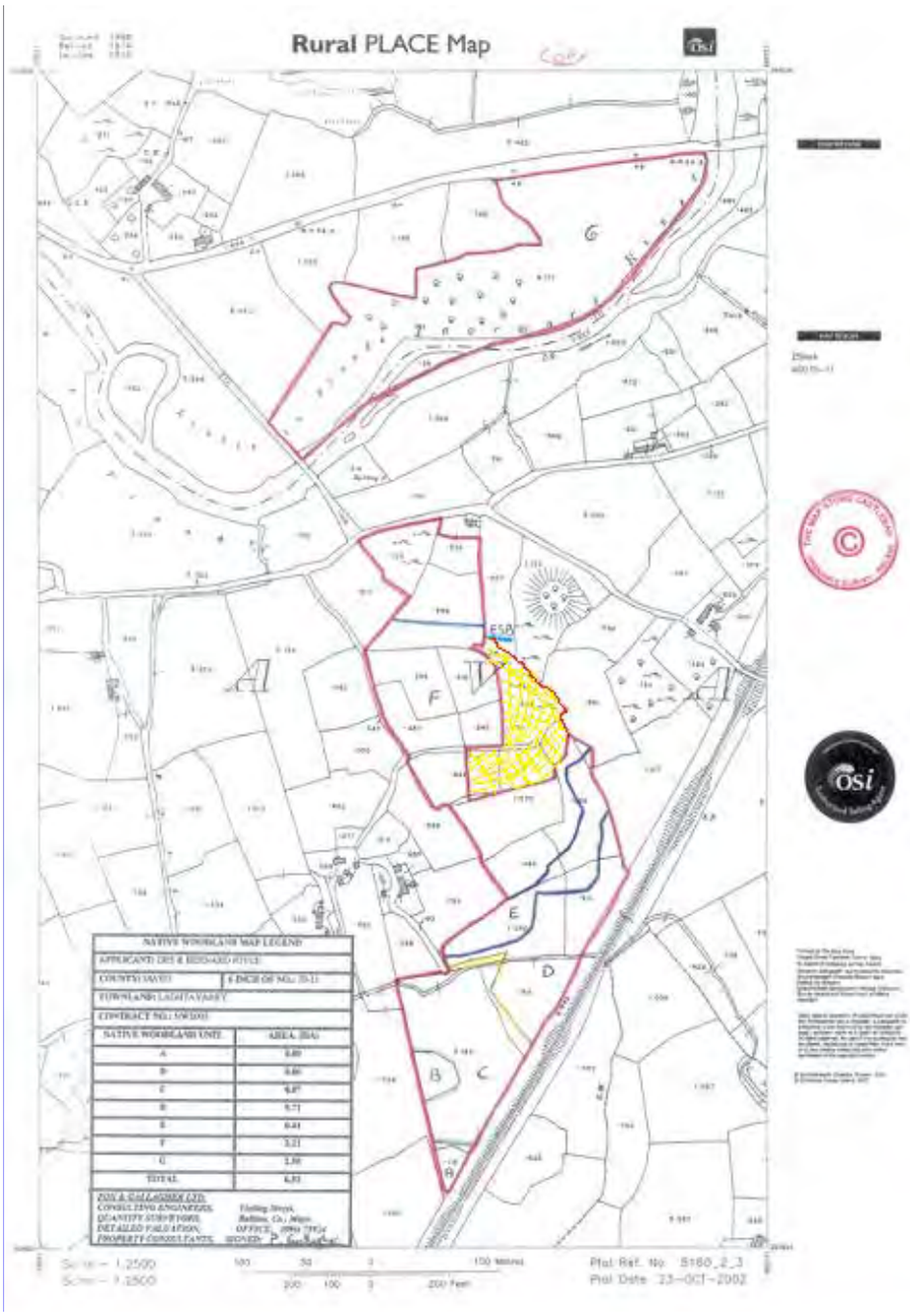
The topography of entire site is mainly drumlin, former floodplain (adjacent the Toormore River which was arterially drained in the 1960s) and localised areas of fen bog. Limestone boulder and gravel lie close to the surface and soils are shallow to moderately deep fertile brown earths. In localised areas, inter-drumlin soils with very poor drainage occur, i.e. gley brown earths and fen peat. Fen peat is also found in the riparian zone adjacent to the Toormore River.

The primary objective of NWS Establishment on the site is to expand the existing woodland onto the adjacent grassland, with the woodland types promoted reflecting site conditions, especially soils and proximity to an aquatic zone, i.e. the Toormore River (Fig. 10). Habitats and biodiversity features retained included calcareous grassland, wet meadow, fen bog, blackthorn scrub, hedgerows and dry stonewalls. Novel interventions included drystone wall repair and hedge-laying, applied both separately and in-combination along sections of the site perimeter.

Based on an ecological survey of wood and non-wood habitats, it was decided to plant primarily:

FH3 Hazel-wood sorrel *(Corylus avellana-Oxalis acetosella)* woodland, which equates to B2. Oak-ash-hazel woodland under the previous NWS classification system (Cross et al., 2010), with some variation (in the form of downy birch and common alder) in areas subject to temporary inundation or water-logging in winter; and

Fig. 11: Site map and NWS Establishment plots, Ballyvary, Co. Mayo. The area marked yellow is NWS Conservation and those bounded in red are NWS Establishment. The area north of the river (in northern section) was planted to represent AF1 woodland while all other NWS Establishment plots are FH3 woodland (similar to NWS Conservation area).



AF1 Ash-remote sedge *(Fraxinus excelsior Carex remota)* woodland, which equates to E3. Wet ash-alder remote sedge woodland (Cross et al., 2010), in areas of calcareous soils subject to winter flooding. In keeping with the owner's objectives (which include the overriding objective of enhancing biodiversity), silvicultural objectives include the expansion of the existing woodland under coppice (restored under NWS Conservation) and some additional wood production of ash, birch and alder sawlog. The woodland will also develop into a valuable local fuel wood resource, a wildlife refuge and a major component in plans for eco-tourism and craft training.

PLANNING & MANAGEMENT

The application of NWS Conservation (0.5 ha in 2001) and NWS Establishment (6.9 ha in 2003) at Ballyvary has been successfully achieved, and active management is ongoing to realise the wood production potential envisaged on this predominantly fertile site. The species planted reflect the appropriate woodland types, i.e. pendunculate oak, ash and hazel woodland on free-draining brown earths, with downy birch and alder (i.e. wet / riparian woodland, on poorly-drained mineral and organic soils and in the riparian zone adjacent to the Toormore River. In 2014, a 10-year management plan was developed (Seery & Gowran, 2014), with a strong focus on wood production, primarily through hazel coppicing (Table 1). Silvicultural objectives include the expansion of the area under hazel coppice (originally restored under NWS Conservation) and the creation of hazel coupes which will be harvested from Year 10, in the two small adjacent fields. The intention is to enlarge the coppice coupe size to between 0.2 ha and 0.5 ha, and realise ten coppice coupes to be harvested for craft and fuelwood on 8 to 16-year rotations.

FUTURE MANAGEMENT

Ballyvary is a very successful NWS project and demonstrates what can be achieved under both elements of the NWS on the same site. It has varied, multiple objectives, especially biodiversity enhancement, wood production and the protection of water quality / aquatic ecosystems, and has considerable potential for ecotourism and woodland training. The challenge will be to continue the implementation of silvicultural interventions over the medium and long term to maximise the woodland's potential, particularly in relation to hazel coppicing. A balance between hazel coppice production and the retention of other native trees and shrubs that become established is required to maintain and enhance biodiversity objectives. There is also the potential for birch and alder sawlog production, subject to the application of respacing and light crown thinning, initially ten to twelve years after establishment and approximately at 5-8 year intervals thereafter. These tasks may be facilitated through an application under the Woodland Improvement Tending & Thinning Scheme (Forest Service, 2015a).

Table 1: The 10-year management plan of the NWS Establishment plots at Ballyvary, Co. Mayo, with a strong emphasis on wood production, primarily hazel with some ash, alder and downy birch.

Management Plan Yr 10 to Yr 20

APPLICANT DETAILS	PLANTATION LOCATION
Name: Bernard and Des Joyce	**Contract No:** CN35330/FO106655Q
Address: 1 Falfadda Ballyvary Castlebar Co. Mayo	**Townland:** Toormore West, Laghtavarry **County:** Mayo **O.S 6"MapNo:** MO70
Contact No: 094 9067080 / 087 2254698	19 AUG 2014

Current Plantation Plot Details*

Plot	Area Ha	Land Use Type	Native Woodland Type	Species	Species Canopy %	Mixture Type	Planting Year	Est. Yield Class	Avg Height (m)	Estimated Year of First Thinning/ Respacing	Excl Area	Excl Type
1	2.58	BHF	WN2/FH	ALD	30%	G	2003	8	8	10	-	-
		BHF	WN2/FH	ASH	20%	G	2003	8	8	10		
		BHF	WN2/FH	HAZ	20%	G	2003	6	5	10		
		BHF	WN2/FH	BI	20%	G	2003	8	8	10		
		BHF	WN2/FH	HAW	10%	I	2003	6	5	10		
2	2.21	BHF	WN2/FH	HAZ	50%	I	2003	6	5	10		
		BHF	WN2/FH	ASH	10%	G	2003	8	6	10		
		BHF	WN2/FH	BI	20%	G	2003	8	8	10		
		BHF	WN2/FH	HAW	10%	I	2003	6	5	10		
		BHF	WN2/FH	B.TH	10%	I	2003	6	5	10		
3	0.71	BHF	WN2/FH	ALD	20%	G	2003	8	8	10		
		BHF	WN2/FH	BI	40%	G	2003	8	8	10		
		BHF	WN2/FH	HAZ	20%	G	2003	6	5	10		
		BHF	WN2/FH	HAW	10%	I	2003	6	5	10		
		BHF	WN2/FH	WILL	10%	I	2003	8	6	10		
BC DE	1.43	BIO	-	-	100%	-	2003	-				
Tot.	6.93										-	-

* In order to update the above details all plots must be accessible in the plantation. Access to all plots will facilitate future management and Department inspections. The above plot details and plot boundaries on the current certified species map must accurately reflect the forest on the ground.

Current Certified Species Map

Revised map dated and signed by forester ☐

No revisions required ☒

Inspection Paths

Present every ~100m ☐

Existing access adequate ☑

Harvesting Road Present

Yes ☐

No ☑

Road required for harvesting ☐

Fire Plan Map Attached

Yes ☐

No ☑

CONCLUSIONS

The results arising from the expansion and management of native woodland at Ballyvary are very encouraging for other landowners on similar site types. There is a mosaic of woodland and non-woodland habits, protective woodland along the Toormore River and working woodland coupes where quality wood is currently being produced now, and in future. Although the soils are shallow, they are very fertile and growth rates of the newly-planted birch and alder, originally planted for biodiversity enhancement only, are particularly impressive. The top height of these stands is ca. 6–8 m, with excellent form and vigour throughout (Fig. 13). Indeed, the growth rates of both species is such that these stands should almost certainly have been thinned before now in order to ensure optimum volume at the end of the rotation. Nonetheless, there is still sufficient choice and quality to ensure that there will be an excellent final crop at year 35-40 using CCF. It is also notable that the planting material for the birch and alder was not derived from approved seed stands with respect to wood quality, but instead, was 'source identified' material (as permitted under the NWS). This suggests that future native provenance birch and alder derived from approved seed stands and planted under the NWS will have appreciable wood production potential if managed appropriately.

The rejuvenated, existing hazel coupes (under NWS Conservation) along with the newly-created hazel coupes (under NWS Establishment) are producing quality hazel poles. Furthermore, the biodiversity assemblages that are developing with regular coppicing interventions will reflect

Fig. 13: A view of the a birch stand planted in 2003 at Ballyvary, Co. Mayo under NWS Establishment derived from 'source identified' native provenance seed. Note the relatively good quality and vigour of many of the trees.

the resulting environmental regime, i.e. the cycle of light exposure followed by gradually canopy closure and subsequent reopening, sequencially in both time and space across the site.

It is recommended that the 10-year management plan (Seery & Gowran, 2014) be dovetailed with the original Ecological Survey / Management Plan (Gowran & O'Reilly, 2001) and extended to include a planning horizon of 50 years plus. In addition, a full timber inventory, including tree diameter, basal area, top and timber height, should be derived for the birch and alder stands. The monitoring of vegetation change in areas with and without wood production objectives within the hazel, birch and alder stands would also provide useful data on woodland development, succession and biodiversity dynamics.

Case Study 5: Delphi Lodge Estate, Leenane, Co. Galway (NWS Establishment)

Visited: May 25th, 2017

BACKGROUND

The Bundorragha River and catchment is located in south-west Co. Mayo, just over the Galway/Mayo border near Leenane village. It supports perhaps the most sustainable population of Freshwater Pearl Mussel (FPM) in Ireland. This species is highly endangered throughout its range in Europe, including Ireland. A bivalve mollusc, it has very exacting requirements regarding water quality. This consideration largely dictates landuse management in the catchment. A considerable portion of the catchment, including the Bundorragha River, two lakes (Finlough and Doolough) and important feeder/nursery streams, including the Glenumera, form the nucleus of the Delphi Lodge Estate, within the case study area (Fig. 14).

Unlike most other FPM populations in Ireland and elsewhere, this population is considered to be viable in terms of its reproductive capacity and recruitment, if water quality can be maintained and enhanced. The catchment also supports commercial angling, and Atlantic salmon are ranched annually to supplement local stocks. To this end, a salmon hatchery is located within the Delphi Lodge Estate.

The primary land uses in this catchment are sheep farming, conifer forestry and recreation (i.e. the Delphi Adventure Centre is located adjacent to the Delphi Lodge Estate). Sheep numbers have reduced considerably in recent years and mitigation measures are planned regarding the existing conifer plantations and areas that underwent clearfell in recent years. Nonetheless, ongoing water quality monitoring indicate that protective measures are required to maintain and improve water quality if FPM populations are to be viable in the future.

In 2012, a NWS Establishment application was instigated after intensive consultations, initially between the estate owners through their Manager, and Woodlands of Ireland, and latterly with the NPWS, the Forest Service and Inland Fisheries Ireland. As the catchment is one of the priority 8 FPM catchments in Ireland and lies within the Mweelrea / Sheefry / Errif Complex Special Area of Conservation (SAC no. 001932), a Natura Impact Statement (NIS) was sought by NPWS and carried out on behalf of the applicants (O'Donoghue, 2012). Consultation with relevant statutory agencies, including Mayo County Council, also took place, prior to submission and subsequent approval of the NWS Establishment application by the Forest Service (Standish, 2013).

OBJECTIVES

The owners are very keen to maintain and enhance water quality, and their key objective in applying NWS Establishment is to create as much protective native riparian woodland along the river corridor and lake margins as is feasibly possible. This would effectively limit the entry of sediment and nutrients - derived from other land uses elsewhere in the catchment - into the aquatic zones.

In 2013, 19.7 ha of the Delphi Lodge Estate, primarily comprising plots adjacent to the main river channel and a major tributary, the Glenumera River, was approved and afforested under NWS Establishment with native riparian woodland (Standish, 2013). This resulted in the creation of generous, permanent semi-natural woodland buffer zones on land previously utilised for sheep grazing (Fig. 15).

Fig. 14: The Bundorragha catchment, Co. Mayo with areas of new native woodland (marked red) planted under NWS Establishment.

Soils in the riparian zones of the NWS Establishment plots are mostly peaty gleys (with localised peats and peaty podzols with increasing distance from the aquatic zones, and increasing elevation). Based on the climatic, site and soil factors described above, three native woodland types were identified for promotion on the site.

The main woodland type established was alluvial woodland, i.e.

SU Almond willow-nettle *(Salix triandra-Urtica)*, which equates to D. Willow woodlands alongside river channels (gallery or riparian woodland under under the previous NWS classification system (Cross et al., 2010).

Also promoted were smaller areas of:

AF1 Ash-remote sedge (*Fraxinus excelsior-Carex remota*) woodland, which equates to E3 (Cross et al., 2010). Ash-alder-remote sedge woodland; and

BM2 Bilberry-woodrush *(Vacciumium myrtillus-Luzula sylvatica)* woodland, which equates to F1. Dry birch woodlands (Cross et al., 2010).

Under the current NWS Framework (Forest Service, 2015a), these woodlands were established under Scenario 4 adjacent to the aquatic zones and Scenario 1 on the slopes distant from the aquatic zones and at higher elevation. The principle species planted were downy birch, grey willow, common alder, targeted in areas earmarked as SU and AF1 woodland. On the drier margins where BM2 woodland applied, rowan, sessile oak and Scots pine were planted (Fig. 17 & Table 2). The NIS identified key habitats to be retained

Fig. 15: A view of a recently-planted AF1 woodland dominated by common alder adjacent to the Glenumera River, in the Bundorragha catchment, Co. Mayo.

unplanted and features to be protected during establishment operations, including blanket bog and potential otter holts (O'Donoghue, 2012).

At the time of the visit in May 2017, the new woodlands planted had established reasonably well. Some follow-up filling-in was required as the site was planted in June 2015 during a prolonged dry, hot spell of weather, which resulted in some tree mortality, particulary on slopes.

FUTURE MANAGEMENT

A follow-up survey of the Delphi Lodge Estate was carried out by Woodlands of Ireland in 2015 (Little & Cross, 2015), and further areas were identified as been potentially suitable under NWS Establishment under Scenario 5A (Forest Service, 2015a). However, the marginal nature of the site and its exposure to relatively harsh climatic conditions (particularly regular and strong wind events) has underlined the appropriateness of the policy to date to establish relatively small areas of native woodland and to monitor their success on an ongoing basis. In addition, the catchment is highly sensitive and it is important not to impose too many operations on it over a very short time frame, in order to mitigate against any risk to water and consequently, to the FPM population (Fig. 16).

During follow-up visits, a potential application under NWS Conservation was identified, involving three separate areas of existing old woodland totalling ca. 25 ha in area (Little & Cross, 2015). The focus of any restoration works would be on rhododendron control, the removal of regenerating Beech, and native woodland renewal / enrichment.

CONCLUSIONS

The establishment of native woodland in this catchment posed considerable challenges for the owner and the NWS Forester. As extensive consultations were required with a range of public bodies (i.e. NPWS, Mayo County Council and Inland Fisheries Ireland) to safeguard biodiversity and landscape attributes, the processing of this application (including the production of the NIS) took a considerable amount of time. This resulted in final approval arriving after the early planting season was over, and pit planting occurred subsequently in summer using plants

Fig. 16: A densely-packed bed of freshwater pearl mussels located in the neck of a deep pool on the Bundorragha River, Co. Mayo.

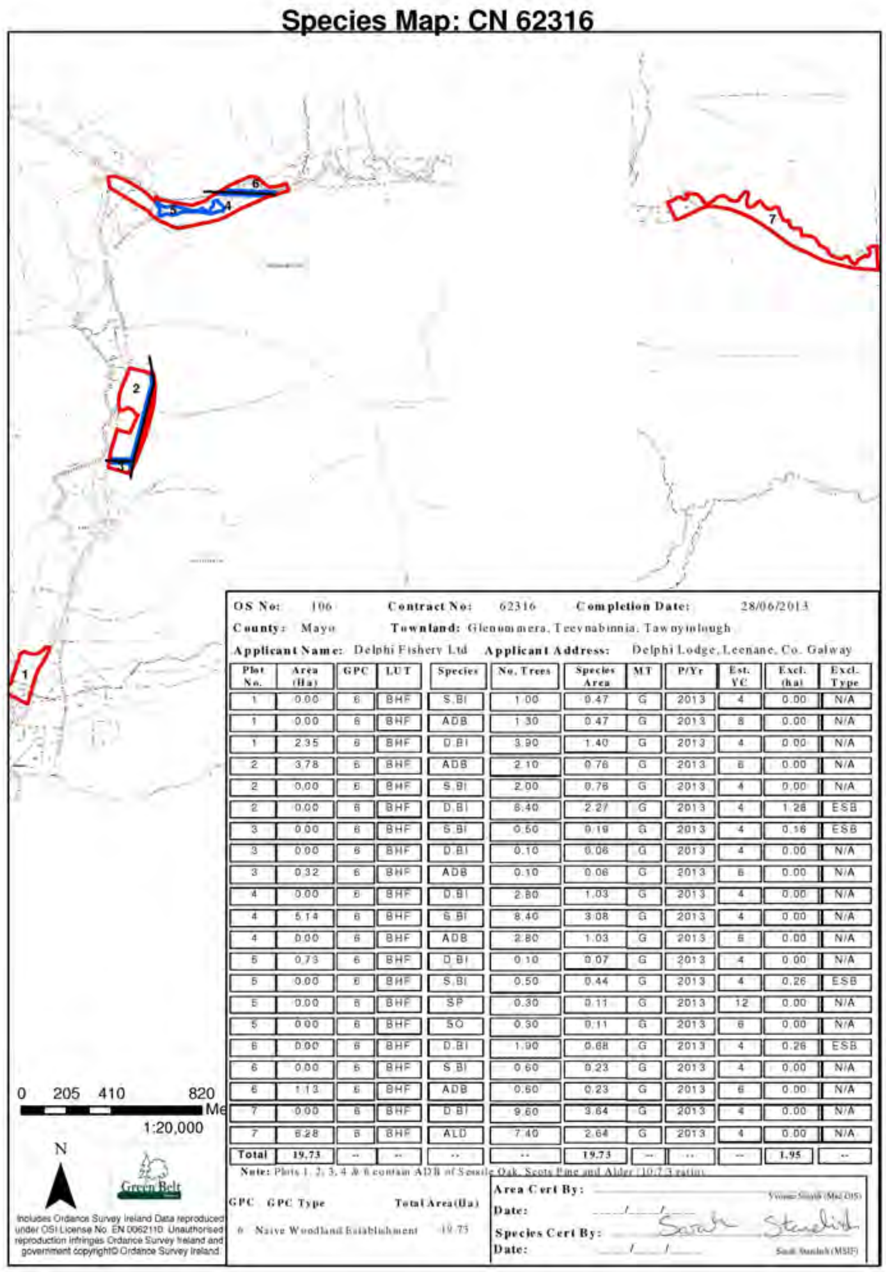
from cold storage (Fig. 17 & Table 2). The weather was hot and dry both during and after planting. Nonetheless, the planted areas have in the main, established reasonably well, especially in riparian areas which are typically wet even in dry summers. These new native woodlands should begin to provide envisaged water-related ecosystem services in a few short years, such as the protection to water quality from potential sources of sediment and nutrients, and the stabilisation of vulnerable banks and the prevention of erosion during flood events in this very spatey catchment.

Vigilance regarding incursions by sheep is required and regular inspection of fence lines around the planted areas is necessary. More time is required to ascertain if these woodlands become fully established, although current evidence suggests they should succeed.

In addition, some of the conditions arising from the NIS were very restrictive from a practical perspective, particularly those relating to vegetation management. While it is imperative to protect species and habitats for which the Natura sites were designated, a review of the need for a NIS for NWS operations is recommended, especially as the cost of the NIS is borne by the landowner / applicant (in addition to the costs of developing the NWS Conservation Form 1 /Native Woodland Plan). For many landowners, these costs represent a significant risk, if their application is turned down and / or if conditions arising from the NIS are so restrictive that they compromise establishment and management. As a result some applicants do not proceed with their NWS applications.

As the appropriate management of these areas is in the national interest, Government agencies should promote, assist and support preliminary measures required to ensure successful native woodland establishment and management. This should also include

Fig. 17 & Table 2: The species map and plots planted under NWS Establishment in the Bundorragha catchment, Co. Mayo.



OS No: 106 **Contract No:** 62316 **Completion Date:** 28/06/2013

County: Mayo **Townland:** Glenummera, Teevnabinnia, Tawnyinlough

Applicant Name: Delphi Fishery Ltd **Applicant Address:** Delphi Lodge, Leenane, Co. Galway

Plot No.	Area (Ha)	GPC	LUT	Species	No. Trees	Species Area	MT	P/Yr	Est. YC	Excl. (ha)	Excl. Type
1	0.00	6	BHF	S.BI	1.00	0.47	G	2013	4	0.00	N/A
1	0.00	6	BHF	ADB	1.30	0.47	G	2013	8	0.00	N/A
1	2.35	6	BHF	D.BI	3.90	1.40	G	2013	4	0.00	N/A
2	3.78	6	BHF	ADB	2.10	0.76	G	2013	6	0.00	N/A
2	0.00	6	BHF	S.BI	2.00	0.76	G	2013	4	0.00	N/A
2	0.00	6	BHF	D.BI	6.40	2.27	G	2013	4	1.28	ESB
3	0.00	6	BHF	S.BI	0.50	0.19	G	2013	4	0.16	ESB
3	0.00	6	BHF	D.BI	0.10	0.06	G	2013	4	0.00	N/A
3	0.32	6	BHF	ADB	0.10	0.06	G	2013	6	0.00	N/A
4	0.00	6	BHF	D.BI	2.80	1.03	G	2013	4	0.00	N/A
4	5.14	6	BHF	S.BI	8.40	3.08	G	2013	4	0.00	N/A
4	0.00	6	BHF	ADB	2.80	1.03	G	2013	6	0.00	N/A
5	0.73	6	BHF	D.BI	0.10	0.07	G	2013	4	0.00	N/A
5	0.00	6	BHF	S.BI	0.50	0.44	G	2013	4	0.26	ESB
5	0.00	6	BHF	SP	0.30	0.11	G	2013	12	0.00	N/A
5	0.00	6	BHF	SO	0.30	0.11	G	2013	6	0.00	N/A
6	0.00	6	BHF	D.BI	1.90	0.68	G	2013	4	0.26	ESB
6	0.00	6	BHF	S.BI	0.60	0.23	G	2013	4	0.00	N/A
6	1.13	6	BHF	ADB	0.60	0.23	G	2013	6	0.00	N/A
7	0.00	6	BHF	D.BI	9.60	3.64	G	2013	4	0.00	N/A
7	6.28	6	BHF	ALD	7.40	2.64	G	2013	4	0.00	N/A
Total	**19.73**	--	--	--	--	**19.73**	--	--	--	**1.95**	--

Note: Plots 1, 2, 3, 4 & 6 contain ADB of Sessile Oak, Scots Pine and Alder (10:7:3 ratio)

GPC	GPC Type	Total Area (Ha)
6	Naive Woodland Establishment	19.73

Area Cert By: ____

Date: __/__/__

Species Cert By: Sarah Standish

Date: __/__/__

the provision of financial support for additional surveys such as NISs.

If it can be demonstrated that new native woodland can be successfully established, particularly within riparian zones, NWS Establishment should be promoted to other landowners here and in other FPM and water-sensitive catchments.

Overall conclusions

The purpose of this exercise was to assess how sites managed under NWS Conservation and Establishment have fared since management was applied to them. In particular, pertinent questions such as;

- Were the objectives outlined at the outset achieved?
- As the capital phase of the NWS is now over, i.e. after 5 years, what are the ongoing management issues that require addressing?
- Are there other objectives that were not envisaged at the outset, such as wood production on marginal sites, that are worth considering now and in future?
- How can the NWS and other Forest Service schemes be tweaked to address ongoing management issues?
- Can the lessons learned be applied to other areas nationally?

It is evident that at virtually all sites the objectives outlined at the outset have been achieved, especially those relating to the achievement of fully stocked, vibrant native woodland communities, the removal and control of non-native and invasive exotic species and the protection of woodland from excessive grazing pressure from deer and livestock. Therefore, the over-riding biodiversity objective has been attained. The exception would be Case Study No. 3 where the very large woodland area was deer-fenced and deer found access due to vandalism of the fence and weak points which were impossible to police.

- It is evident from observations made at sites where deer fencing is effective, i.e. Case Study No. 2, the total maximum area to be fenced under NWS projects in future should be reduced and other measures such as deer management, regular population assessments, culling, and the use of internal exclosures and tubes are required.
- Under the current NWS format, a limit of twelve hectares is applicable to NWS Conservation applications per annum but this will be reviewed periodically.
- Ongoing issues that arise after the NWS capital grant expires include the ongoing control of exotic and invasive species. To date, veteran naturalised trees such as beech and sycamore have been retained for biodiversity and cultural values.
- Invasive species such as rhododendron and cherry laurel may be controlled under a follow up NWS Conservation application 15 years after the original NWS has elapsed
- In large NWS Conservation woodland area applications, i.e. > 12 ha, where there are stands of beech and sycamore, consideration should be given to managing these under the WIS in conjunction with the NWS in surrounding woodland dominated by native woodland
- Clearly the future management plans of some sites should be flexible enough to adapt to opportunities not envisaged at the outset, e.g. the birch and alder stands at Case Study No. 4. Even on marginal, upland sites (Case Study No. 2) and woodlands of high conservation value (Case Study No. 1), there is considerable wood production potential, especially birch, alder and Scots pine. This can be achieved under CCF/close-to-nature silviculture, and almost certainly without any or no adverse impact on biodiversity attributes.
- NWS Establishment projects should be closely assessed within the first 10 years of planting and where form, vigour and quality attributes are sufficiently promising, management plans should be revised - complete with thinning schedule and costs -to address wood production objectives. This can be pursued by applying for the WIS Tending and Thinning grant.
- As pioneer species show the greatest potential with respect to wood production potential, it is imperative that thinning and re-spacing occurs between 10 and 15 years of age and should be applicable to the WIS Tending and Thinning grant and for subsequent thinning operations
- An important key lesson is the application of valuable non-timber functions that the NWS can deliver, especially in areas of the highest sensitivity and biodiversity value (Case Study No. 5). The NWS can be used to protect water quality, instream species (FPM and salmonids), stabilise riverbanks, moderate instream temperatures (shade) and provide food and litter for the benefit of instream fish and invertebrates. In the past, too much focus was placed on timber benefits only. However the NWS can address important natural capital, non-timber, multifunctional forestry ecosystem services when applied carefully and in consultation with the key stakeholders involved. More effort is required to ensure that the statutory agencies work more efficiently together to ensure successful outcomes, especially as these projects are dependent on the involvement, patience and goodwill of private landowners in most cases.
- Another key lesson learned is that quality wood production is feasible in native woodlands and that the forest sector needs to adapt accordingly. This requires training of CCF principles at forest level, the adaptation of sawmills to process the resultant timber, the development of markets for indigenous wood and innovation to develop down stream products.

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Appendix 1: Site, soil, vegetation and timber mensuration data, from case study 1, Deputy's Pass, Glenealy, Co. Wicklow.

Fig. 1.:Schematic outline and data of soil survey and vegetation plots at Deputy's Pass, Co. Wicklow.

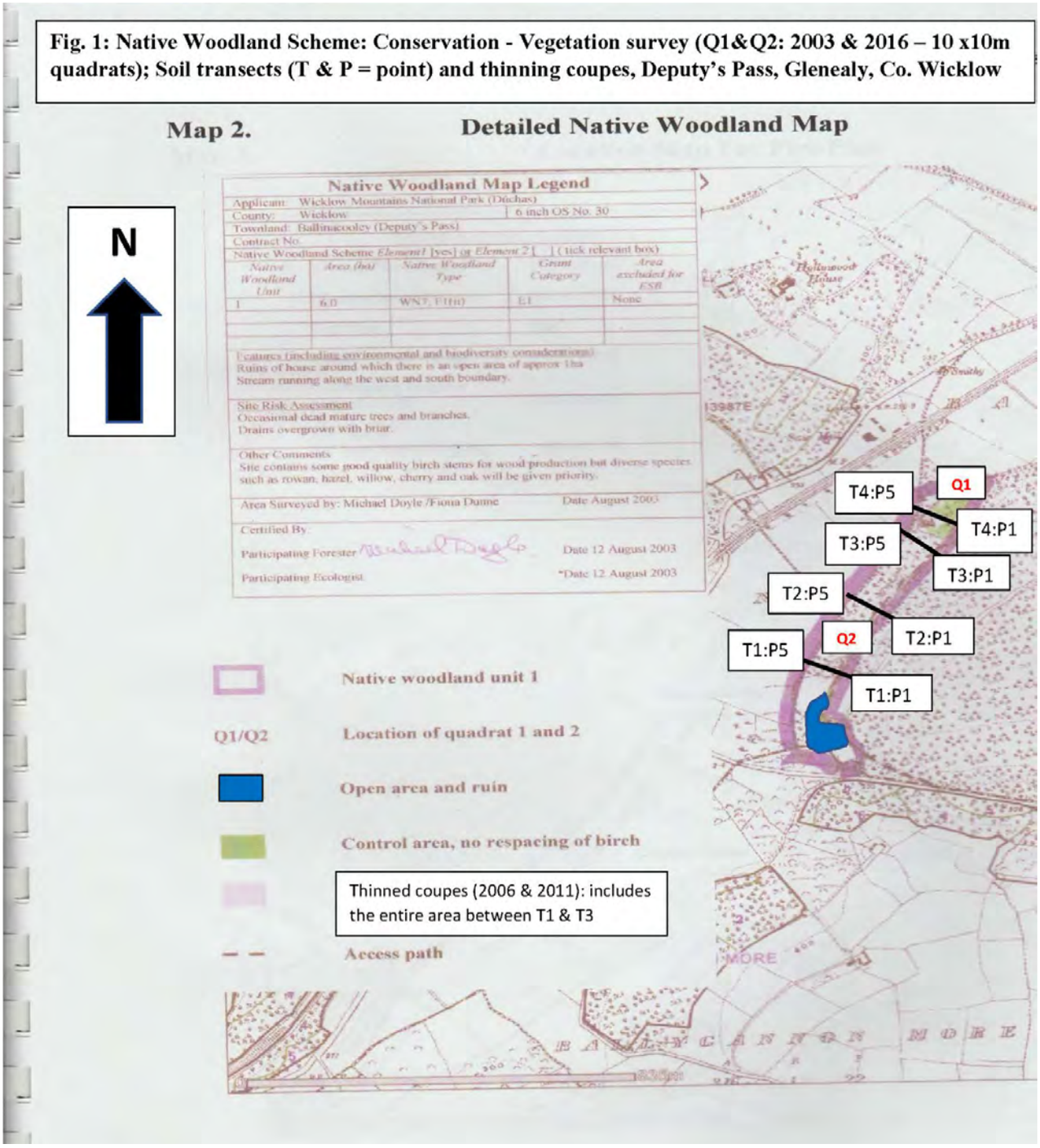

Table 1: Soil survey data, Deputy's Pass, Glenealy, Co. Wicklow

Table 1: An example of soil profile data from Transect 1, points (P) 1-5, from the unthinned birch stand, Deputy's pass, Glenealy, Co. Wicklow.

•	•	•	•	•
P1	**P2**	**P3**	**P4**	**P5**
Stagnohumic Gley	**Ditto**	**Ditto**	**Ditto**	**Ditto**
Moist/wet	Wetter	Very wet	Very wet	Saturated
O = 10cm	O = 5cm	O = 3cm	O/A = 7cm	O/A = 5cm
A = 15cm	A = 8cm	A = 5cm		
B1g = 20cm	B1g = 30cm	B1g = 35cm	B1g = 40cm	B1g = 45cm
B/C = 20+cm	B/C = 20+cm	B/C = 20+cm	B/C = 15+cm	B/C = 15+cm

The site is typically characterised by soils derived from shale and are base poor. Additional nutrients are provided via alluvium in the floodplain and hence, soils tend to be more nutrient-rich as one approaches the aquatic zone. The fluctuating water table throughout the birch stand is likely to restrict the diversity of native trees and shrubs to those that can tolerate soil wetness, i.e. birch, willow, alder and ash. As one moves away from the aquatic zone upslope toward the access track with increasing soil drainage, more diversity will occur in time as is evident from the vegetation and soil transect survey data.

Soil Transects: Notes

1. Five points at ca. 5m intervals were sampled, i.e. Transect 1 Point 1 to Point 5 (T1: P1 to P5), with P1 at eastern and P5 at western extremities of transects.
2. The site slopes gradually from ESE to WSW (0 – 5 degrees) and also from NNE to SSW (10 – 15 degrees).
3. There is increasing soil wetness/gleying from sampling points P1 to P5 on all transects, i.e. from the outer edge of the riparian zone to the aquatic zone, i.e. the Potters river.
4. Because of the slope from SSW to NNE, the outside edge of transect 4 (T4: P1) which is elevated, is characterised by a free draining iron podzol.
5. The dominant soil type is a silty Stagnohumic gley influenced by alluvium and a fluctuating water table. Drains (ca. at 15m intervals) were dug in the 1960s when Sitka spruce was established - the site is dry in summer and wet in winter.
6. Soil structure is moderate to good in topsoil (0-15cm) but very poor with increasing depth thereafter (massive to blocky). Therefore, the site is susceptible to compaction and sensitive harvesting using all-terrain vehicles is required.

Table 2: Timber mensuration data, Deputy's Pass, Glenealy, Co. Wicklow.

Species: Downy birch (*Betula pubescens*).

Planting Year: Natural regeneration 1991/1993 – Native woodland unit dominated by downy birch with holly, rowan, sessile oak and willow in the understorey.

Management: Plots 1 & 2: Respaced in 2006. Light crown thinning 2011. Plot 3: Control/no thinning.

	Birch: Plot 1 Thinned	
	Stems/ha	
Main	Th.	Total
400	550	950
	Basal Area m^2/ha	
12.527	9.130	21.657
	Mean DBH(cms)	
20	14	17
	Vol. (m^3/ha)	
119.6	66.55	195.7

	Birch: Plot 2 Thinned	
	Stems/ha	
Main	Th.	Total
600	850	1450
	Basal Area m^2/ha	
12.780	8.820	21.60
	Mean DBH(cms)	
17	12	14
	Vol. (m^3/ha)	
116.4	68.0	184.4

Birch: Plot 3 Unthinned/control
Stems/ha
Total
2050
Basal Area m^2/ha
21.64
Mean DBH (cms)
12
Vol. (m^3/ha)
164