A NEW DAWN FOR NATIVE WOODLANDS: BRACKLOON WOOD, CO. MAYO - PILOT SITE FOR THE NATIVE WOODLAND SCHEME

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KEY WORDS: oakwood, ecological monitoring and research, conservation, management.

Abstract

Brackloon Wood is an ancient, semi-natural Atlantic oakwood designated as a Special Area of Conservation (SAC) and Natural Heritage Area (NHA). Over the last fifteen years it has been the focus of considerable attention with respect to environmental monitoring, research and management. The information gleaned from all these activities has been used in the development and implementation of the recently adopted Forest Service 'Native Woodland Scheme'.

Long-term forest health and ecological monitoring has been ongoing in the woodland since the early 1990s. Consequently, a considerable amount of ecological, historical and research information has being collated and is the basis for an imminent publication (Cunningham, in press).

In 1996, the owners, Coillte Teoranta, designated the site for biodiversity management and in 1998 applied to the Forest Service to implement a 5-year management plan under the 'Woodland Improvement Scheme'. The scheme was tailored to the nature conservation requirements of the wood in addition to promoting limited wood production using a continuous cover silvicultural system. Some of the research and monitoring data were used in the development of the management plan.

Subsequently, Brackloon became a pilot site for the new 'Native Woodland Scheme' in 1999. Since then close co-operation between the owners, the Forest Service, Woodlands of Ireland, the management consultants, the Forest Ecosystem Research Group at University College Dublin (UCD), the local community and others has contributed to the appropriate management of the wood and the fine tuning of the Native Woodland Scheme which was launched in 2001.

Background

Native woodlands cover no more than 1.5% of the Irish landscape today. It is estimated that native woodland cover was over 80% *c.* 6,000 years ago but that woodlands have declined since then due to human impact - primarily through clearance for agriculture - and climate change, resulting in the spread of blanket bog. The history of Irish woodlands is one of decline, over-exploitation and latterly, neglect (Little, 2002). The resource is currently fragmented and is threatened primarily by overgrazing, invasive exotics and development activities.

In recent years, native woodlands have received a lot of attention through concerted efforts to urgently address their current plight. The dawn of a new millennium presented an opportunity for many concerned individuals and groups to present proposals for a millennium project on native woodlands. The establishment of a body in 1997, namely Woodlands of Ireland, to focus these efforts in partnership with all interested stakeholders, also provided the impetus to develop, not only a millennium project, but other projects designed to secure the future of the native woodland resource.

To date, two major initiatives have been developed -a millennium project entitled 'The People's Millennium Forests project' and the Native Woodland Scheme.

The first of these, managed by Coillte Teo. in partnership with Woodlands of Ireland, the Heritage Council, the Forest Service and National Parks and Wildlife Service (NPWS), has been implemented successfully and was designed primarily to create awareness amongst the general public about native woodlands.

The second initiative, the Native Woodland Scheme (NWS) is currently being implemented by the Forest Service. The NWS provides support to landowners to protect and enhance existing native woodlands and to establish new native woodlands, using 'close-to-nature' silviculture. (Anon., 2001). In 1999, Woodlands of Ireland submitted a draft NWS to the Forest Service. It was further developed and finalised by a technical working group established by the Forest Service, which comprised of woodland ecologists, foresters, contractors, relevant State bodies (i.e. Forest Service, NPWS, Marine Institute, COFORD, Coillte, etc.) and environmental non-Governmental organisations (ENGOs) such as Crann. As there was relatively little experience in native woodland management in Ireland at that time, guidelines of best practise were drawn from the management of woodlands by the NPWS, the Millennium project and experience derived from woodland management in the UK. Management at Brackloon Wood, a pilot site for the scheme, also contributed to this process.

Brackloon Wood – pilot site for the Native Woodland Scheme

Prior to the introduction of the NWS, native woodlands were managed on an *ad hoc* basis, usually in the public sector and especially under the auspices of the NPWS, i.e. woodlands were targeted for management at a regional level as opposed to a national strategy. Until recently, the Forest Service had a selection of forest and woodland schemes but none that were suitable for the ecological and conservation requirements of native woodlands.

The Forest Service 'Woodland Improvement Scheme' (WIS), which was most often applied to old plantation woodlands, was designed to encourage quality wood production in often derelict, unmanaged old woodlands. Though its focus was not primarily nature conservation or ecologically oriented, the scheme did provide a template that could, with considerable adjustments, be tailored to meet the requirements of native woodlands. This is especially the case where the overriding conservation objective of the NWS is augmented with a secondary wood production objective.

The owners of Brackloon Wood, Coillte Teoranta, designated the site for biodiversity management in 1995. It was opportune that the management of the wood also coincided with the development of the NWS. Consequently, it allowed for the WIS management plan to be amended in order to meet the specific ecological requirements of the wood whilst at the same time identifying areas where wood production could be encouraged. In addition, the research and monitoring databases provided useful information in the development of management initiatives.

Research and monitoring input

Brackloon Wood is situated 4 km east of Croagh Patrick mountain and 7 km south-west of Westport, Co. Mayo. It is set in a landscape dominated by rolling topography with frequent rock outcrop, marginal pasture and regenerating, secondary woodland. The wood is classified as Oak-birch-holly semi-natural woodland (WN1) (Fossitt, 2000). It is believed to be 'ancient woodland' (i.e. woodland present since at least 1600) as evidenced from recent palaeoecological investigations (pollen analyses and radiocarbon dating) (von Engelbrechten *et al.,* 2000). Soils are generally shallow, stony, acidic and infertile and are derived from base-poor schists and gneiss. Annual precipitation, at approximately 1700 mm/yr, and a high year-round humidity regime contribute to soil leaching and consequent podzolisation (Little *et al.,* 2001).

As part of a doctoral research project Brackloon Wood was included in a nationwide study of oakwood sites on acid soils in 1990 (Little, 1994; Little *et al*., 1997). This study also undertook to investigate the history of land use and woodland development over the centuries to help understand the development of acid soils, specifically podzols, under the current oak-dominated canopy. Subsequently, the wood was included in the EU forest health programme (EU International Co-operative Programme established under EU Regulation 3528/86) in 1991. The aim of this monitoring is defined as 'intensive monitoring of forest condition aimed at the recognition of factors and processes, with special regard to the impact of air pollutants, on the more common forest ecosystems in Europe'. To this end the chemistry of ecosystem water strata (bulk precipitation, throughfall, stemflow and soil water) are analysed on a weekly to 4-weekly basis, in addition to tree litter and foliage (Boyle *et al.,* 2000). A complimentary tree root survey (and charcoal analyses) was undertaken at that time (Delaney, 1992).

Expansion of monitoring and complementary research studies began in 1996 when Brackloon Wood became the prototype site for a proposed Irish Ecological Monitoring Network (IEMN) (Little *et al.,* 2001). The site was chosen on the basis that it represents a very common woodland type extant in Ireland, is similar to the majority of semi-natural woodlands with respect to human impact, and its consequent 'medium' biodiversity rating, which is almost certainly similar to many of Irelands' remaining ancient woodlands.

Monitoring of flora and fauna using best practise was instigated and generated a considerable data set. These included flora (Fox *et al.,* 2000), birds (Duffy *et al.,* 1999), mammals (Dowling, 1997; Turner, 1998; Reynolds, 1998; Laurent, 1998) soil and surface invertebrates (Gaughran, 1997; McInerney *et al.,* 2000). Nuclear fallout, primarily from Chernobyl, was also assessed (Seymor *et al*., 1999).

In addition, complimentary studies contributed to the interpretation of monitoring data and included a management plan (Daly, 1997), a soil survey (Cummins, 1997), a study of human impact on soil and vegetation dynamics (Ciaurriz, 1997) and palaeoecological investigations (von Engelbrechten *et al.,* 2000). Examination of charcoal in soil and archaeological remains has also contributed to our understanding of past human impact and woodland development (Delaney, 1992; Morahan, 2001).

Results and conclusions of research and monitoring

A number of interesting preliminary conclusions can be drawn from the research and monitoring at Brackloon Wood. The floral survey yielded a number of rare woodland specialists, including wood melic *(Melica uniflora)*. Narrow-leaved helliborine *(Cephalanthera longifolia)* is also present and the lichen known as 'lungwort' or 'elephants ear' *(Lobaria pulmonaria)* is very common. The first Irish record of a lichenicolous species *Pronectria anispora* (a fungus that is parasitic on a lichen) was made during the vegetation survey. In total, the species list comprises 116 vascular plants, 11 ferns, 306 bryophytes and 437 fungi and lichens. The riparian zone between the wood and the Owenwee river, which is continuous wet woodland, is the most diverse zone with respect to flora in the woodland, especially with respect to mosses, liverworts and ferns.

There is a considerable variety of soil types throughout; acid brown earths, brown podzolics, humo-ferric podzols and peaty gleys predominate (Cummins, 1997). The relationship between soil type, topography and woodland plant communities confirmed the preferences of species to specific conditions, especially as there are very acid, moderately acid and waterlogged soils present in an undulating landscape (Ciaurriz, 1997). Soil faunal communities within the wood also vary with soil type, with more earthworm species and populations present in acid brown earth soils compared to brown podzolics, podzols and gleys (McInerney *et al*., 2000).

The mammal surveys identified the roosting sites of bat species and helped elucidate changes in the population dynamics of wood mouse *(Apodemus sylvaticus)* as a result of disturbances such as clearfelling. A large badger *(Meles meles)* population is present as evidenced by an extensive sett with outliers. Though there are few faunal woodland specialists in the wood, the presence of pine marten *(Martes martes)* has been confirmed. Most species of birds are opportunistic generalists, however the presence of the long-eared owl (*Asio otus*) is notable.

Of considerable relevance to management is the conclusion that the wood has been considerably altered over the millennia; evidence for human occupation in the area dates back to the Bronze Age *c.* 3,000 years ago. A large Christian Age ring fort is present within the wood on a hill overlooking the surrounding landscape. A number of charcoal hearths are also present, one of which dates from 400 ± 40 years BP (before present) attesting to a period of sustained felling for a nearby iron furnace at Knappagh (von Engelbrechten *et al.,* 2000).

Human impact has resulted in a reduction in woodland area regionally and a loss of woodland biodiversity. This is confirmed by palaeovegetational analyses from a small hollow and a deep, organic-rich lake/basin within the wood (von Engelbrechten *et al.,* 2000). The resultant pollen diagrams indicate a number successive phases of canopy opening and closure almost certainly attributed to continual human impact. Species present in the past that are absent today include yew *(Taxus bacata)*, aspen *(Populus tremula)*, juniper *(Juniperus communis)* and Scots pine *(Pinus sylvestris)*. Elm *(Ulmus spp.)*, hazel *(Corylus avellana)*, oak *(Quercus spp.)* and ash *(Fraxinus excelsior)* were far more prominent in the past vegetation of Brackloon than they are today. In addition to natural succession resulting in the displacement of these species, their gradual decline may also be as a result of a combination of human activity, climate change and competition. Continual felling resulted in the opening of the canopy with consequent soil leaching and impoverishment. This in turn has affected the composition of floral communities, which almost certainly have become less diverse. Base-demanding species such as elm, ash and to a lesser extent hazel are likely to have been particularly sensitive to this changing soil environment and declined accordingly.

The pattern of exploitation does not however appear to be consistent throughout the wood; some areas appear to have been cleared more often than others as evidenced by the presence of strongly leached podzols and the presence of appreciable charcoal fragments over wide areas. These are interspersed with isolated pockets of moderately fertile acid brown earth and brown podzollic soils, which support more nutrient-demanding species, i.e. ash and hazel are especially prevalent on brown earths. These pockets are most often located on steep and relatively inaccessible slopes. Crucially, all the soils are derived from very similar parent materials as confirmed by mineralogical analyses (Little *et al*., 2001). This leads to the conclusion that variation in soils is primarily due to human impact and topography. By comparison, soils outside the woodland are even more degraded as a result of increased leaching due to the permanent removal of woodland cover and continuous soil exposure (Little, 1994; Little *et al.,* 1997).

Research, monitoring and relevance to management

The moderately rich biodiversity status of the wood as elucidated in the baseline studies and monitoring programmes reinforce the recommendations of a report compiled by the then Forest and Wildlife Service in the early 1970s (Neff, undated). It recommended actively conserving the wood through restoration, mainly through the removal of underplanted conifers and rhododendron. Exotic and naturalised shrub *(Rhododendron ponticum*) and tree species *(*e.g. *Picea sitchensis, Fagus sylvatica* and *Acer pseudoplatanus)* were introduced in recent centuries and these can impact negatively on native woodland biodiversity mainly by displacing floral species by altering light regimes and impacting on soil faunal communities.

The more recent studies provided detailed information, many of which are relevant to current and future management initiatives. The ecological surveys confirmed the presence of species that require specific niches, which can be provided via management, for example, the retention of veteran, hollow trees for bat species and the long-eared owl. The retention of deadwood from the cutting and stacking of naturalised and exotic trees and shrubs will augment faunal communities, especially those involved in the degradation of wood and organic matter.

The research on human impact poses a number of pertinent questions. The implications for current and future management of past human impacts, which resulted in lower biodiversity, a predominantly even-aged stand and the occurrence of leached, degraded acid soils, can be broadly encapsulated into two issues:

- What should management try to achieve with respect to floral composition and woodland structure?

- In severely degraded areas characterised by the presence of humus-iron podzols and the appreciable presence of charcoal, should lime and fertiliser be added to soils under controlled conditions subject to research and monitoring?

The recommendations of the broad-based management plan (Daly, 1998) and the subsequent, detailed WIS management plan (Hawe, 2000), both of which took into account the main research and monitoring outputs, go some way to answering the first question. Their primary recommendations include reconnecting isolated mature oak-dominated stands, the diversification of age and species (native trees and shrubs) and the retention of lying and standing deadwood. However, the relative proportions of trees within newly created woodland blocks are not easy to determine. For example, it is likely that the relative dominance of oak seen today may be as a result management practise over the last 500 years or so. Oak may have been favoured at the expense of other tree species. This implies that newly planted woodland areas need not have such a high proportion of oak. Equally, the predominance of oak in existing old woodland blocks may well decline in future as woodland dynamics re-establishes its own equilibrium.

The second question posed is even more difficult to answer. Approximately 10 ha of the wood are dominated by humo-ferric - and humo-ferric gley podzols with very acid and fibrous peaty topsoils (pH < 4.0). Though mature oak dominates the canopy with holly and birch in the understorey regeneration of trees and shrubs is sparse. Even with a decrease in grazing pressure in recent times, it is too early to ascertain if woodland regeneration is sufficient to sustain woodland communities on these very infertile, acidic soils in the long term. The system is almost certainly continuing to lose vital nutrients, which are already in short supply and nutrient amendments, especially lime–based material, may be required to reverse this process thereby ensuring woodland continuity and viability in these areas. Alternatively, the woodland could be allowed to develop without intervention, which may result in the woodland being succeeded by blanket bog in the long term. Further long term research in these areas is required to assess nutrient budgets and recycling, regeneration potential of a specific range of native trees and shrubs and the costs of alternative management options before finally deciding what management strategy is most suitable.

Management

The management objectives outlined by the management consultants are (a) to restore and conserve the semi-natural status of the entire woodland (b) to ensure the sustainability and longevity of the woodland and (c) to optimise the biodiversity of the wood (Hawe, 2000). In order to achieve these objectives the implementation of the management plan has primarily endeavoured to mimic the composition of WN1 – oak-birch-holly woodland on acid soils (Fossitt, 2000), the predominant woodland type present.

The soil survey of the entire wood (Cummins, 1997) is a very useful management tool with respect to confirming the presence of alternate woodland units/types and the selection of tree and shrub species for enhancement planting. The most suitable sites for the establishment of appropriate woodland units were identified from the soil map. Native tree species, for example, oak, ash and Scot's pine were planted in mixture with the secondary shrub species related to that woodland type, e.g. hazel, rowan and holly (Hawe, 2000). Very wet soils are being allowed to naturally regenerate, which avoids damage to these soils by machinery. Some modifications of woodland type WN1, occur where soils vary and in flushed and/or wet areas where wet woodland types prevail.

The general vegetation, mammal, birds and archaeological surveys, the location of rare flora, faunal roosting, nesting and habitation sites as well as unmapped archaeological remains provides useful information to the management consultants and contractors. Exclusion zones were created and/or extreme caution was exercised when carrying out operations in these areas. Examples include the locations of the narrow-leaved helliborine, badger setts and lazy beds within what appears to be the remains of a ringfort with an accompanying standing stone.

Woodland structure is being diversified by retaining the old, isolated stands of oak-dominated woodland and reconnecting them by removing underplanted and adjacent conifer blocks. The resultant clearfells are being allowed to regenerate naturally and/or are being planted with locally-derived trees and shrubs. This approach will also lead to age and species diversity. In the past five years, replanting and natural regeneration has already made a significant visual impact and will almost certainly enhance avian biodiversity, as well as creating new habitats for fauna and flora. In addition, veteran trees will be allowed to deteriorate and die *in situ* thereby providing habitat for other flora and fauna. This strategy also addresses habitat defragmentation, i.e. planting of oak and other seedlings in areas between outlying oak woodland blocks and the main oak woodland (i.e. an intact area of c. 11 hectares). This operation is designed to reconnect all areas of existing oak-dominated woodland to provide a seamless habitat, essential to the maintenance of biodiversity in that it allows for species mobility. Woodland regeneration as a result of natural regeneration - which allows for natural succession - and enrichment planting generates a minimum of two distinct age and size classes that is designed to promote the longevity and sustainability of the woodland.

Mounding and (shallow) drainage was carried out where enrichment planting was being undertaken on compacted soils. The siting of the silt trap at the outer edge of the riparian zone has allowed for the creation of an irregular pond area with shallow margins to promote aquatic species diversity. Other operations designed to revitalise the woodland have also been carried out, including the removal of exotics, especially rhododendron, and regenerating naturalised trees, especially beech. Cut material has been stacked to supplement the deadwood habitat within the wood. Tall, weak, native trees and shrubs within areas felled of conifers that are liable to break or be windthrown have been cut back to the stump. This will promote more viable coppice shoots less likely to suffer windthrow. Windblown oaks and other native trees and shrubs have been left *in situ* where they are not a threat to public safety. The reduction of grazing pressure has been assisted by the erection of a stock-proof fence around the perimeter of the wood. The impact of grazing on the woodland currently is considered to be minimal with very few herbivores present.

Scots pine, a component of the wood up to *c.* 2,000 years ago, has been planted with a view to limited quality wood production under a continuous cover system. Natural regeneration, particularly of birch and willow, is occurring vigorously in some areas. Some of the birch will be re-spaced in order to encourage the production of quality stems.

Management operations aim to address other aspects of biodiversity. In particular, the expansion of the native gene pool is being achieved by growing locally derived trees at somewhat lower planting densities than specified under WIS. Collections of native tree seed were undertaken locally in similar woodland types, i.e. Oak-birch-holly woodland (WN1), and planted in Brackloon.

Conclusions

Until recently, there were little or no financial resources directed specifically at nature conservation management in semi-natural woodlands. With the advent of the NWS opportunities for management of neglected old woodlands like Brackloon exist. If implemented fully the NWS will protect and enhance the last vestiges of our once extensive native woodland resource. This will protect, enhance and expand woodland biodiversity, thereby ensuring the survival of species that rely heavily or solely on woodland ecosystems.

As Brackloon was a pilot site for the NWS, management differed appreciably compared to what is prescribed under WIS. Trees used for planting did not originate from certified stands - as is specified under WIS - where timber production characteristics are paramount. Planting densities were somewhat lower than prescribed under the WIS, especially as biodiversity was the primary objective. There was considerable focus on minor species such as birch, willow, holly and rowan which primarily were used for biodiversity objectives rather than being a focus for wood production. In addition, WIS management plans are drawn up by a forester only; currently, the NWS plans must be drawn up by a forester and an ecologist to a specific format. The success or otherwise of the practical application of management operations, i.e. natural regeneration, planting mixtures/densities, control methods of competing vegetation and rhododendron, and wood production systems, are and continue to be assessed in order to fine-tune the NWS as it develops.

The management of semi-natural woodlands is a complex issue. Human impact over the millennia makes it difficult to ascertain what specific management operations are required to maintain and enhance biodiversity objectives. Alteration of past woodland composition and ecosystem function result in difficulties with respect to management decisions regarding future woodland composition and species. Though the research and monitoring programmes were not designed specifically with management in mind, the experience at Brackloon shows what can be achieved. Research and monitoring data has provided guidance *vis a vis* the appropriate management of the wood. Equally, difficult questions have arisen that cannot be answered without further investigations and continual monitoring.

It is not recommended that all native woodlands earmarked for management should have a complementary research and monitoring programme as it is both unnecessary and not cost effective. However, in order to address the specific management requirements of each of Ireland's native woodland types, representative sites of high biodiversity value should be selected for a research and monitoring network to complement future management planning. The data produced could contribute toward the appropriate management of similar woodland types elsewhere in Ireland.

Acknowledgements

I would like to thank Jerry Hawe and Prof. Ted Farrell for their comments on earlier drafts of this paper. Considerable credit is due to all involved in the Brackloon project over the years, including Mr Paudie Blighe, Coillte Teoranta, and the local community, FERG, UCD, Sylviron Ltd., Conservation Volunteers Ireland (CVI) and all the researchers who contributed to the project.

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