

RESTORING NATURA FOREST HABITATS



Report of a LIFE-Nature Conference, Fort William, October 2001



Published by Highland Birchwoods. All rights reserved to the publisher and Scottish Natural Heritage (SNH). The contents of this document should not be reproduced in any form without the permission of either the publishers or SNH.

Any enquiries should be addressed to:

Highland Birchwoods, Littleburn, Munloch, Ross & Cromarty IV8 8NN *or*:

Nigel Smith, Scottish Natural Heritage, Caspian House, Mariner Court, Clydebank Business Park, G81 2NR

ISBN 0 19536447 5 8

February 2003

This report should be cited as follows:

Caledonian Partnership (2003) *Restoring Natura Forest Habitats*. Highland Birchwoods, Munloch.

Desktop publishing by footprints; scwf@footprints.sol.co.uk; *telephone: 01808 521368*



Highland Birchwoods is a charitable company (SCO21146), limited by guarantee and registered in Scotland (142892).

Registered office: Redwood, 19 Culduthel Road, Inverness IV2 4AA

Restoring Natura Forest Habitats

Report of a LIFE-Nature Conference

Fort William, October 2001

Acknowledgements:

The Caledonian Partnership — Highland Birchwoods, Scottish Natural Heritage, the Forestry Commission, Forest Enterprise, Countryside Council for Wales, the National Trust, Royal Society for the Protection of Birds and the Centre for Ecology and Hydrology — wish to thank all those who contributed to the success of the *Restoring Natura Forest Habitats* conference and the production of this report. Specifically, all the presenters on the day and those who authored the papers included here; Maurice Pankhurst, of the National Trust, Cumbria, for contributing additional valuable experience from England; the conference participants, without whose input there would be no field event notes; Jack Mackay, Forest Enterprise for recording and compiling the field notes; all the landowners and organisations who hosted the field visits, generously giving of their time and openly contributing their experience. Lastly, but crucially, Shona Maclennan and Stewart Meikle of Solas Business Services for their outstanding organisation of the event.

The UK has been fortunate in its award of LIFE-Nature projects. This publication records reports of activity achieved through two of these projects — The Restoration of Atlantic Oakwoods, and the Wet Woods Restoration Project. Both were delivered through the Caledonian Partnership, who wish to acknowledge the financial support provided by the European Union through the LIFE-Nature programme.

The views expressed in these papers are those of their authors. Members of the Caledonian Partnership do not necessarily endorse any statement or opinion expressed in this report.

Photograph credits: *Front cover; inserts by Colin Legg & Peter Quelch (far right) on a background photograph by Edmund May; page 10, Peter Quelch; page 14, Colin Legg; page 18, John Parrott; pages 28-32, Raimo Heikkilä; pages 39-42, Erik Sandström; pages 50-52, Maurice Pankhurst; page 52, Tim Clifford (bottom two). All other photographs by Rachel Haines, Scottish Natural Heritage. Cover map montages by Ewan Purser, Highland Birchwoods.*



Introduction	3
David Henderson-Howat	
Introduction to Natura 2000 and the role of LIFE-Nature Programme	4
Micheal O’Brian	
The Atlantic Oakwoods. Past Management and Present Condition	10
Peter Quelch	
The status of wooded bogs at Abernethy, Strathspey	12
Colin Legg, Heather McHaffie, Andy Amphlett and Rick Worrell	
Floodplain Woods — A Journey through the Riparian Zone	17
John Parrott	
Oakwood Favourable Condition and Current Management Needs	19
George Peterken and Rick Worrell	
Bog Woodland Restoration in Finland	28
Raimo Heikkälä	
Deer Management Requirements for the delivery of Natura 2000 Objectives in Atlantic Oakwoods	33
Phil Ratcliffe and Brian Staines	
Sweden — Integrating Natura and Community Aspirations	39
Erik Sandström	
Sunart Conservation and Rural Development	43
Michael Foxley	
New LIFE and the way ahead	46
Alistair Sim	
Multi-objective Natura: Conclusions	47
John Markland	
Wet Woods Site Visit	48
Jack Mackay	
Borrowdale Woodland Complex	50
Maurice Pankhurst	



Introduction

David Henderson-Howat, Forestry Commission

National Office of Scotland, Upper Spur (West), 231 Corstorphine Road, Edinburgh EH12 7AT



Abernethy

These proceedings report on a conference, *Restoring Natura Forest Habitats*, held in Fort William, Lochaber, Scotland on 4 & 5 October, 2001. The conference reported on the outputs from two LIFE-Nature funded forest restoration projects: The Restoration of Atlantic Oakwoods and the Wet Woods Restoration Project. The papers in this volume include some which were given at the conference, including PowerPoint presentations, and others which were submitted subsequently. A brief account of the field visit to Strathspey Wet Woods is also given.

Together these two LIFE projects have a financial value of almost five million euros (£3m). The predecessor of these projects was the Caledonian Forest Project; there are another four LIFE projects which have recently been awarded funding. Clearly, the EU input has been a catalyst; equally, things would not have happened if there had not been a tremendous amount of work happening here in Britain, by people who realised the opportunities provided by the EU money and who have developed the vision. These people then had the hard graft of filling in the forms and bringing the partners together.

It is worth saying a word about the Caledonian Partnership; it is, essentially, an informal collection of organisations involved in making the EU LIFE projects work. It includes Highland Birchwoods, Scottish Natural Heritage, Forestry Commission, English Nature, The Countryside

Council for Wales, the National Trust, the Royal Society for the Protection of Birds and the Centre for Ecology and Hydrology.

As well as the people who provided the money, developed the vision and filled in the forms, there are also the people who have actually made things happen on the ground; they have organised the work, enthused the owners and managers of the land, undertaken the hard physical work on the ground and the restoration monitoring. It has been a tremendous collective effort to undertake the work that was reported of the event and viewed on the field visits.

The purpose of the conference and the field visits was to share experiences gained across these two EU LIFE projects and to hear something of the Caledonian Forest Restoration project that seeded them. The projects have contributed to the wider aims of taking Natura 2000 forward in Scotland. There have been some particularly valuable lessons learned about the involvement of local communities in these projects and ensuring that there are local economic benefits. Some of the ground-breaking work that the projects undertook was discussed, as were their economic, environmental and social pillars. This is happened both at the European level and with the Scottish Forestry strategy. The past management and present condition in Natura forests was then looked at, followed by a discussion of favourable condition and current management needs.



Introduction to NATURA 2000 and the role of LIFE-Nature Programme

Micheal O'Briain

Nature & Biodiversity Unit, Environment Directorate General, European Commission,
1049 Brussels, Belgium

The management and restoration of Natura 2000 forests is an issue that concerns all Member States. This conference is therefore a very welcome event as it provides a useful forum to share, among experts and key stakeholders, the experiences of two strategic LIFE-Nature projects for forest conservation and restoration in the United Kingdom. Given the strong partnership approach that has been developed under both projects they will also be of interest to a wider audience both within the UK and throughout Europe.

In this introductory presentation the involvement of the European Union in forest conservation in Europe is outlined. The vision of Natura 2000, especially as regards the management and restoration of forests of high conservation value is described. The implications of designation, for future management of these areas, are explained. Finally, the role and potential of the LIFE-Nature fund as well as other EU financial instruments for the conservation of forests is underlined.

Europe's forests

After a period of long decline, forest cover and timber production is on the increase in the European Union. One third of Europe, a total of 130 million hectares, is forested, of which 65% is privately owned. Much of the recent increase has been in afforestation of former farmland and grassland areas. As a result of the reform of the Common Agricultural Policy which started in 1991, Regulation 2080/92 contributed to a further reforestation area of one million hectares over the past eight years. The current trend of taking agricultural land out of production and using it for forestry, significantly aided by the European Community, is likely to continue into the future. This makes forestry one of the major land use practices in Europe.

Forests offer valuable elements for the environment *per se* (e.g. scenic beauty), important environmental assets (e.g. watersheds, biodiversity) and store more carbon than the atmosphere. Forests protect the environment far beyond their physical range by exerting influence on global climate, regional weather conditions and microclimate in adjacent croplands, as long as they are managed in a sustainable way. Unfortunately, not all forests

are managed sustainably.

Beside the environmental forest functions already mentioned, forests also provide an important contribution to the protection of nature and conservation of biodiversity. In the Dobris+3 report¹, the European Environmental Agency points out the need to reverse the continuing losses of old natural and semi-natural woodlands, loss of forest biodiversity, and losses of forest habitats. This report states that "forest habitats are changing through the intensification of management, increasing uniformity and fragmentation, widespread use of exotic species, introduction or maintenance of animal species for hunting, drainage and air pollution such as acidification and eutrophication."

The Community's role in forestry and biodiversity

The Treaty of the European Communities does not provide for a comprehensive common forestry policy, but the EU, especially through its agriculture and rural development, trade, internal market, research, regional and environment policies, has an important influence on forestry activities in the Member States. The Treaty also calls for a high level of environmental protection. Environmental protection requirements must therefore be integrated into the definition, and implementation, of the other policy areas, with a view to promoting sustainable development.

These environmental requirements include EU legislation for biodiversity and nature conservation directly relevant to forests. The Community is also a signatory to resolutions on the conservation of biodiversity, adopted at the Pan-European ministerial conferences on the protection of forests in Europe. It also has made commitments under the Convention of Biological Diversity relating to forest biodiversity.

The Commission's Communication on a Forestry Strategy for the European Union, as well as its Communication on a European Community Biodiversity Strategy, emphasise the multifunctional roles of Europe's forests and the need for ecological, economic and social sustainability. Sustainable forest management has been defined as "*the stewardship and use of forests and forest lands in a way, and at a*



rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems.”

Natura 2000

There are few natural undisturbed forest areas remaining in the EU and most forests of conservation importance are either planted or have been managed over long periods of time. The principal EU laws for the conservation of forests of high nature value are the Habitats and Birds Directives. These Directives have been adopted unanimously by the Council of Ministers and with the support of the European Parliament. The establishment of Natura 2000 is a key objective of these Directives.

Natura 2000 is the most ambitious undertaking ever at EU level for the conservation of our shared wildlife heritage. It complements measures already being taken at national level to protect wildlife and represents a major collective effort by the Member States in the field of nature protection. It is also fully in line with our international obligations, significantly contributing at Community level to the aims of a range of international nature conventions.

The overall objective is to safeguard biodiversity in the European Union through the establishment of a common framework for the conservation of animal and plant species as well as natural and semi-natural habitats that have been identified as being of Community interest. The aim is to maintain or restore these interests to a favourable conservation status. The main practical mechanism to achieve this objective is the creation of an ecological network called Natura 2000. The importance of Natura 2000 as a main pillar of Community efforts to conserve nature was reinforced by the conclusions of the European Summit in Gothenburg in June 2001, which has set an ambitious target of halting the decline of biodiversity in the Community by the end of this decade. The Habitats Directive has introduced several innovative features:

- It establishes the principle of conserving habitats for their own sake and not only because they host rare or threatened species
- It introduces a ‘Biogeographical Region’ approach which allows for more meaningful comparison between Member States with similar biodiversity
- It provides for a strong level of protection for sites in Natura 2000 with proactive (positive management), preventive and procedural (dealing with plans and projects) safeguards.

Establishment of the Natura 2000 network involves the close co-operation and co-responsibility between the Commission and the Member States. The main forum for exchange is the Habitats Committee, comprised of officials from the competent national nature authorities and chaired by the Commission. The Habitats Committee is aided by a scientific working group, which advises on technical issues. The overall aim is to ensure a common approach, especially as regards scientific and legal interpretative issues.

Natura 2000: conserving forests of high conservation value

Forest habitat types of European conservation interest, 59 of them, are listed under the ‘Forest category’ of Annex I of the Habitats Directive. Of these, 42% are of priority interest under the Directive because they are considered among the most threatened habitat types for which the EU has a particular global responsibility. These include several types in the United Kingdom such as ‘residual alluvial forests,’ ‘bog woodland’ and ‘Caledonian Forest’.

The Annex I forest habitat types correspond to ‘(sub)-natural woodland vegetation comprising native species forming forests of tall trees, with typical undergrowth and meeting the following criteria: rare or residual, and/or hosting species of Community interest’.

Member States are required to designate Special Areas of Conservation (SACs) for each of these habitat types, which cover a very wide range of naturally occurring forest types in the EU and are grouped in the following categories:

- Forests of boreal Europe
- Forests of temperate Europe
- Mediterranean deciduous forests
- Mediterranean *Sclerophyllous* forests
- Temperate mountainous conifer forests
- Mediterranean & Macronesian mountainous conifer forests

The categories that contain the largest number of forest habitat types are the ‘forests of temperate Europe’ and the ‘Mediterranean deciduous forests’. The Habitats Directive also lists species of European conservation interest, dependent on forest habitats, which require SAC designation (e.g. flying squirrel, brown bear). Similarly, there is a requirement to classify Special Protection Areas (SPAs) for endangered and migratory bird species (e.g. white-backed woodpecker, capercaillie). The site conservation objectives of the Habitats and Birds Directives need to be complemented by wider countryside measures.



Progress in establishing Natura 2000

The establishment of Natura 2000 involves three stages. On the basis of scientific criteria Member States were to propose a list of national sites within three years of adoption of the Directive (by June 1995). For each of the Biogeographic Regions of the European Union, the Commission and the Member States were to agree a Community list of sites by June 1998. Then Member States would have a further six years to designate all the agreed sites as SACs and establish the necessary measures for their conservation.

However, putting Natura 2000 in place has proved to be much more difficult than originally foreseen. Some of this variable progress appears to have been linked to the need for extensive consultation in Member States. Due to the late and incomplete transmission of national lists by the Member States it has not yet been possible to complete the second stage for any of the Biogeographic Regions.²

Given the serious delays, which threatened to undermine the whole process, the Commission, as custodian of the Treaty, has had to take legal action against a number of countries for their failure to fulfil their legal obligations. In September 2001, France, Germany and Ireland were condemned for having failed to provide complete lists of sites.

As a precautionary measure, the Commission has also threatened to block Community-funded programmes that could be used to cause irreparable damage to sites which should be protected under Natura 2000. It informed Member States that they risked delays in the approval of Rural and Regional Development Programmes, unless their lists of Natura 2000 sites were substantially complete.

The initiation by the Commission of a number of legal actions before the court, and also the link it established between the approval of certain Structural Fund programmes and the submission of site lists, has contributed significantly to this recent progress.

There has been significant progress in the past few years and more than 14,000 sites, covering an area equivalent to 14% of the Community's territory (an area larger than Germany), have now been proposed by the Member States. However, there are still some significant differences between Member States in the area of sites that has been proposed.³

Progress on forest Natura 2000 sites

For the purpose of this progress evaluation, a forest site is an area including some surface

covered by forests, comprising the 59 forest habitat types of Annex I of the Habitats Directive. There is incomplete data for Member States, especially for Germany, to allow a thorough analysis of the proposals, but based on a database of approximately 10,000 sites (September 2001) the following patterns emerge:

- Approximately two thirds of the sites have some forest component
- The total Annex I forest habitat area of these sites is greater than seven million hectares representing about 20% of the total proposed area
- There is considerable variation between Member States in the extent to which forests form part of their proposed Sites of Community Importance (SCIs), ranging from about 35% in Sweden & Finland to less than 5% in Ireland
- Most of the forest area included in proposed SCIs is proposed by Member States in the Boreal, Mediterranean & Alpine regions.

The forest component of the proposed sites varies considerably with 40% of the sites having only a minor Annex I forest component (<20% of area of site). Less than 20% of the sites are predominantly Annex I forests (>80% of area). This suggests that the vast majority of areas are multiple interest sites, containing other Annex I habitat types as well as other habitat types, including forest habitats, not covered by the Directive. Likewise, the Annex I forest area of individual sites varies considerably with the majority (63%) of sites covering less than 1000 hectares. Only 9% cover areas greater than 10,000 hectares. In fact, more than half the forests cover less than 100 hectares.

There also appears to be significant differences between Member States in the average size of their proposed forest SACs. Countries such as Austria, Greece, Portugal and Spain have tended to propose larger sites while countries like Belgium, Denmark and Ireland, which probably have fewer natural and semi-natural forests, have tended to propose small sites.

An assessment of the sufficiency of the national lists for each forest habitat type is made within the framework of Biogeographic Seminars which also aims to determine whether each site proposed is of Community interest. These expert meetings are organised under the joint chairmanship of the Commission and the European Topic Centre on Nature Protection & Biodiversity of the European Environment Agency.

The conclusion of the first seminar for the Atlantic Biogeographic Region, (in which the UK is entirely located), which took place in September and November 1999, was that all



forest habitat types and species were insufficiently represented in one or more Member States. The next Atlantic seminar will further evaluate the progress by Member States, with a view to finalising a list of sites of Community interest for this region⁴.

Managing Natura 2000 forest sites

The creation of the Natura 2000 network is intended to ensure that these habitats and species are maintained at, or, where appropriate, restored to a favourable conservation status. It has been necessary to dispel a number of myths that have emerged concerning the implications of Natura 2000 designation on the rights of users, and landowners:

- ***“Natura 2000 sites will all become nature reserves”***

Although Natura 2000 forest sites will include unexploited nature reserves, this is not a prior requirement of the Directive. In fact, the philosophy of Natura 2000 is not about creating nature reserves where human activities are to be excluded. The majority of sites are likely to be privately owned areas and the emphasis will be on ensuring that any human activities are sustainable, with a view to maintaining the conservation values of the sites. The reality is that Member States will have a choice of mechanism to use to manage the sites including statutory, contractual and administrative measures.

- ***“We will have to stop all our activities within a site for the sake of preserving nature”***

The reality is that conserving species and habitats is not necessarily incompatible with human activities. In fact, nature conservation provides additional opportunities for human use, including activities such as environmental tourism, pursuit of leisure activities and labelling of natural products. Any restricting or stopping of certain activities that are a significant threat to the species or habitat, need to be addressed on a case by case basis.

- ***“Brussels will dictate to us what can or cannot be done in each site”***

The reality is that the Directive and Natura 2000 are based on the principle of subsidiarity. The provisions of the Directive clearly make the Member States responsible for the management of Natura 2000 sites. The Commission has consistently promoted the development of management plans, both as an instrument for ensuring appropriate conservation management of the sites, and being the framework for judging the compatibility of different uses with conservation objectives. They also represent an excellent way to actively involve key interest groups, who may be affected by the designation, in

management decisions. Given the extensive range of habitat types and situations, no standard formula can be applied. However, as a general rule it will be important to ensure continuation of traditional management regimes, which very often have been crucial in creating and maintaining the habitats, which are valued today. Careful management planning for Natura 2000 forests may prove to be particularly important, given that many of the sites concerned are relatively small in size.

- ***“Once a site is included in Natura 2000 it becomes untouchable as regards future development”***

The Directive does not, *a priori*, prevent any new activities or developments within a Natura 2000 site from taking place. This needs to be judged on a case-by-case basis. Article 6 of the Habitats Directive requires that any new plan or project that is likely to have a significant effect on a site must undergo a prior appropriate assessment. If a proposed activity is likely to cause significant damage to a site and all possible alternatives have been exhausted it may still go ahead if it is of overriding public interest and if compensatory measures are provided⁵. In the case of developments which will have an adverse impact on sites which host priority habitats or species the Directive requires the Commission to give an opinion on whether an overriding public interest is involved. Activities affecting the integrity of a site are equally relevant under Article 6 whether inside or outside its boundaries,

Forestry can also have an impact on Natura 2000 sites designated for other habitat types and species of Community interest. It is estimated that more than 15% of the territory of the Community will be included in Natura 2000. Therefore, afforestation must be carried out in such a way that it does not negatively affect Natura 2000 areas or other ecologically important sites in the Member States. Planting in such sites should only be encouraged when it contributes to, or is fully compatible with, their nature conservation value.

The role of LIFE-Nature and forests

Although it has only a relatively modest budget in Community terms, the LIFE-Nature fund is of strategic value for demonstration projects in Natura 2000 forest sites. Since 1992, there have been nearly 300 projects involving forest and woodland habitats and species. These projects, which have taken place in all Member States⁶, cover a wide range of activities such as:

- management planning
- land acquisition and leasing



- habitat restoration (sometimes arising from former inappropriate afforestation)
- non-recurring and recurring biotope management actions
- information and awareness.

Many of the projects have involved strategic partnerships between forest and nature conservation authorities, as well as NGOs and private landowners. In fact, the key elements of successful LIFE-Nature projects include:

- the forging of strategic partnerships and engaging other interest groups in finding the most sustainable solutions
- the sharing of results and experiences
- the development of models for integration into other policy areas, such as agri-environment, which can be applied elsewhere.

As a result, there is an emerging broad base of expertise and best practice in relation to the conservation and sustainable use of Natura 2000 forest sites.

Future financial considerations

Whereas the LIFE-Nature fund has acted as an excellent demonstration and pump-priming tool it is modest in size and will not, of itself, satisfy the management needs of Natura 2000 sites. Other Community financial instruments, particularly those linked to Rural and Regional Development, also offer opportunities to support conservation activities in Natura 2000 sites.

During the preparation of the last plans, the Commission maintained pressure on the Member States to provide commitments in them that any possible negative impacts on protected or to be protected Natura 2000 areas would be assessed and appropriate measures taken. It also actively encouraged the use of funds, especially under the Rural Development Plans, to support the objectives of the Birds and Habitats Directives.

Under the Rural Development Regulation, Member States are required to have prepared National Forestry Plans or similar instruments which fully take account of all their international environmental undertakings, especially regarding the issue of sustainability in the management of forests. An important provision under the regulation is support for measures to maintain and improve the ecological stability of forests where:

- the protective and ecological role of forests are of public interest
- the costs of maintenance and improvement measures exceed the income from forestry.

These measures have considerable potential

to support the conservation of forest areas, including those of low economic value. However, for future programmes there will be a need to have better estimates of the overall costs of managing sites in the Natura network.

In this regard, the Habitats Directive legally foresees that there will be Community co-financing for such measures in Natura 2000 sites hosting priority habitats and species. The essential provisions are contained in Article 8 of the Directive, which is likely to have a strategic influence on the way that the network will ultimately work. Member States must communicate their financial needs and, in coordination with them, the Commission is required to identify the essential measures and their costs. The Commission must then develop a financial prioritised action framework having regard to sources of funding under relevant Community instruments.

The Commission is launching an expert group to reflect on the issue of financing Natura 2000, involving representatives of experts and stakeholder groups. This will include an estimation of the likely costs involved in the management of the Natura 2000 network, and a review of the adequacy of existing Community instruments to contribute to co-financing. Finally, the group will make recommendations and examination of options for a future funding framework for Natura 2000, including a consideration of which kinds of costs should be eligible for Community support. Drawing on the findings of the expert group, it is intended to present a Communication on this subject to the Council of Ministers and to the European Parliament in 2003. This Communication should send a strong signal of the Commission's commitment to help ensure the success of this key nature and biodiversity objective.

Some concluding comments

A substantial part of the Natura 2000 network will be comprised of forests of high conservation value. These areas will play a key role in safeguarding Europe's natural heritage and biodiversity. Some of these areas will be undisturbed nature reserves, which will provide opportunities for activities such as scientific research, education and amenity. However, a large proportion of the Natura 2000 forests will be privately owned lands, whose future will depend upon the active involvement and engagement of landowners and stakeholders.

There will be a need to find solutions to conservation management issues that are tailored to local circumstances and that take account of existing socio-economic activities.

The sharing of best practice is therefore critical to achieving this objective. The experiences of



the 'Restoration of Atlantic Oakwoods' and 'Wet Woods Restoration Project' LIFE-Nature projects are therefore of high demonstration value in the development of Natura 2000. They are also particularly important in that they are based on a partnership approach, on which the future of many Natura 2000 sites will ultimately depend.

Notes

¹ European Environment Agency: Europe's Environment — The Second Assessment [Dobris+3], pp.144; 163-164;167-168; 174).

² The first Biogeographic List, concerning the Macronesian Region, was adopted by the Commission in December 2001.

³ A Natura barometer, which provides regular updates on the progress of Member States' proposals for Natura 2000, is to be found on the nature home page of DG Environment's web site: www://europa.eu.int/comm/environment/nature/home.htm

⁴ Despite substantive progress, the conclusions of the second Atlantic Seminar, which took place in the Hague, June 2002, confirmed that there were still gaps in the network of sites for forest habitat types in the majority of Member States.

⁵ The services of the Commission have produced an interpretative guide entitled *Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive* (ISBN 92-828-9048-1). It has also published a methodological guidance document on the provisions of Article 6(3) and 6(4) of the directive (ISBN 92-828-1818-7).

⁶ A full listing of all projects is available on the LIFE-Nature page of DG Environment's web site: www://europa.eu.int/comm/environment/life/life/nature.htm



The Atlantic Oakwoods. Past Management and Present Condition

Peter Quelch

Forestry Commission, Whitegates, Lochgilphead, Argyll PA31 8RS



The Bridge over the Atlantic

The Bridge over the Atlantic joining Seil Island to the mainland south of Oban is evocative of the western oceanic atmosphere which pervades the Atlantic oakwoods. This bridge is in the centre of the spread of oakwoods and other types of semi-natural woodlands, varying according to geology and soils, up and down the western seaboard of Scotland.

A wide ranging look at these woodlands will be taken to demonstrate the wide diversity of structure and inherited condition in today's semi-natural woodlands. They are often described as remnants or relics, and indeed some are, precariously hanging on to life. But they are much more than that. There is much field evidence pointing to the long influence and interaction between man and the natural woodland resource which developed after the glaciers retreated some 10,000 years ago.

Typical Atlantic oakwood landscapes in Scotland are found in Galloway, Cowal, North Kintyre, Loch Sunart, Lorne & Lochaber, Loch Ness-side, and further north at Loch Maree. In Glenorchy, near Dalmally, the oakwoods almost join up with small remnants of the once greater Caledonian pinewood forest. At the head of Glen Nevis, and on Loch Arkaig, the native pinewood remnants are also close to remnants of broadleaved woodland. Many millennia ago, before fragmentation, these woodland types would have flowed naturally from one to another, with intergrade types of a sort probably not seen today.

It must be stressed, however, that there are still a number of associated woodland types that are found close to, and merging with, the oakwoods. Apart from the native pine, which occupies a very similar soil type to oak, other

associated woodland types include mixed ash/elm/hazel woods on the more base-rich soils and in nutrient rich flushes. In the coastal zone, often on steep terrain on well drained soils and screes, occur the coastal hazelwoods where ash and elm are infrequent. These are thought to be survivals from once more extensive post-glacial hazel woods and scrub. On nutrient-rich but wetter soils, the slope alderwoods with ash and the sallow willows are actually more common as a woodland type in west Scotland. Fen alder types, perhaps mixed with bird cherry, are found on low lying nutrient-rich fens and valley bottoms, and in riparian woodland strips. Finally, the ubiquitous birchwoods interchange with oak or pine on more or less the same soils, both in spatial terms, and also as an exchange of oak- and birch-dominated stands over time on the same site.

Other native species associated locally with oakwoods are aspen and juniper, both of which were previously much more common. Rowan deserves a mention as it is common throughout most of the drier woodland types.

Key features in the associated vegetation of the western woodland types includes colourful displays of bluebells, wood anemones, cow-wheat, wild garlic and a wide range of ferns. However it is the lower plants and, in particular, the bryophytes (mosses and liverworts) and lichens which are at their richest in the oceanic conditions of the Atlantic oakwoods and associated types. Bryophyte mats on veteran oaks can be so profuse as to build up into characteristic terraces or layers. The polypody fern occurs as an epiphyte on these very moss layers, and in other niches on the veteran trees.

The lichens are particularly well developed, including very rich assemblages of the *Lobarion* community on old oak and also in the ash/elm/hazel stands. Old ash trees in moderately open conditions can be astounding hosts for the range of species of lichen which make up the *Lobarion* community. Old sycamores in the open can also play a similar role. On smooth barked trees like holly, rowan, and especially on hazel, there is a second main community of crustose lichens (the *Graphidion*) which are not so conspicuous. Yet they repay careful study since they contain Scottish endemics, and other species which are restricted to equally oceanic locations around the world such as the coast of Chile, or the islands of Madeira.



A historical review of oakwoods

There have been several key periods of history which have strongly influenced the oakwoods, and have contributed to their current distribution and condition. The most obvious period of influence was in the two centuries from 1650 to 1850. A large proportion of the western oakwoods was utilised on a commercial scale to provide raw material for iron furnaces, set up by Cumbrian companies to capitalise on the abundant source of Scottish oak charcoal. Iron ore was imported by sea to the new Highland furnaces, rather than exporting the friable and bulky charcoal to the existing Cumbrian furnaces. Associated with this use of oakwoods for charcoaling in a 25-year coppice regime, was the use of stripped oak bark for leather tanneries in the Scottish towns. At times of high demand, for example during the Napoleonic wars around 1810, the oak bark harvest was worth more to the estates as a source of revenue than the charcoal.

Following the industrial revolution, there were other trades which utilised small broadleaved roundwood in bulk. Apart from other aspects of the 'war industry', notably the numerous rural gunpowder mills, there was also a whole set of wood-using industries connected with the cloth trade. Bobbin or pirn mills were set up in many locations in the Highlands, mainly using birch wood, worked by saws and by wood-turning lathes powered by watermills. Wood distillation factories used similar coppiced roundwood for the distilling of acetic acid, used to etch printing plates in the cloth works, and also for other valuable industrial chemicals like methanol, acetone and wood tar.

High rental values for the oak woodlands encouraged the estates to manage selected woodlands. They built stone dykes to protect coppice regrowth from livestock, and to protect new and enrichment planting of oak in the gaps. Non-oak species were replaced with more oak. This work had a profound effect on the natural origin oakwoods that the owners used as the raw material for these improvements. The woodlands became enclosed, fixed in the landscape, and their structure became unnaturally pure in oak as a tree species. Their structure became simplified to either coppice or coppice with standards. These structures have been handed down, and are readily recognisable in most of today's semi-natural oakwoods.

Coal began to substitute for charcoal in the ironworks, ships began to be built of iron rather than wood and leather was tanned with coal derived chemicals. The previously coppiced oakwoods, which then had little sawmilling timber value, fell into decline and were usually

grazed by the sheep and cattle stocks on the estate farms. Red deer numbers began to rise on some sporting estates and adjacent forests and woodlands. In some locations high numbers of deer grazed the oakwoods.

In the 20th century, the oakwoods, especially those with any remaining timber 'standards,' were exploited for sawn timber during both world wars. The oakwoods reached a low point after the second world war when they ceased to have any real value in land use terms, and many were converted to conifer forestry.

A change of attitudes slowly occurred from about 1970 onwards, culminating in the Forestry Commission's 1985 broadleaves policy which protected semi-natural and broadleaved woodland for the first time. Since then, the appreciation of the ecological value of ancient semi-natural woods has increased to the point that ambitious restoration schemes have been funded through European and UK Lottery sources. Thus arose the current LIFE oakwood restoration project.

The pre-industrial period before 1650 completes the historical review of western oakwoods. Oak was used to make charcoal for iron smelting, but early iron working was in small local furnaces known as bloomeries. The remains of these rural ironworks may still be found in the oakwoods of today, as can the hearths or platforms on which the charcoal was made. Earlier than this, charcoal was made in small pits rather than on large platforms and remains of these have been excavated. Woodland archaeology is trying to understand these earlier woodland influences.

In the pre-agricultural improvement era woodlands were an integral part of the early pastoral way of life. Herds of black cattle were raised in the Highlands for droving to the markets of midland Scotland and the south. There is evidence today of wood pasture and oakwood structures which pre-date the organised coppicing systems of the 18th century. Little is known about the woodmanship of this era, but there is much field evidence relating to pre-industrial coppicing and wood pasture systems waiting to be fully interpreted.

In conclusion, the overall effect of this long history of human intervention is to leave us with a complex variety of structure and condition in the Atlantic oakwoods. Far from them all having a simple structure like the abandoned oak coppice dating from the mid-19th century, the western oakwoods display a wonderful variety of structure and condition. This gives both a challenge to their future management, since simple prescriptions are not enough, and also an opportunity to maintain and amplify this inherited diversity.



The status of wooded bogs at Abernethy, Strathspey

Colin Legg¹, Heather McHaffie¹, Andy Amphlett² and Rick Worrell³

¹ Institute of Ecology and Resource Management, The University of Edinburgh, King's Buildings, Mayfield Road, Edinburgh EH9 3JU

² RSPB, Forest Lodge, Nethy Bridge, Inverness-shire PH25 3EF

³ Upper Park, Aberfeldy, Perthshire PH15 2EH

Introduction

Most of the relatively undisturbed bogs in the UK are treeless, including both the remaining raised bogs and the extensive blanket bogs of Scotland. However, there are several bogs and bog complexes in Scotland where Scots pine (*Pinus sylvestris*) and sometimes birch (*Betula spp.*) are a significant component of the vegetation. Good examples can be found in Glen Affric and near Loch Maree in the west, but most are in the east of Scotland and they are best developed in association with the native pine forests on the north side of the Cairngorms (MacKenzie & Worrell 1995). This paper reviews the wooded bogs at Abernethy, Inverness-shire, within the RSPB Reserve and the current status of the wooded bog vegetation.

The wooded bogs of Abernethy present a distinctive landscape. The numerous bogs, ranging in size from tens to thousands of metres across, fill hollows (kettle holes) in the morainic gravel deposits surrounded by mature Scots pine forest on the eskers and outcropping bedrock. They support a sparse canopy of stunted pine trees with flat-topped crowns and twisted stems and branches. There are several unusual species of bryophyte (*e.g. Dicranum bergeri, Sphagnum austinii*), dragon and damsel flies (*e.g. Coenagrion hastulatum, Somatochlora arctica* and *Leucorrhinia dubia*) associated with this habitat, and a very rare predaceous diving beetle (*Agabus wasastjernae*) was recently found in pools of water created by the lifted root plates of fallen trees (Owen *et al.* 1992). The trees themselves support a diverse collection of lichens, fungal pathogens and invertebrates. This habitat is of high conservation status and 'Bog woodland' is listed under Annex 1 of the EC Habitats Directive as a priority habitat.

Although uncommon in the UK, it is considered the norm for bogs in the more continental parts of Europe to be associated with trees (Ellenberg 1988). Waterlogging constrains the growth of trees, and tree size and density are strongly associated with water table characteristics. Denser stands of taller trees are found near bog margins where annual fluctuations of the water table are greater and where well-aerated peat is present for longer time periods.

The habitat is easily destroyed by unsympathetic management, and less than 1000 hectares probably remain of a vegetation type that would once have been much more widespread. Many of the remaining sites have been disturbed in the past and there are many threats to the integrity of others.

Threats to the wooded bogs

Peat cutting is one of the most direct and apparent threats to wooded bogs. It has been practised throughout Scotland for centuries where bogs are close to habitation. The hydrology of the bog can be severely disrupted, though the immediate effects on vegetation often seem to be localised and restricted to within a few metres of the margin of the cut face. At Abernethy there is clear evidence of former peat cuttings on the margins of many of the bogs, although other bogs seem to be largely untouched. While there are examples at Abernethy of peat faces with a dense and vigorous growth of pine on the drier banks of aerated peat, this pattern does not occur everywhere. There are other examples with a dense regrowth of young pines within the very wet cuttings themselves, even though the uncut banks remain free of trees. Here the effects of the higher mean water table may be offset by greater seasonal fluctuations in water table and release of nutrients from the disturbed peat. In other areas, no contrast in tree density can be detected on either side of ancient peat banks, suggesting that this vegetation type may be robust to disturbance where the hydrology of the system is able to recover.

Abernethy is unusual as a bog system in the UK in that the whole forest area has been managed and protected from the early 17th century (Grant 1994). The estate was managed first for its timber resources and then mainly for sporting interests from the late 19th century. It was purchased for conservation by the RSPB in stages from 1975 onwards. Major forest fires were reported in 1746 and 1762 (Grant 1994). Abundant fine charcoal particles in the peat (Carvalho 1999) suggest that there may be a long history of management for cattle by burning the understorey vegetation. This would have ceased after most of the residents were evicted or resettled in other parts of the estate by 1869



(Grant 1994). Recent fires, however, have mostly been small and infrequent, resulting in a long mean return interval; grazing is now restricted to relatively low numbers of red and roe deer.

Grazing animals may have two opposing effects on the development of tree cover. Browsing suppresses the emergence of tree seedlings from ground vegetation cover. Extensively grazed bogs in the vicinity (e.g. Tulloch moor) have very few trees, though there is sometimes much suppressed regeneration. However, trampling damage may play an important role in breaking the mat of vegetation and providing micro-sites for seedling establishment. Similarly, management fires traditionally associated with grazing management destroy seedlings and small saplings, but may open the vegetation to provide suitable seedbeds for seed germination and establishment. Larger trees are likely to survive surface fires over bogs where the fuel load is relatively low. One may therefore anticipate that changes in density of grazing animals or frequency of fires will affect the future population dynamics of trees in these sites. However, it is not immediately obvious if small changes in grazing and fire frequency will result in an increase or a decrease in tree cover.

The biggest impact on the wooded bogs of Abernethy in recent years has come from forestry operations. Bogs have been drained and planted with Sitka spruce, lodgepole and Scots pine from the 1960s through to the early 1980s. Small-scale drainage has taken place on most bogs in the past, usually associated with grazing, but drainage on this scale has completely changed the nature of the affected bogs; the lowered water tables, topography of ridge and furrow, and shade cast by thicket-stage conifers has had dramatic effects on the vegetation (Anderson 2001). It is the restoration of these drained and planted bogs that has been the main focus of the Wet Woods Restoration LIFE Project.

In addition to these direct impacts on the wooded bog habitat, there are two more insidious threats that need to be considered. The first is from climate change. The primary factor determining the distribution of trees on bogs is the nature of the water table. In ombrotrophic bogs there is very little lateral flow of water across the surface, so the water table is determined largely by the balance between rainfall and evapotranspiration (Lindsay 1995). It is therefore probable that the water table will be influenced by changes in temperature and/or rainfall. It is currently impossible to predict how this balance will change at any particular site. One might anticipate that a lowering of the water table may result in some of the drier bogs

being invaded by trees, though the wetter bogs are likely to remain as predominantly open bog vegetation. Conversely, an increase in rainfall and/or decrease in evaporation may result in waterlogging of some woodland areas and reversion from forest to bog. The only sensible precaution that can be taken against this threat is to maintain a wide range of types of bog, including wooded bog, at a number of sites in the hope that climate change will not result in the complete loss of this valuable habitat.

The second insidious threat, however, comes from the traditional attitudes of conservationists. There is a general perception amongst UK conservationists that ombrotrophic bogs 'should' be treeless. This is reflected in several books that only make passing reference to the natural occurrence of trees on bogs, or which mention trees only in the context of damage/ degradation (e.g. Lindsay 1995, Burgess *et al.* 1995).

As a consequence, a great deal of time and money has been spent in many places trying to eradicate trees from raised bogs (e.g. Webb 2001; Anderson 2001). There seem to be several reasons for this attitude. Firstly, because trees will often invade bogs following burning, drainage or peat cutting, trees are seen to be a consequence of disturbance and therefore 'unnatural'. Secondly, trees are seen to be a threat to the sensitive bog system itself. Trees can intercept rainwater and increase the rate of evapotranspiration and so tend to dry out the bog surface and lower water tables (Anderson 2001). They create shade and litter that smothers the rare plants in the few remaining raised bogs. They may also trap particulate material from the atmosphere (particularly in polluted areas) and increase the rate of nutrient input to these inherently nutrient poor systems (Schauffler *et al.* 1996). Bogs with trees are therefore seen by many as associated with damaged bogs of relatively low conservation interest (e.g. Brooks & Stoneman 1997). While all of these things may be true in many situations, it is not necessarily true that all trees on bogs are a consequence of disturbance, nor that all trees on bogs will lead to a degradation of the conservation interest of the site.

Because of this 'naive conservationists' perspective, wooded bogs have received rather little attention from British ecologists (with notable exceptions, e.g. McVean & Ratcliffe 1962; Steven & Carlisle 1959). For example, the National Vegetation Classification (Rodwell 1991) scarcely mentions pine or birch in the context of mire communities (*Pinus sylvestris*: is recorded with presence class I of seedlings in M14 and M16, saplings have presence class I in M21; *Betula pubescens*: presence class I of seedlings in M6 and M16, saplings in M9). It





seems that bogs with trees have fallen between the two stools of mire and woodland vegetation have been largely ignored as a vegetation type, and given a low conservation profile as a consequence.

Restoration objectives

The Wet Woods Restoration Project aims to restore bog woodland habitat where this has been destroyed by ploughing and planting with exotic conifers. Such a project requires clear management objectives and targets. A survey of bog woodland vegetation at Abernethy was therefore necessary to catalogue the main plant communities present and assess their distribution and status. These communities were to be placed within the context of the National Vegetation Classification and indicators of past disturbance identified where possible. The objective of restoration is to hasten the recovery process following disturbance. It was therefore hoped that such a survey would identify the end-points of post-disturbance succession as targets for restoration management.

The survey

Three hundred quadrats, each two metres square, were recorded from 20 selected bogs at Abernethy between September and mid-December, 1998. Up to five examples of each perceived vegetation type were recorded from each bog, placing quadrats at least 30 metres apart. Small-scale mosaics were sampled within a single quadrat, but when the hummocks or

hollows exceeded two metres in diameter these were sampled separately. Percentage cover was estimated for each vascular plant, bryophyte and macro-lichen species present. An estimate was made of the tree height and density.

Data analysis

The survey identified 153 species including 16 *Sphagna* and 18 species of the lichens, *Cladonia*. The vegetation data were classified using TWINSpan. The end groups were amalgamated to generate nine discrete vegetation types representing a range of wet heath, raised and blanket mire and woodland communities (McHaffie *et al.* 2000). Both the individual relevés and the nine vegetation types were compared with the NVC communities (Rodwell 1991) using several different matching coefficients in the ComKey program (Legg 2001).

The relevés could mostly be attributed to NVC types M15 (*Scirpus cespitosus*-*Erica tetralix* wet heath), M17 (*Scirpus cespitosus* - *Eriophorum vaginatum* blanket mire), M18 (*Erica tetralix* - *Sphagnum papillosum* raised and blanket mires), M19 (*Calluna vulgaris*-*Eriophorum vaginatum* blanket mire) and W18 (*Pinus sylvestris*-*Hylocomium splendens* woodland). A small but heterogeneous group of quadrats containing frequent birch (*Betula pubescens*, a generally uncommon species at Abernethy) appeared to be closest to W4 (*Betula pubescens*-*Molinia caerulea* woodland), though more samples are required to confirm their status.

Results and discussion

Numeric comparison of the final groups with the NVC showed reasonably good fit with the main NVC communities, though with some consistent differences described below. There is no particular reason why TWINSpan should place the divisions between the vegetation types in the same place as the divisions in the NVC and the final groupings therefore tended to be intermediate between the NVC sub-communities. For these reasons, and also because of the floristic similarity of the NVC sub-communities, it was not possible to assign the groups to particular sub-communities.

The Abernethy data were consistently different from 'typical' NVC M15, M17, M18 and M19 communities in the frequencies of certain taxa. Several species with a more oceanic distribution were uncommon or absent from the Abernethy mires (e.g. *Myrica gale*, *Molinia caerulea* and *Pleurozia purpurea*). Others may have been less common at Abernethy than expected from the NVC tables because of the low levels of grazing (e.g. *Potentilla erecta*, *Nardus stricta*, *Trichophorum cespitosum* and *Juncus squarrosus*). Among the species more abundant than



indicated in the NVC for these communities, *Carex pauciflora* appears to have been overlooked completely in the NVC tables. Both *Hylocomium splendens* and *Sphagnum cuspidatum* were also more abundant in the Abernethy data than suggested by the NVC, but this is probably because of variation in small-scale hummock and hollow topography. The NVC classification is designed for use at a scale above the hummock-hollow microtopography of bogs and gives a valuable summary of mire plant communities at the site level (Lindsay 1995). Its vegetation units are not intended to be used in defining finer scale mosaics of patterned surfaces. Small-scale mosaics were not distinguished here but *S. cuspidatum* is considered part of the bog pool communities in the NVC (M2 and M4).

The most notable feature of the wooded bogs data was obviously the high frequency of *Pinus sylvestris*, either as seedlings or small trees, even though pine is not recorded in any of these blanket or raised mire communities in the NVC. Pine occurred in all nine of the vegetation types recognised at Abernethy, though pine seedlings were less uniformly distributed, being abundant in the more open wet vegetation, but less common in the closed dwarf-shrub communities.

A further set of 142 published relevés was collected from the literature (sources listed in McHaffie *et al.* 2000). Numerical analysis of these other data ran into several difficulties. This was partly due to confusion caused by the sampling methods (*e.g.* in the completeness of the bryophyte and lichen records) and by taxonomic problems (*e.g.* confusion between *Hypnum curpessiforme/Hjutlandicum*; *Vaccinium oxycoccus/V. microcarpum*; *Cephalozia sp./Cephaloziella sp.*). There were consistent differences between the data from different sites that one would expect for geographically separated sets of samples. However, the same patterns became clear. Pine was commonly present at other sites but, again, the full range of M17, M18 and M19 communities were present in the wooded bogs.

Conclusion

It is clear that Scots pine is a widespread component of bog communities that occurs at numerous sites in Scotland. In the ideal conditions at Abernethy, Scots pine is an almost ubiquitous constituent of bogs. It is also equally clear that wooded bogs do not represent a single community type; Scots pine can be present in any of the M15, M17, M18 and M19-type bog communities if the conditions are right. There is an analogy here between the W18d / W18e and H21 / H22 communities that are very similar in species composition except for the

presence of pine in W18. However, if a new community were established for these treed bogs, then the variation within the new community would be almost as great as that across all four of the mire types. On this basis, it is not appropriate to suggest that wooded bogs should be considered a new community type that has been omitted in the first-edition of the NVC. A second option might be to create sub-communities in each of the four main mire types. There is some justification for this from the Abernethy data in that there are consistent differences between the data and the NVC types, running across all of the vegetation groups, that reflect the continental end of the spectra represented by the NVC types. However, this is to be expected from data that all originate from a relatively small geographical region. This option would need further justification by demonstrating that similar trends are apparent in wooded bogs in other parts of Scotland.

The simplest option at present is to describe these bogs as variants of the four NVC mire types, defined on the basis of physiognomy and structure, rather than on floristics. The structure of sparse woodland of short trees with twisted branches and flat-topped crowns is distinctive.

McHaffie *et al.* (2002) recognised three main types of bog with Scots pine at Abernethy that differ in structure and ecological function:

- **Woodland Bog:** predominantly bog vegetation but with abundant pine seedlings derived from the heavy seed rain from surrounding woodland. There is high seedling mortality and the few stunted trees that survive are heavily diseased and have a low seed production. The water table is permanently high preventing the trees from full development.
- **Wooded Bog:** predominantly bog vegetation with scattered trees of moderate height but with an open canopy. The trees produce abundant seed and all stages of regeneration are present suggesting a self-supporting population. The water table is high, but dense ground vegetation suppresses most seedlings.

- **Bog Woodland:** predominantly woodland vegetation with tall, dense tree cover over deep peat. Relicts of bog vegetation remain in the ground flora but most has been displaced by a woodland community of dwarf shrubs and bryophytes. Bog woodland is clearly derived from open bog, but some factor has resulted in a lowering of the water table that has permitted the trees to develop a full canopy.

This pattern is very similar to that described as typical for bogs in continental Europe (*e.g.* Ellenberg 1988) and it seems clear that wooded



bogs represent the more continental end of the range of bog vegetation in Britain (the study area has a mean annual precipitation of only 795 mm). The presence of bog woodland is clear evidence of dynamics in the vegetation where open bog vegetation has been replaced by closed forest. There are also examples at Abernethy where trees have died, apparently due to changes in the water table causing a reversion to open bog. This suggests a dynamic system in that the three vegetation types may change from one to another. This may be triggered by disturbance events, such as periods of drought or fire, permitting seedling establishment, fluctuations of the water table permitting root growth and the development of a dense forest canopy.

The conservation and management of such a system requires a light touch. It is neither possible to force the system into a 'natural state', nor appropriate to expect long-term stability to be achieved on all sites. The effects of draining and planting by the forestry treatments from the 1960s to the 1980s cannot be reversed quickly. Rather, restoration will require the careful removal of exotics and manipulation of the water table to encourage *Sphagnum* growth and peat formation to restore bog surface structure and hydrology (Anderson 2001). Only when this has been achieved and the nutrients released from the peat by the disturbance have subsided to their initial levels will the balance between tree seedling establishment and growth be restored and the characteristics of wooded bog be regained.

The restoration of bog woodlands will be a long-term project, but is crucial to the future of this unique and valuable habitat.

References

Anderson, R. (2001) Deforesting and Restoring Peat Bogs: A Review. *Forestry Commission Technical Paper No. 32*. Forestry Commission, Edinburgh.

Brooks, S. & Stoneman, R. (1997) *Conserving Bogs: The Management Handbook*. Stationery Office, Edinburgh.

Burgess, N., Ward, D., Hobbs, R. & Bellamy, D. (1995) Reedbeds, fens and acid bogs. In: Sutherland, W. J. & Hill, D. A. (eds) *Managing Habitats for Conservation*. Cambridge University Press.

Carvalho, J. (1999, unpublished) *Fire History of the Caledonian Pine Forest at Abernethy Forest Reserve*. MSc Resource Management dissertation. Institute of Ecology and Resource Management, The University of Edinburgh.

Ellenberg, H. (1988) *Vegetation Ecology of Central Europe*. Cambridge University Press.

Grant, E. (1994) *Abernethy Forest: Its People and Its Past*. The Arkleton Trust, Nethy Bridge, Inverness-shire.

Legg, C.J. (2001, unpublished) *ComKey: A Computer Program for Community Classification*. Institute of Ecology and Resource Management, The University of Edinburgh.

MacKenzie, N.A. & Worrell, R. (1995) *A Preliminary Assessment of the Ecology and Status of Ombrotrophic Wooded Bogs in Scotland*. Scottish Natural Heritage Report No. 40.

McHaffie, H., Legg, C. & Worrell, R. (2000) *Classification of Bog Woodland Habitat and Review and Analysis of Restoration Management at the RSPB Abernethy Forest Reserve*. Unpublished report to the Wet Woodlands Restoration project.

McHaffie, H., Legg, C., Amphlett, A., Worrell, R. & Cowie, N. (2002, in press) *Scots pine growing on forested mires in Abernethy Forest, Strathspey, Scotland*. Botanical Journal of Scotland.

Lindsay, R. (1995) *Bogs: the Ecology, Classification and Conservation of Ombrotrophic Mires*. Scottish Natural Heritage, Battleby, Perth.

McVean, D. N. & Ratcliffe, D. A. (1962) *Plant Communities of the Scottish Highlands*. Monographs of the Nature Conservancy. No. 1. HMSO.

Owen, J. A., Lyszkowski, R. M., Proctor, R. & Taylor, S. (1992) *Agabus wasastjernae (Dytiscidae) Sahlberg new to Scotland*. *The Coleopterist*, 1: 2.

Rodwell, J. S. (1991) *British Plant Communities. Volume 2: Mires and Heaths*. Cambridge University Press.

Schauffler, M., Jacobson, G. L., Pugh A. L. & Norton, S. A. (1996) Influence of vegetational structure on capture of salt and nutrient aerosols in a Maine peatland. *Ecological Applications*, 6: 263-268.

Steven, H. M. & Carlisle, A. (1959) *The Native Pinewoods of Scotland*. Oliver & Boyd, Edinburgh.

Webb, S. (2001) Life after conifers. *Enact*, 9: 18-22.



Floodplain woods — A Journey through the Riparian Zone

John Parrott, North Highland Native Woodlands

The Old School House, Errogie, Stratherrick, Inverness IV2 6UH

This paper journeys through the riparian zone to the floodplain woodlands.

The word 'riparian' derives from the Latin word for riverbank. Riparian woodlands are therefore those closely associated with freshwater. The term 'riparian' cuts across all woodland types, and does not imply dominance by any particular species. The 'freshwater' may be anything from a tiny burn, through a raging torrent to a loch.

Riparian woodlands are special in many respects, perhaps most uniquely through their relationship with another ecosystem. They occupy the boundary between the land and freshwater.

Riparian trees play an important role in the shaping and stabilisation of riverbanks. Tree roots protect banks from erosion and help to create undercuts and deep pools. They provide a refuge for fish from predators and spates. Bankside trees provide shade, thereby helping with the regulation of water temperature. Overhanging vegetation provides a rain of invertebrates through the summer months, an important source of food for many fish, especially trout. In the autumn, leaves fall, accumulate in the water and provide the basis for a food-chain on which countless species depend. Large woody debris helps create pools, and aids the retention of smaller debris, adding to the biodiversity and productivity of the freshwater ecosystem.

Riparian woodlands are also a valuable habitat in their own right. Typically, their biodiversity is high. This is partly due to a natural diversity in soil types, drainage, and topography, but it is also due to management. Because of difficult terrain or flood risk, riparian sites are often less intensively managed than others.

Riparian woodlands provide a sheltered and relatively stable microclimate for many sensitive species, among them many lower plants, the lichens, mosses and ferns. They act as wildlife corridors, facilitating the movement of species throughout a catchment. A few species, notably beaver, are confined almost exclusively to riparian woodlands.

Riparian woodlands typically have a high amenity value. They are a popular location for informal recreation and also provide an attractive, as well as a productive, environment

for fishing. In the landscape, the variety of tree species renders them especially attractive, particularly in autumn.

In many upland areas, riparian woodlands are often the only woodlands left in an otherwise treeless landscape. This is equally true in intensively farmed parts of the lowlands, where corridors of riparian habitat often provide the only sanctuary for wildlife.

One sub-set of riparian woodlands will be looked at more closely — those which occupy floodplains.

For most of the year, the river on a floodplain is confined to the main channel. But when floodwaters rise and spill out onto the floodplain, the boundary between woodland and freshwater becomes blurred and the relationship between ecosystems becomes more intimate and more complex. As the flood recedes, alluvium is deposited on the floodplain, and pools are left behind. Secondary channels occur where water flows only in times of flood. As channels migrate, backwaters and oxbow lakes are formed, and islands are created. This process produces a great variety of topography, drainage, soils and levels of disturbance which support an ever-evolving mosaic of different habitats.

Alder is often dominant. Willows and ash are often important components, depending on wetness. Deadwood is an important feature, adding to the biodiversity. Some derives from within the woodland, while some is brought from higher in the catchment.

A stable floodplain has been described above. On high-energy rivers such as the Spey, which drain large high-altitude catchments prone to heavy precipitation and especially snow-melt, a much more active, dynamic system is found. On the lower Spey, when the river is in full spate, uprooted trees are thrown up onto shingle banks. Channels can change their course overnight. What is shingle today may be woodland in 40 years time. Today's trees may be swept away by tomorrow's floods.

The process of erosion and deposition creates a mosaic of mature and young woodland, shingle banks and areas of scrub. Many of the non-woodland habitats have a high biodiversity value. Exposed shingle banks and islands provide important breeding sites for birds such as terns. River shingles elsewhere on the Spey





Lower Spey



The Mound

have been found to support Red Data Book species, probably reliant on dead wood and detritus trapped in the shingle.

Active floodplains often support extensive areas of willow scrub. On the continent, such areas are attractive to bluethroat, a species which has attempted to nest a number of times in the Highlands, and might be induced to do so regularly, given enough of the right habitat.

But it is not only the river which shapes the floodplain. Grazing, too, affects the way in which habitats are formed and evolve. Large herbivores, such as wild ox, would have been attracted to the fertile, sheltered conditions on the floodplain. Today, domestic cattle may occasionally fill this role and maintain a mosaic of floodplain habitats.

Beavers play a major role in creating new habitats by felling trees, building dams, creating pools and digging channels. This dimension has been lost with the beaver's extinction.

The great majority of our floodplain woodlands have been lost. Indeed, in Europe as a whole, floodplain woodlands are among the least well-represented of all woodland types. They have been cleared principally for agriculture, and floodplains themselves have been transfigured by the construction of dams and flood defences.

Here in the Highlands, the few remnants of floodplain woodland are frequently invaded by alien species. As alluvium is deposited on the floodplain, so too are the seeds of exotic species such as sycamore. Other alien species such as giant hogweed, Japanese knotweed and Himalayan balsam are often encountered. These are all aggressive plants which can crowd out the native flora. The removal of exotic species can be a costly undertaking. These sites are often difficult of access and require special techniques for management.

Neither have floodplains escaped the ubiquitous planting of conifers. There have been some

projects to reinstate natural floodplain woodlands on these sites. Examples include the Etrick in the Borders and Achnashellach in Wester Ross.

Finally, if a concerted effort is to be made to restore our floodplain woodlands, the bigger picture must be studied. Woodland cannot be considered in isolation from other floodplain habitats. Together, these habitats form a dynamic entity. Furthermore, if a fully-functioning system is to be restored, natural hydrological processes must be maintained, or restored. The role played by keystone species, such as the beaver, might also, perhaps, be considered?



Oakwood Favourable Condition and Current Management Needs

George Peterken¹ and Rick Worrell²

¹Beechwood House, St. Briavels Common, Lydney, Gloucester GL15 6SI

²Upper Park, by Aberfeldy, Perthshire PH15 2EH

Introduction

This paper is based on work undertaken for Highland Birchwoods and Scottish Natural Heritage (Peterken & Worrell 2001). We were asked to provide a framework document for the management of the Loch Sunart Woodlands, candidate Special Area for Conservation (cSAC). The aims were to describe the Sunart woodlands, their development and their present management; define 'favourable condition' as it applies in these woods, and evaluate the present condition in these terms; propose management that will maintain the woods within the favourable range and report on the opportunities for utilising timber products and other service from the woods.

The oakwoods around Loch Sunart form one of the most highly regarded Atlantic oakwood concentrations in Britain. The cSAC was delimited to include most of the oak-dominated woodland as examples of 'old oak woods with *Ilex* and *Blechnum* in the British Isles', one of the habitat types under the EU Habitats Directive. More recently, some ash-dominated woods in the district have also been proposed as examples of *Tilio-Acerion* ravine woodland.

Whilst designated woods form only a small proportion of all semi-natural woods in Britain, designation of the Loch Sunart Woodlands cSAC covered the majority of the semi-natural stands around Loch Sunart, and a particularly high proportion of those containing oak timber. If high valuation for nature conservation led to a general policy of minimum intervention, most of the resource would be incapable of use as hardwood timber. From a European and national perspective the designation was well merited, but from a local perspective the designation might preclude multiple-use, including use of timber in local enterprises. Even if the multiple-use considerations were set aside, there was still uncertainty about how best to manage the woods for nature conservation, and how to expand the resource.

Accordingly, our aim was to propose an approach to management that would not only be satisfactory for nature conservation, but would also allow opportunities for utilisation of some of the timber and afford opportunities for expansion of the 'oakwood' resource.

Nature Conservation Features

The Sunart woodlands are renowned as some of the richest oceanic woodlands in Europe, with outstanding assemblages of bryophytes and epiphytic lichens (Ratcliffe 1977). These depend on mature, relatively undisturbed stands of native broadleaves. Some species (especially many lichens) thrive in the semi-shade of wood edges and open canopies, but others (especially oceanic bryophytes) perform best in full shade close to streams.

The woods and their surroundings also display a complete zonation from marine habitats to woodland. The woods themselves include a wide range of woodland types, and the main semi-natural woods are unusually free of introduced tree and shrub species. A wide range of grassland, wetland and moorland types are associated with the woodlands.

The district is also notable for otters, pine marten, wildcat and several raptors. Notable invertebrates include the New Forest Burnet moth *Zygaena viciae ssp argyllensis* (RDB1), the micro-moth *Scropipalpa clintoni* (RDB2), Ringed carpet moth *Cleora cinctaria bowesi*, Pretty pinion moth *Perizoma blandiata*, Pearl-bordered fritillary *Boloria euphrosyne*, and Chequered skipper *Carterocephalus palaemon* (Ravenscroft 1996). The Northern Emerald dragonfly *Somatochlora arctica* is also present.

Ecological Aspects of the Sunart Oakwoods

Four sources were available for an assessment of the development, current condition and potential of the woods and their surroundings:

- Historical sources, such as Anderson (1967), Smout (1997)
- Existing ecological survey records held by Scottish Natural Heritage, site notes by Peter Quelch, and our own, limited, fieldwork
- Maps of potential woodland prepared by Macaulay Land Use Research Institute
- Quantitative assessments of the whole district based on OS grid intersections.

The development of the Sunart woods is summarised in Figure 1. Historical sources and field survey confirmed that the Sunart woods had, like perhaps most of the western Highland



woods, passed through a prolonged period of wood-pasturage before conversion of some ground to oak coppice or high forest during the 18th and 19th centuries. No direct evidence was found on the nature of this conversion, but the suddenness of the change, the sharpness of the boundaries, and the uniformly high oak stocking all pointed to planting. Coppicing had continued in some woods into the 20th century, and several woods had evidently been retained as high forest, but silvicultural operations had ceased in all woods several decades ago. Remnants of wood-pasturage survived as ancient oaks, ash and alder in younger oak high forest and as scatters of trees in pasture. In contrast, the birchwoods, alderwoods and ash-elm-hazel woods apparently originated as long-established coppice or by natural regeneration; the oakwoods that formed the core of the SAC designation were arguably the least natural of all the semi-natural woodland types in the district.

Fig.1: Summary of woodland development in Sunart

• *Until mid-18th century or possibly later*

Traditional management as wood-pasture and coppice with an irregular scatter of woodland. Pasturage by cattle, goats, etc. Estate records also suggest some felling in high forest.

• *Late 18th century to mid-19th century*

Progressive planting of (i) oak woods (ii) policy woods. Coppicing of some oakwoods for charcoal and tanbark. Continued wood-pasturage and alder coppicing elsewhere, but steady breakdown of system leads to failure to regenerate. Non-native trees introduced mainly into policy woods.

• *Mid-19th century to c.1940*

Cessation of coppicing in oakwoods and alder wood-pastures. All-pervasive pasturage by sheep. Localised reduction in grazing pressure allows birch regeneration. Policy woods maturing, but not intensively managed.

• *c.1940 to 1980s*

Steady expansion of conifer plantations onto both open ground and as replacements for oak woods and other native woodland. Disruption of sheep pasturage patterns allows substantial natural regeneration of native woodland. Limited and patchy spread of non-native trees and shrubs.

• *Late 1980s onwards*

Expansion of conifer plantations now limited. Mature plantations harvested, enabling native broadleaves to be planted and freed from competition. Continued but decreasing pasturage in most native woods.

The maps of potential woodland were generated from data on soil and land form (MLURI paper). Combinations of these were used to define land types, and an assessment was made of which NVC woodland type (Rodwell 1991) would develop on each. Maps were generated in NVC terms to show the natural woodland potential of the whole district. The maps matched well with the actual woodland on the ground, but perhaps this was hardly surprising, since the woodland on the ground was the basis for the NVC. In this instance 'natural' was the 'present-natural' of Peterken (1996).

Ecological surveys of the cSAC woods furnished information on fauna, flora and vegetation types, but did not include detailed information on stand characteristics. In an attempt to gather some quantitative information for the whole district, the woodland was characterised at each of the 1km square intersections of the national grid falling within the district. Each point was characterised in terms of;

- Potential NVC woodland type (or non-woodland type).
- Altitude (above or below 250 metres, taken to be the limit for growing utilisable hardwoods)
- Location within enclosed farmland or 'open hill' land.
- Ancient woodland site (using the Inventory)
- Current woodland (broadleaved, conifer plantation, plantation with some broadleaves), using Ordnance Survey maps and Forestry Commission stock maps as sources.
- Current canopy condition, using air photographs (well-stocked, mature; well-stocked, small crowns; poorly stocked; sparse woodland).

Current Condition

Some 251 intersections fall within the study area, which thus extends to about 25,100 hectares. Of these, 69 (27.5%) were above 250 metres, 17 (6.8%) were in enclosed farmland, and 165 (65.7%) were in unenclosed land below 250 metres.

Some 83 intersections were forested, i.e. the study area is 33.1% forested. Most forested land is under plantations (55 intersections, of which five had a broadleaved admixture), but 28 intersections had broadleaved woodland (11.2% of study area; 33.7% of all forested land). Not surprisingly, forested land was mainly below 250 metres, and broadleaved (mainly semi-natural) was proportionately more abundant on the low, enclosed ground (Table 1).



Table 1: Forested land in relation to land zones

The number of 1 km² intersections for each combination is given

	Land above 250m	Below 250m, not enclosed	Enclosed farmland	Total
Broadleaved	0	22	6	28
Plantation	6	49	0	55
Not forested	63	94	11	168
TOTAL	69	165	17	251
Forest as % of land type	8.7	43	35.3	
Broadleaved as % of land type	0	13.3	35.3	

The potential woodland types for the study area (Table 2) were dominated by the birch types, which would occupy 69.7% of the land, leaving the oak types on 19.9% and the base-rich types on 9.2%. Land above 250 metres would be almost wholly occupied by the birch types, with the oak and base-rich types restricted to land below 250 metres. This must be a consequence of the assumptions behind the MLURI map. Ancient woodland sites total 43 intersections (17% of area; 23.6% of land below 250m). Of these, 26 have broadleaved woodland (60% of

ancient woodland sites), two have plantations with a broadleaved admixture, and 15 have plantations. None is above 250 metres, but six fall within enclosed farmland. Some 28 fall within the oak types, five within the base-rich types and ten within the birch types. Figures are subject to the uncertainties surrounding the Inventory methodology, but they correctly reflect the understanding that woodland continuity is limited to less than one-quarter of the land below 250 metres, and is most strongly associated with the oak types.

Table 2: The range of potential woodland types in relation to land type, woodland history and current forest cover

The number of 1 km² intersections is given for each combination

MLURI type	Inter-sections	Above 250m	Enclosed farmland	Ancient woodland site	Broadleaved	Plantation with broadleaves	Plantation
W7	4	0	0	0		1	
W7/W11	3	0	0	0			
W9/W7	2	0	1	0			
W9	12	0	3	5	3	2	1
W9/W11	2	0	0	0			
W11	26	0	6	18	15	7	
W7/11/17	8	0	1	3	3	1	
W17	16	0	2	7	4	2	1
W4 'blue'	126	42	2	8	2	26	2
W4 'purple'	29	16	0	0		10	
Birch-willow	20	9	1	2	1	1	1
Other	3	2	1	0			
Totals	251	69	17	43	28	50	5



Management models

Each wood is unique at some level of detail, and each requires individual consideration before its management is determined, but in order to specify management for the whole district we elected to recognise five management models. These should be understood as reference points in a continuum. For each management model a set of criteria was set down, which in effect defined favourable condition at the site scale.

1. Minimum intervention model

This would apply to woods that are set aside as minimum intervention reserves (Peterken 2000a). The acceptable composition can be either (i) future-natural, in which any composition is acceptable, or (ii) original-natural or inherited-natural, where only the recognised site-native species would be acceptable. In both types, limits of acceptable direct and indirect human influence would be specified, but any structure would be acceptable. Favourable condition would therefore be maintained if:

- No silvicultural operations take place. Exceptions are allowed for removing and excluding introduced species where inherited- or original-natural composition is the target.
- Grazing is maintained at levels that allow regeneration in gaps.
- Access tracks remain at low density and are well-maintained.
- Introduced species are marginalised. If present, they are maintained in a non-reproductive state. This applies only to woods where the chosen objective is original- or inherited-natural composition.

Management according to this model would probably allow mature woodland with large trees and a diverse stand structure to persist, though large-scale disturbances can never be ruled out. Large volumes of standing and fallen dead wood would accumulate. Such conditions are 'near-natural', and provide suitable habitats for oceanic bryophytes, epiphytic lichens and the whole 'saproxyllic complex' of species dependent of dead wood. The disadvantages include the probable long-term reduction in light-demanding trees, notably oak, and the probable loss of open space habitats. There would be no harvest of timber.

2. Long-rotation high forest model

This would apply to woods where an existing mature structure is to be maintained, but from which a limited harvest of timber would be extracted. The basis would be rotations of 150-200 years, combined with small-scale felling and restocking by natural regeneration,

planting, or both. Felling at this rate would allow 0.5-0.67% of the canopy to be renewed each year, but felling and restocking would in practice take place in episodes of, say, 10.0-13.4% restocking at intervals of 20 years. It would probably be practicable to use some of the ground in such woods as pasture. Favourable status would be maintained if:

- Mature and maturing stand structures to be maintained over at least 70% of the area. 'Maturing' in this instance would be 50 years growth or more, the age at which an oak plantation would be expected to develop an underwood, or the age at which a semi-natural oak-birch stand would start to appear mature and diverse. The criterion implies that up to 30% of an existing mature oak wood can be felled and restocked in the next 50 years.
- Rotation of canopy oaks to be at least 150 years. This allows much longer rotations, but ensures that the stand remains generally mature.
- Fell and restock patches to be a range of sizes up to two hectares. This mimics natural disturbance patterns and allows openings large enough to allow oak to grow into the canopy without permitting large clear-fell coupes. Most gaps would be no more than the spread of two to three mature trees.
- Thinning, to remove no more than of the 30% crown, in any one operation. This leaves a mature stand that would rapidly fill most canopy gaps by crown expansion.
- At least 50% of the site to remain unthinned during the last ten years. This avoids disturbing at least half the site until the rest of the wood has recovered from the last operation.
- Canopy trees retained indefinitely to be at least five per hectare. These provide a minimum density of large old trees.
- Deadwood volume to be at least 40 m³/hectare. This is slightly above the values generally obtained in managed semi-natural stands.
- Shrub layer covers at least 10% of area in stands over 50 years old. It can hardly be higher if it is to apply to strongly acid oak-birch woods.
- Regeneration predominantly natural by seedling regeneration or vegetative regrowth. In the event of regeneration failure, planting confined to oak at low density on less than 50% of the ground.
- Grazing and browsing to be reduced to allow regeneration for at least one period of 15 years in every 100 years over 50-



75% of site. This allows a pulse of regeneration over a majority in gaps and as advanced regeneration in shade within the life-span of canopy trees.

- Glades and other open space habitats (temporary and permanent) to occupy at least 10% of site. Gaps created by windthrow or silvicultural operations would count as open space habitats.

This model would maintain existing mature stands, and should be particularly suitable for mature oak woods. It perpetuates mature stands, but also diversifies the structure and helps to generate younger age-classes. It also enables timber to be utilised. The disadvantage is that stand structures and ground conditions that have been undisturbed by felling within recent decades would be disturbed, and that some habitat trees for epiphytes would be removed. Care would therefore be required to ensure that extracted trees are not only utilisable, but do not currently support rare epiphytes.

3. Standard-rotation high forest model

This would apply where new oak-dominated stands are to be created by appropriate new planting, natural regeneration or enrichment of existing (birch-dominated) stands. Since their conservation values are likely to be lower than those of existing mature oakwoods, they would be prime candidates for more intensive treatments yielding higher timber volumes. Although a few of the younger oak-dominated stands might be placed in this category, for most stands the vision of substantial oak timber yield is long-term.

‘Favourable’ criteria have been couched in terms appropriate to a hypothetical steady-state management of an existing resource. In these terms, all new woods will be in an ‘unfavourable’ state until they reach towards maturity. The basis for management would be a rotation of 100-120 years, which implies that 8-10% of the canopy would be restocked in ten years under a steady-state regime, and that 50-58% of a wood would be 50 years or more at any time:

- Mature and maturing stand structures to be maintained over at least 50% of the area. ‘Maturing’ in this instance would be 50 years growth or more, the age at which an oak plantation would be expected to develop an underwood, or the age at which a semi-natural oak-birch stand would start to appear mature and diverse.
- Rotation of canopy oaks to be at least 100 years.
- Fell and restock patches to be a range of sizes up to five hectares. This mimics

natural disturbance patterns and allows openings large enough to allow oak to grow into the canopy. Most gaps would be no more than the spread of two to three mature trees.

- Thinning, to remove no more than 50% of the crown, in any one operation. This leaves a mature stand that would rapidly fill most canopy gaps by crown expansion.
- At least 50% of the site to remain unthinned during the last five years. This avoids disturbing at least half the site until the rest of the wood has recovered from the last operation.
- Canopy trees retained indefinitely to be at least five per hectare. These provide a minimum density of large old trees.
- Deadwood volume to be at least 25 m³/ha. These are the values generally obtained in managed semi-natural stands.
- Shrub layer covers at least 10% of area in stands over 50 years old. It can hardly be higher if it is to apply to strongly acid oak-birch woods.
- Regeneration predominantly natural by seedling regeneration or vegetative regrowth. In the event of regeneration failure, planting confined to oak at low density on less than 50% of available ground.
- Grazing and browsing held at levels that allow regeneration in gaps and advanced regeneration in shade.
- Glades and other open space habitats (temporary and permanent) to occupy at least 10% of the site. Gaps created by windthrow or silvicultural operations would count as open space habitats.

These criteria allow oak-birch woods to be managed, but they do not force them to be managed, except to ensure that regeneration occurs in any gaps, and that a minimum proportion of gaps is maintained. The advantage of this model is not that it generates outstandingly valuable habitats, but provides a realistic basis on which timber can be grown using native species, thereby enabling the woodland resource to be extended. The disadvantages are that the woods would appear much more obviously managed than most existing broadleaved woodland. In so far as they are developed by afforestation, they would restrict pasturage.

4. Wood-pasture model

This covers a wide range of conditions that may once have been generated by traditional management, and which still survive on a small scale. Wood-pastures can take the form of almost closed woodland permanently open to



stock, but they may also be sparse parkland, i.e. a scatter of individual trees whose ground cover totals no more than 5-10%. Traditionally, wood pastures include large, old, open-grown trees: the trees range from large, ancient individuals to scrub. However, since any new wood-pastures would lack large old trees for a considerable time, a broader definition is used here to include grazed and open woodland that may lack old trees. Note that the boundaries of these sites are generally undefined, i.e. the area specifications below depend on the notional boundaries of the wood-pasture.

In existing wood-pastures, 'favourable' criteria would be based on retaining existing trees and a pasturage regime, whilst ensuring a limited amount of recruitment:

- Mature trees retained indefinitely covering at least 20% of the area. Existing mature trees all retained. Veteran trees.
- Grazing and browsing reduced to allow regeneration for at least one period of 15 years in every 100 years over 50-75% of the site.
- Age-class of trees under 50 years old present representing 10-50% of tree population.
- All tree species to be represented in under-50 year age class.
- Regeneration to be predominantly natural. Planting restricted to tree species that fail to regenerate.
- Where wood pastures are extended by tree-planting into pasture, criteria should be based on the satisfactory establishment of enough trees to form wood-pasture when they mature. At a ten-metre canopy spread, this implies a density of 13 trees/ha for 10% cover. Allowing for losses, and the fact that some tree species do not grow that large, a planting density of at least 50 trees/ha seems appropriate, which would be reduced by four per hectare for every mature tree already on the ground.

Wood pastures, when mature, provide excellent habitat for epiphytic lichens, and a structurally diverse habitat with large amounts of edge habitats. They allow continued grazing, afford some shelter to stock, and help to diversify 'bleak' pastoral landscapes. Regeneration, however, usually requires fencing that is expensive for the number of trees established. Whilst there is no reason why branchwood should not be harvested, in practice most wood-pastures would not yield timber.

5. Coppice model

Within the Sunart district, this could apply only to W7 and W9 woods, and in practice is most

likely to apply to limited areas of alder (W7). Coppice can be treated as a formal, highly organised system, or as a label to cover informal and irregular cutting, and there would be little to choose between them on nature conservation grounds:

- Cutting rotation to be between 15-40 years.
- Area cut to be less than 25% of the total area in any five year period.
- Cutting heights on existing stools to be no lower than the last cut.
- Standard trees retained at density of 5-20 trees per hectare.
- Grazing to be minimal for five years after cutting.

These specifications allow considerable latitude in structure, but prevent any coppice from being clear-cut completely, and ensure that rotations are at least 20 years.

Any glades would be retained by allowing grazing within five years of cutting.

Coppices provide very rich habitats, especially for the species associated with open spaces, woodland gaps and young growth of trees. Properly fenced, they regenerate vigorously and can yield a large volume of small wood. On the other hand, they preclude pasturage, and only generate mature timber habitats if special measures are taken to allow some trees to grow large and old.

Ash-hazel woods are often very valuable for epiphytic lichens, the full development of which depends on long-rotations and the retention of some older stems on each stool to provide nuclei for recolonisation of new stems. This implies that selecting areas for coppice requires care, that special attention should be paid to developing and retaining standards, and that patches of coppice should be left uncut.

Variations in models for other woodland types

Similar criteria could be adopted for the few stands of ash-elm, accepting that ash would largely replace oak as the main large, or timber, tree. Rotations might be a little shorter than for oak.

Where birch stands remain as such, without any attempt to enrich them with oak, two possibilities seem appropriate:

- i. the criteria for standard rotation high forest can be adopted with a shorter rotation, or
- ii. the criteria for existing wood pasture can be adopted.

Alder stands would generally go into either coppice or the birch version of standard rotation high forest.



Whole district scenarios

The management models do not, by themselves, form a complete basis for determining the management and restoration of the woodland resources in the district as a whole. For that, one needs an assessment of the whole resource, and a quantitative indication of where each management model would be most suitable. Accordingly, three illustrative scenarios were set out to facilitate discussion between all interested parties locally.

One basis for the scenarios was the concept of a forest habitat network, which had earlier been developed in conjunction with SNH (Peterken *et al.* 1995). The minimum requirement for a forest habitat network is about 30% forest cover, reasonably well distributed through the area under consideration (Peterken 2000b). If this is accepted as the threshold or target, the current deficiencies in the Sunart area are that the broadleaved proportion below 250 metres is too low, or that forest habitat quality is too low, *i.e.*, conifers predominate.

Broadleaved expansion

Forest Enterprise has already agreed to convert those parts of the conifer plantations that still contain a proportion of broadleaves into native broadleaved woodland. The estimated area is 500 hectares, or 9% of the plantation area.

Further new broadleaved woodland would be needed to bring the total proportion up to 30%. For practical purposes, including growing utilisable timber, this would be confined to land below 250 metres. This totals 16500 + 1700 = 18,200 hectares, so the 30% target amounts to 5460 hectares. Since 2800 hectares is already occupied by broadleaved woodland and a further 500 hectares will be generated by conversion of conifer plantations, the amount of broadleaved afforestation required would be 2160 hectares.

The land 'available' for this amounts to 3400 hectares. This is the ground below 250 metres that is (i) mapped as potential oak or ash woodland (types 1-8 of Table 2), and is not already forested by either broadleaves or plantations. The opportunities appear to be concentrated on the north side, west of Glenborrodale, but with scattered locations along to Strontian, and on the south side, east of Laudale and west of Glencripesdale. Opportunities are limited in the central parts on both sides for the very good reason that broadleaved woodland and plantations are already abundant there.

If these conversions and expansions were achieved, forested land of all kinds would occupy 54% of the Sunart study area below 250

metres, which would have substantial implications for both grazing and landscape. This may well be judged to be too much woodland and plantations, in which case two responses are available that would still enable the forest habitat network threshold to be achieved:

- Broadleaves can be introduced into the 4,400 hectares of wholly-conifer plantations, *e.g.*, on ride margins, rock outcrops, as a measure for improving habitat quality within plantations.
- The broadleaved expansion could be achieved as wood-pasture, *i.e.* by planting oak and ash into pasture, say, along margins, rock outcrops, watercourses, and continuing to use the land as pasture. This should be suitable for many woodland species, and may in the long term be particularly suitable for epiphytic lichens.

Thus, the 30% threshold for a forest habitat network could be achieved by reducing the area of broadleaved afforestation below 2,160 hectares in proportion to the area of new wood-pasture and conifer plantations with broadleaved admixture.

Broadleaved woodland management

Estimates of the state of the broadleaved woodland resource were obtained from 1988 air photographs. At the 28 intersections with broadleaved woodland recorded on the Ordnance Survey 1:25,000 map, the woodland was classified into four categories. Unfortunately, the available prints did not cover the northern fringes of the study area, so five of the 28 intersections could not be assessed.

Assuming that the omitted intersections were representative of the whole, then the existing broadleaved woodland comprises: 600 hectares well-stocked, mature trees predominate; 750 hectares well-stocked, small-crowned trees predominate; 1100 hectares poorly stocked; 350 hectares sparsely treed. These figures form an uncertain basis for considering future management, but they are all that is currently available. They allowed quantitative scenarios to be set out for broadleaved woodland management in terms of the five models. Scenario 1 allows a substantial proportion of minimum intervention in the existing mature woodland, and for all the new woodland to be treated as timber-growing broadleaved plantations. Scenario 2 allows less minimum intervention, but allows for 1000 hectares of conifer plantations to be enriched by native broadleaves, and a commensurate reduction in the area of new broadleaved afforestation. Scenario 3 repeats scenario 2, but allows for a much larger proportion of minimum intervention in existing woodland.



Fig.2: Different scenarios

	Total area of type	Minimum intervention	Long-rotation high forest	Short-rotation high forest	Wood-pasture	Coppice	Conifer high forest (CHF)
--	--------------------	----------------------	---------------------------	----------------------------	--------------	---------	---------------------------

Scenario 1:

Minimum intervention in 1/3 of mature broadleaf (BL); otherwise, all BL to be managed, no BL added to conifer high forest (CHF) except 500ha conversion to BL.

Existing pure conifer plantations	4400						4400
Converted from conifer plantation	500			500			
Existing well-stocked, mature	600	200	400				
Existing well-stocked, small crowns	750		100	400	200	50	
Existing poorly stocked	1100			800	300		
Existing sparse woodland	350				350		
New broadleaved afforestation	2160			2160			
TOTALS	9860	200	500	3860	850	50	4400

Scenario 2:

Limited minimum intervention, but more BL added to CHF, and proportionately less new BL afforestation

Existing pure conifer plantations	4400				1000		3400
Converted from conifer plantation	500			500			
Existing well-stocked, mature	600	50	500	50			
Existing well-stocked, small crowns	750		100	400	200	50	
Existing poorly stocked	1100			800	300		
Existing sparse woodland	350				350		
New broadleaved afforestation	1160			1160			
TOTALS	8860	50	600	2910	1850	50	3400

Scenario 3:

As 2, but much larger minimum intervention in existing BL woodland

Existing pure conifer plantations	4400				1000		3400
Converted from conifer plantation	500			500			
Existing well-stocked, mature	600	400	200				
Existing well-stocked, small crowns	750	200	100	300	100	50	
Existing poorly stocked	1100	50		750	300		
Existing sparse woodland	350	50			300		
New broadleaved afforestation	1160			1160			
TOTALS	8860	700	300	2710	1700	50	3400

NB; the 1000 hectares of wood-pasture formed from existing pure conifers in Scenarios 2 and 3 does not imply that all the conifers would be removed immediately. Rather, in about 1000 hectares of plantations, broadleaves would be inserted at wood-pasture density, say 10% cover.

On these three scenarios in Figure 2, the proportion of existing broadleaved woodland that would be treated as minimum intervention would be 7%, 2% and 25% respectively. The proportion that would be treated as minimum intervention and long-rotation combined would be 25%, 23% and 36% respectively.

The numbers in this analysis should not be taken too literally. They provide a semi-quantitative basis for presenting possibilities in a way that can be debated with minimal misunderstanding. Without them, discussion would be based on vague phrases (such as, 'balance between this and that'). The scenarios



can be modified and adjusted as necessary in debate and as better information on current stand structure becomes available. If a particular scenario were agreed, it would still be no more than an indication of what the people currently think is desirable. Scenario 3 should be sought in the first instance, but reviewed in the light of experience after an agreed period of, say, ten years. This would still allow a good deal of silvicultural intervention in existing native woodland, a substantial programme of introducing native broadleaves to conifer plantations, and would provide for substantial new native woodland. It would also safeguard the critical mature native woodland resource from intervention until after experience of the effects of silvicultural interventions has been accumulated in a minority of such woods. The proposed review of targets would take into account not only experience of the effects of management, but also any changes in the aspirations and policies of stakeholders.

Discussion

It is difficult to apply the concept of 'favourable condition' to woodland management. In both natural and managed woods, no single state is 'best' — there are usually several reasonable options, all with distinct advantages and disadvantages.

Natural woods are driven by episodes or events that have long-lasting effects (*e.g.* blowdowns and rare regeneration episodes) and managed woods are usually treated in pulses of activity separated by many years of minimal intervention. Whether managed or natural, woods work in cycles, and all states of a cycle are equally satisfactory. Thus, if a wood is not regenerating now, that does not mean that it cannot or will not regenerate in time to sustain the system. In any case, disturbances may be necessary to sustain woods, *e.g.* heavy grazing may be needed to create the conditions that allow regeneration when grazing is withdrawn, or felling may be needed to maintain a balanced age-class distribution. There is also a need to assess condition at several scales. That which is judged to be suitable or best in one site is determined partly by what happens at other sites, or, to put it another way, two identical stands will not necessarily merit the same treatment. Furthermore, there is also a need to consider other habitats, for species that only partly depend on woodland, *e.g.* chequered skipper in Sunart.

There is no doubt that nature conservation interests should be precise about their needs, and evolve clear criteria for judging whether conditions are satisfactory or not. Many attributes will necessarily have to be couched

in broad terms (*e.g.* oak 5-95%, which effectively says oak should be present, but not absolutely dominant). Criteria will be needed at site, district and national scales, and decision rules will be needed to determine which management model, or combination thereof, is most appropriate for each site. There is also a case for evolving a terminology that is readily appreciated by people outside nature conservation.

Acknowledgements

This Sunart study was commissioned by Highland Birchwoods and Scottish Natural Heritage, and owes a great deal to the encouragement and practical support of staff from these organisations, the Forestry Commission and people living and working around Loch Sunart. We would particularly like to thank Tim Clifford (Highland Birchwoods), Brian Eardley (Scottish Natural Heritage), Jamie McIntyre (Forest Enterprise) and Philip Sansum (University of Stirling).

References

- Anderson, M. (1967) *A history of Scottish forestry*. Nelson.
- Peterken, G.F. (1996) *Natural woodland*. Cambridge University Press.
- Peterken, G.F. (2000a) *Natural reserves in English woodlands*. English Nature Research Reports No. 384.
- Peterken, G.F. (2000b) Rebuilding networks of forest habitats in lowland England. *Landscape Research*, 25: 291-303.
- Peterken, G.F. & Worrell, R. (2001) *Conservation management of the Sunart oak woodland SAC and the potential for supporting rural development*. Report to Scottish Natural Heritage and Highland Birchwoods.
- Peterken, G.F., Baldock, D. and Hampson, A. (1995) *A forest habitat network for Scotland*. Research, Survey and Monitoring report 44, Scottish Natural Heritage, Edinburgh.
- Ratcliffe, D.A., (1977) (ed) *A nature conservation review*. Cambridge University Press.
- Ravenscroft, N. (1996) *The chequered skipper*. Butterfly Conservation, Dedham.
- Rodwell, J.S. (1991) *British plant communities. 1. Woodlands and scrub*. Cambridge University Press.
- Smout, T.C. (1997) (ed) *Scottish woodland history*. Scottish Cultural Press, Edinburgh.
- Towers, W., Hester, A., Malcolm, A., Stone, D. and Gray, H (2000) Modelling native woodland potential in the Scottish uplands. *Landscape Research*, 25: 392-394.



Bog Woodland Restoration in Finland

Raimo Heikkilä

Kainuu Regional Environment Centre, Research Centre of Friendship Park, Lentiirantie 342, 88900, Kuhmo, Finland



Natural mosaic of forest, bog and fen in Ellmyssaio, east Finland

Different kinds of pristine bog woodlands

- In the Finnish mire classification, approximately 40 different site types belonging to bog woodlands have been classified.
- About 75% of bog woodlands have been drained to improve timber growth, especially in the southern half of Finland.



Small sedge pine bog with *Trichophorum cespitosum* and *Eriophorum vaginatum*



Eriophorum vaginatum pine bog



Spruce mire with *Equisetum sylvaticum*



Spruce mire with *Athyrium filix-femina*

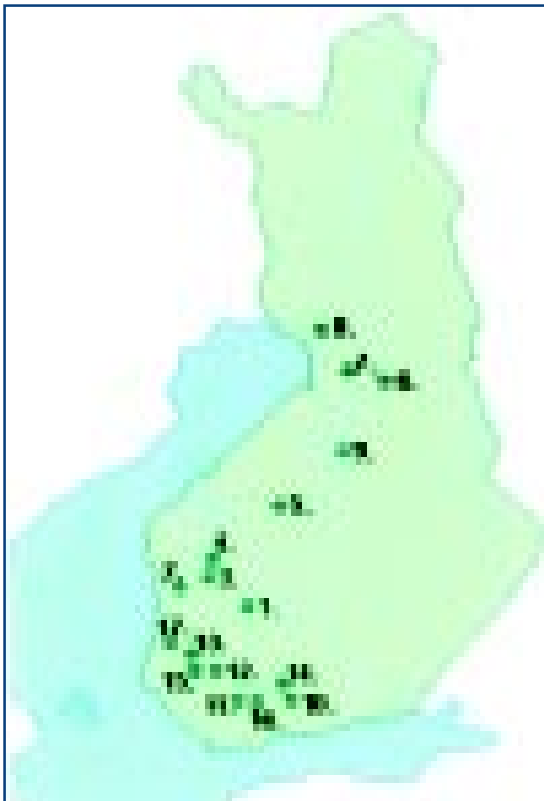




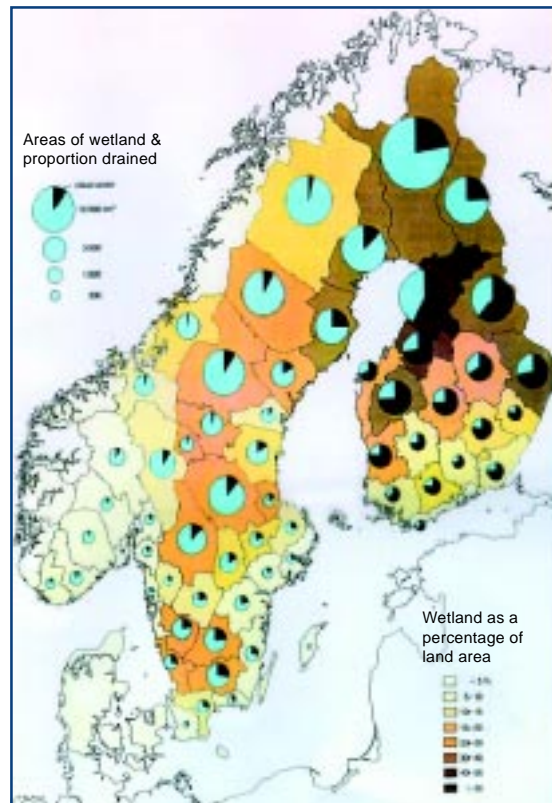
Rich spruce fen

The amount and state of mires in three countries in northern Europe

	Finland	Sweden	Estonia
Area of the country, 1000 x km ²	338.0	450.0	47.2
The amount of mires, million hectares	10.4	10.4	1.01
Mires, % of the area	32.1	23.1	22.5
Drained for agriculture, million hectares	0.7	1.0	0.3
Drained for forestry, million hectares	5.7	1.5	0.3
In peat production, 1000 x hectares	57.0	15.0	60.0
Abandoned cut-away areas, 1000 x hectares	3.0	0.3	15.0
Mires in pristine state, million hectares	3.2	4.9	0.32

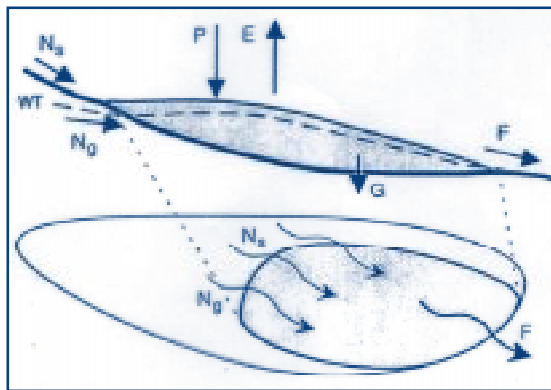


Sites restored in the LIFE project, covering 1600 hectares altogether

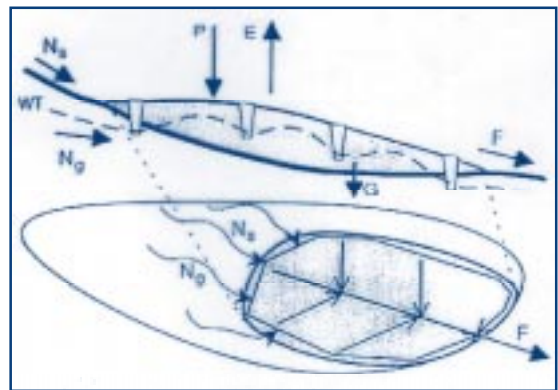


Proportion of mires and forestry drainage in different regions of Finland & Sweden





Hydrology of a pristine bog



Hydrology of a drained bog



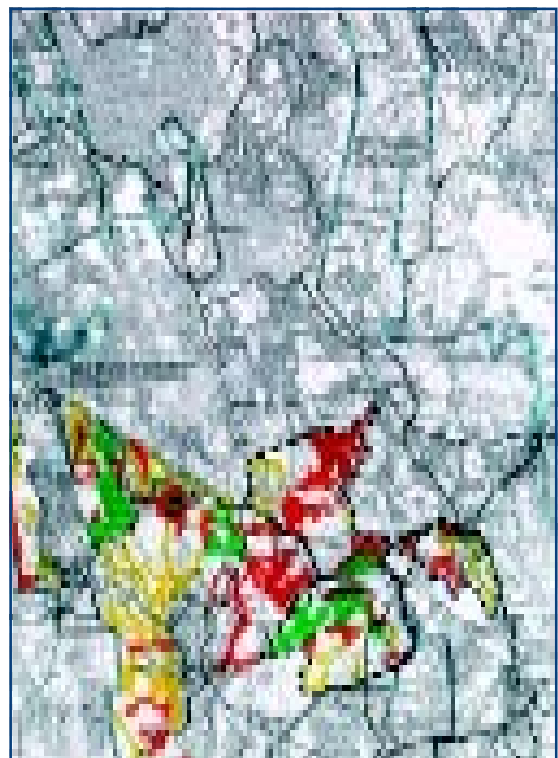
Filling of ditches with an excavator in Seitsemien National Park



Constructing a wooden dam in a ditch in Olvassuo Strict Nature Reserve

Restoring peatlands in nature reserves

- The aim is to restore the area's landscape, flora and fauna.
- Restoring the hydrology is a fundamental requirement to restore a peat-producing ecosystem.
- The basis for a peatland restoration plan should be an entire peatland system and its drainage basin.
- The most urgent sites are usually also the most difficult ones to restore (spruce mires, spring fens, transitional zones between peatlands and mineral soil forests, catchment areas of minerotrophic aapa-mires, the borders of raised bogs, habitats of threatened species, peatlands with special landscape value).



Restored bog woodlands in Seitsemien National Park, south Finland in 1996 (yellow); 1997 (green) and 1998 (red)





Drained *sphagnum fuscum* pine bog in Mustasaarenneva mire reserve, west Finland, before restoration in 1997



Previous site after restoration in 1999



Restored bog woodland landscape in Sotkamo, mid Finland

How restoration success is evaluated

- Inventories and monitoring of hydrology, vegetation succession, birds, butterflies and moths in nature reserves.
- Studies on the carbon cycle on restored peatlands.

Restoring peatlands in forest drainage areas

- Especially important in Finland (56,000 hectares in present and planned nature reserves plus 0.5 million hectares where profitable management for forestry has failed).
- Buffer zones between forestry land and waterways to filter suspended solids and nutrients and to restore biodiversity.

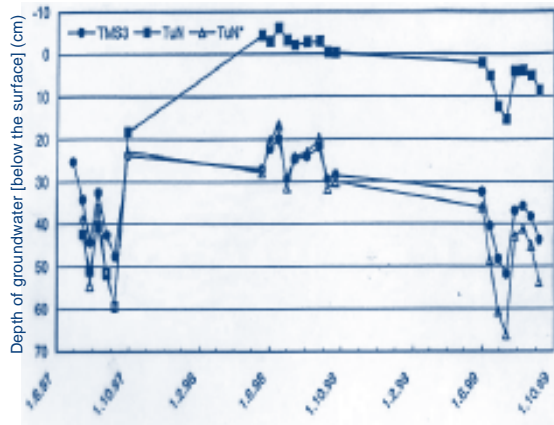
Restoring peatlands in other areas

- To support the continuity of peatland ecology in general.
- To create any kind of aesthetically and recreationally acceptable wetland landscape.

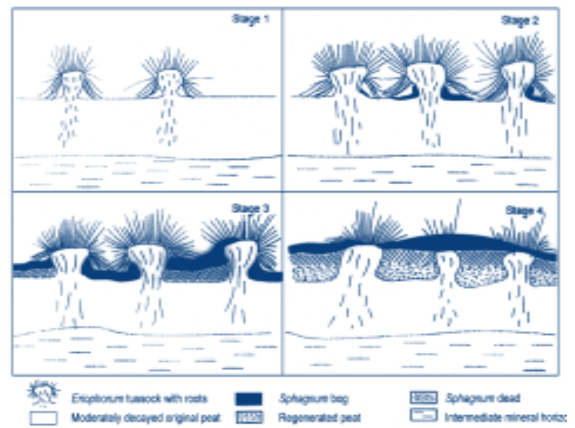
Precautions of restoration in general

- The likely risks and benefits of restoration should be evaluated.
- Restoration work must not endanger the valuable protected features of the areas.
- No measures need to be taken if changes induced by natural processes are currently moving in the right direction and will lead quickly enough to the re-establishment of a natural state similar or comparable to the original state.





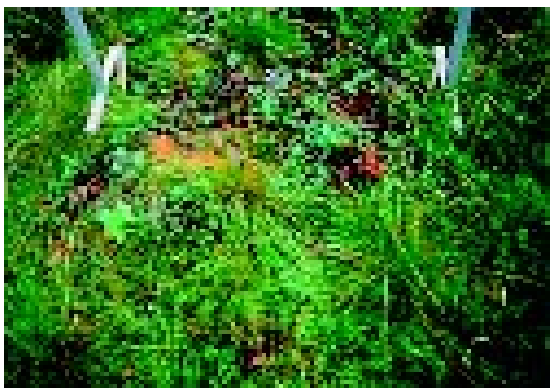
Fluctuation of water level in a restored mire and two drained sites



Restoration succession in an abandoned cut-away area



Vegetation monitoring plot in 1997



Vegetation monitoring plot in 1999

Conclusions

- Restoration of peatlands drained for forestry is important, both from the nature conservation and water protection point of view.
- In cut-away areas, restoration is usually one of three options — forestry, agriculture or creating water-fowl habitats.
- After peatland species establishment, carbon balance changes *i.e.* restored peatland becomes a sink for carbon.

• This paper is adapted from a PowerPoint presentation given at the conference

Deer Management Requirements for the delivery of Natura 2000 Objectives in Atlantic Oakwoods

Phil Ratcliffe¹ & Brian Staines²

¹Lochan Wood, Sandbank Road, Dunoon, Argyll PA23 8QR

²260 Contlaw Road, Milltimber, Aberdeen AB13 0EJ

This paper proposes a vision for the favourable conservation status of Atlantic Oakwoods in Scotland in about 25 years time, relevant to the interactions of wild deer and their woodland habitat. It builds on the criteria proposed by Peterken & Worrell (2001) for Sunart Oakwood candidate Special Area of Conservation (cSAC). A strategic approach aimed at achieving a shift in management from the current condition of unacceptable impacts of deer to a situation of 'favourable conservation status' for the SAC Atlantic Oakwoods is proposed. The ethos reflects the view that the management focus should be on the habitat and deer range, rather than on the deer themselves, and that the landowners and tenants have a responsibility of good stewardship toward Natura 2000 sites.

In addition, this paper provides an introductory framework for the development of individual deer management strategies for candidate SACs at Loch Lomond, Loch Etive and Sunart. Individual plans have previously been drafted for Rahoy (Sunart), Loch Etive, Loch Lomond and Tainish.

The ethos adopted here is to introduce strategic approaches to deer management that illustrate best practice regardless of current land-uses, policies, attitudes, traditions and short-term solutions. For example, it is important that deer densities and impacts, which have led to the recent erection of deer fences as a short-term measure to achieve regeneration, are reduced so that it will not be necessary to maintain these fences in perpetuity. It is vitally important that this approach fully considers the practical means of progressing from the current position to the vision encompassing a 'favourable conservation status'.

Natura 2000 objectives for woodlands

Natura 2000 is a network of areas designed to conserve natural habitats and species that are rare, endangered or vulnerable in the European Community. The conservation of habitats and species other than birds is focused on Special Areas of Conservation (SACs) and supported by the Habitats Directive. This is an important vehicle for delivering, in a European context, the agreed objectives of the Biodiversity Convention, which was agreed by more than 150 countries at the Rio Earth Summit in 1992.

There is a statutory requirement on government to protect Natura 2000 sites.

The following woodland types have been identified as requiring attention: alder woodland on flood plains — residual alluvial forests (*Alnion glutinosa-incanae*); bog woodland; mixed woodland on alkaline soils associated with rocky slopes (*Tilio-Acerion* ravine forests); Scots pine forest (Caledonian forest) and western acidic oak woodland (Old Oakwoods with *Ilex* and *Blechnum* in the British Isles). The latter type is synonymous with the 'Atlantic oakwoods' recognised by the Caledonian Partnership and which are the subject of this study.

Within the UK, the UK Biodiversity Action Plan has led to a series of Habitat Action Plans (HAPs) for the most important habitats. The HAP for Upland Oakwoods covers a much wider suite of woodlands than those included in the Natura 2000 programme. Sites covered by the HAP are not restricted to the best examples nor are they confined to the wetter oakwoods of western Britain. Rather, they include all oak woodlands described in the Ancient Woodland Inventory. The Atlantic Oakwoods are thus a sub-set of this type.

An important provision of the Habitats Directive (transposed to UK law in Regulation 37 of the Habitats Regulations), and one which is often overlooked, is the requirement to improve the ecological coherence of the Natura 2000 network of sites. The definitions of 'favourable conservation status' for habitats and species support this objective. This requires policies to encourage the management of features of the landscape that are of major importance for wild flora and fauna. A consideration of opportunities to expand and connect woodlands, especially through application of the principles of forest habitat networks is incorporated here.

Favourable conservation status and favourable condition

The objectives of Natura 2000 include the introduction of management regimes that will achieve favourable conservation status of habitats and species. Favourable conservation status of a natural habitat is achieved when its natural range and areas it covers within that range are stable or increasing, the species



structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and, lastly, the conservation of its typical species is favourable (as defined below).

The favourable conservation status of a species is defined when population dynamics data on the species concerned indicate:

- that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- the natural range of the species is neither being reduced nor is likely to be reduced in the foreseeable future;
- that there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

An interpretation of favourable conservation status aimed at the site level has been developed in the UK and is referred to as 'favourable condition.' Within the context of the Sunart Oakwoods cSAC, Peterken & Worrell (2001) have described a range of conditions that they believe will satisfy the requirements. This range of conditions can be described by using *habitat criteria* e.g. acceptable species composition and woodland structure, and/or using *management criteria* e.g. acceptable management regimes, such as use of appropriate felling coupe sizes and thinning regimes.

The criteria used to assess these must be measurable in the field so that comparisons can be used to monitor progress toward the achievement of favourable conservation status and favourable condition. Once these conditions have been achieved, limits of acceptable change can be described to provide the basis for future management and the maintenance of favourable condition.

Criteria for favourable condition

Peterken & Worrell (2001) suggest the following criteria for the areas of the Sunart Oakwood cSAC that have been identified as oak woodlands (W11 & W17) within the National Vegetation Classification (NVC):

- Composition should be assessed at a large scale (ten to 100 hectares) and not at a stand scale.
- Oak should represent between 5-95% of live trees (measured by basal area or volume) *i.e.* only oak monocultures and a virtual absence of oak throughout an entire wood would be considered unfavourable.
- Site native tree and shrub species should comprise at least 95% of the stand. However, where this level is currently exceeded, the actual proportion should be regarded as the lower limit of acceptable change.

These criteria should be applied to all birch and oak woods below 250 metres, except that a lack of oak is acceptable in birch-purple moor-grass (W4) woods.

The deer species

There are four free-ranging deer species in Scotland. Red and roe deer, the two native species, are extant in all the proposed Scottish SACs. Fallow deer were introduced into Britain in Norman times and a small population occurs in the southern part of the Loch Lomond cSAC. Sika deer were introduced into Scotland in the 1890s and are now widespread throughout much of Scotland. All of these deer species are normally associated with woodlands, although red deer in Scotland have adapted to occupy large expanses of open range where they have been traditionally managed for sport hunting.

The management of high densities of red deer for stalking has been a primary land use for over two hundred years. Conflicts between red deer-sporting interests and other land uses have been evident for almost all of this time and it would be naive to believe that this project could solve this problem. However, attempts are made to advance the debate by suggesting important shifts in current approaches and thinking which, hopefully, will help towards achieving a solution.

The ecological role of deer in Atlantic Oakwoods

Virtually all British woodlands evolved in the presence of deer and they are an important component of woodland ecosystems. Native deer should, therefore, be regarded as a 'keystone species', given their important role in creating a diverse structure that in turn supports a high degree of woodland biodiversity. Amongst the species that benefit from limited grazing by deer are oakwood specialists such as redstart, wood warbler, pied flycatcher and tree pipit. In the drier pinewoods, wood ants, crested tits and capercaillie also benefit from the structural diversity created by deer.

Tree regeneration and establishment is dependent upon subtle influences of climate (both annually and seasonally), site quality and tree species. For example, many tree species are close to their climatic limits in Scotland and produce seed only sporadically. Where deer are present, the planning of management intervention to favour natural regeneration, for example group felling to coincide with plentiful seed crops, will increase the chances of successful establishment but it is recognised that predicting such conditions can be difficult.

In terms of the restoration of 'favourable condition', (defined later), it is important to



recognize the differing approaches required to achieve the release of suppression of existing seedlings and on the other hand, the regeneration of new seedlings following seed dispersal and germination. A lack of tree regeneration is frequently due to a range of factors that have no connection with herbivory. Conversely, the suppression of high densities of existing seedlings is a frequent phenomenon in native woodlands that is directly attributable to the presence of herbivores.

Given the beneficial effects on the woodland ecology of low intensity grazing levels, it is desirable to maintain a low density of deer in most cases. The historical presence of large predators may have provided an important regulatory factor in controlling deer populations and maintaining low densities and their recent extinction has made it difficult to maintain appropriate densities. Habitat fragmentation and short rotation commercial forestry have also increased the capacity of habitats to support high densities of deer. It is important, therefore, to make the most effective use of all of the methods available in order to maintain densities that are compatible with forest management objectives. However, roe deer are not well adapted to the wet oceanic climate of western Britain where many juvenile animals do not survive heavy prolonged spring rain. Currently, therefore, red deer are the most significant species in terms of negative habitat impacts.

Acceptable deer densities

A total absence of grazing can lead to the development of dense thickets that prevent light reaching the forest floor, thus having a detrimental impact on some species. However, deer densities greater than ten deer *per* km² can markedly alter vegetation composition and structure, for example driving a change from dwarf shrubs to grassy swards.

From a working knowledge of the impacts associated with relative extremes of deer density (eg 0-2 deer *per* km² compared to >20 deer *per* km²), coupled with limited research, a rule of thumb has frequently been applied in recent years, which suggests that densities of 2-6 or 4-8 deer *per* km² may be compatible with woodland regeneration.

A rapid response of suppressed seedlings, following a reduction in deer densities to these levels, has been demonstrated at Inshriach, Abernethy (Strathspey) and Rothiemurchus on Scots pine and birch, and on birch and other broadleaves at Creag Megaidh (Loch Laggan), in recent years. The exact threshold at which seedling suppression occurs varies, is dependent upon local conditions, and needs further research.

Research by the Centre for Ecology and Hydrology (Palmer *et al.* 2001) supports the view that the threshold densities vary and goes further to suggest that “blanket recommendations based upon a threshold density are likely to be over-simplistic”.

Although this is almost certainly true, simple rules of thumb are necessary to guide managers toward approximately acceptable densities of deer. Having achieved approximate target densities in the range, two-eight deer *per* km², an acceptable growth increment on seedlings can be achieved through modification of local deer control practice. This research also highlights a number of other factors that have a role in reducing the establishment and growth of saplings. Low light levels under dense canopies of oak appear to reduce growth rates and reduce the potential for compensatory growth of oak seedlings in particular. However, the response of long-established browsed seedlings in open areas did show a satisfactory response following a cessation of grazing (Palmer *et al.* 2001).

Management criteria

Peterken & Worrell (2001) suggest using ecological and management requirements, inferring that management requirements are often easier to monitor. This is not the case with regard to deer densities, nor does it measure the direct conservation objective. For example, an objective that ground vegetation should be at least 30 centimetres high in May where ferns and grasses are dominant, provides a much easier measure than measuring the density of wild deer. Importantly, however, measures of deer density facilitate predictive management, and it is suggested, therefore, that both of these need to be carried out in monitoring progress toward favourable condition in cSACs.

In addition, and with regard to the role of native species of wild deer in ecosystem dynamics, it is proposed that open glades and a reduced density of seedlings and saplings are naturally associated with densities of deer in the range 2-6 deer km², while allowing some regeneration in gaps. These impacts have an important positive effect on a number of other species and in this respect native deer should be treated as a ‘keystone’ species. Depending upon the densities of deer on adjacent range, fences might help or hinder the achievement of these densities locally in the short term.

This necessitates the adoption of a further criterion aimed at ensuring the recruitment of seedlings into the shrub and tree layers. However, this will be influenced by the management regime adopted. Peterken &



Worrell (2001) suggest five possible regimes appropriate to the Atlantic oakwoods; minimal intervention, long-rotation high forest, standard-rotation high forest, wood pasture, and coppice.

In minimal intervention areas, no domestic stock would be permitted and it is proposed therefore that seedling performance should indicate that at least 20% of previous years' seedlings are undamaged and are at least 30 centimetres above the surrounding vegetation in May.

The same criteria should apply in long and standard-rotation high forest and also wood pasture, except that domestic stock grazing can be allowed so long as this is excluded for ten-15 years in each 100 year period over 50-75% of the woodland (Peterken & Worrell 2001). Wild deer densities will need to be maintained in the range of 2-6 per km² during the stock exclusion period.

Coppicing is not recommended in upland oakwoods as it can damage the high bryophyte and lichen interests of these woodlands. Pollarding is seldom used but does protect newly growing shoots from large grazing mammals. This can successfully permit low levels of grazing while facilitating woodland regeneration and its use should be further investigated. Coppice management is probably only likely over small areas of slope alder woodlands (W7), (Peterken & Worrell 2001). Such a regime is likely to involve small patches of clear cutting where very low levels of grazing can be permitted for up to ten years after coppicing. The suggestion to restore woodland on 30% of land below 250 metres by planting and regeneration will necessitate the wider application of the threshold densities of wild deer discussed earlier.

A vision

The area of oakwoods will extend beyond each current cSAC area to encompass adjacent areas of potential oak woodland and will continue to increase over all suitable land below 250m. The presence of oak will vary from none in adjacent birch-purple moor-grass woods to around 95% in some managed woods. Site native species will account for more than 95% of shrub and tree species. Old growth core areas (minimum intervention natural reserves) will have been identified on appropriate sites and will provide connectivity within the wider woodland area for a large number of relatively immobile species. Representative species will have been identified and their conservation requirements put in place through the Local Biodiversity Action Plan (LBAP) process. These will aim to maintain and increase the numbers of species where appropriate.

Deer densities will be maintained in the range two - six deer per km² throughout the woodland, but domestic stock may be seasonally grazed in the long and standard-rotation and wood pasture areas for periods of 15 years in each 100-year period (this is more likely where pollarding has been used). In the areas not grazed by domestic stock, the herb layer will be at least 30 centimetres tall and at least 20% of previous years' tree and shrub seedlings will be undamaged, and extend at least 30 centimetres above the surrounding vegetation in May of each year.

Deer fences will only occur where strategic planning aims to optimise the use of fences (*e.g.* a minimum of fences is used where it is necessary to separate high-density red deer range, that is managed for sporting objectives, from woodlands).

Constraints to achieving the objectives

In the Scottish cSACs, overgrazing is recognised as one of the primary threats preventing the achievement of favourable condition. Indeed, throughout Scotland, overgrazing by wild deer is one of the primary factors suppressing the regeneration, expansion and potential natural diversity of all native woodlands. Populations of all species of wild deer in Scotland have risen substantially in recent years. Densities throughout the year frequently exceed ten deer km² and in some cases they exceed 20 deer km². Winter densities can be considerably higher than this, in some cases reaching 150 deer km², where deer are concentrated onto sheltered areas by severe weather.

However, it is important to distinguish situations where deer may not be responsible for a lack of regeneration. Heavy shade, poor seed production and unsuitable ground conditions for germination, result in poor establishment of tree seedlings. When deer are the problem, seedlings are often present, sometimes at very high densities, but remain suppressed below the level of surrounding vegetation.

The public agencies responsible for nature conservation (Scottish Natural Heritage, SNH), forestry (the Forestry Commission, FC) and deer management (the Deer Commission for Scotland, DCS) recognise the need to reduce deer numbers in order to restore native woodlands. However, on privately-owned land adjacent to woodlands with sporting (deer hunting) objectives, the reduction of deer densities is frequently resisted due to the socio-economic benefits of this as a primary land-use. Yet it is these deer in particular that often cause serious impact on these woods in winter.



In practice, the local reduction of deer densities in Scotland has seldom been achieved, and, throughout the country numbers continue to rise. A considerable tension exists between people and organisations with conflicting and sometimes apparently irreconcilable objectives. In spite of this, skeletal Deer Management Strategies have been produced for three cSACs.

High fences to separate conflicting land uses, particularly forestry and deer stalking, have been used widely throughout northern Scotland. The complete exclusion of deer from forest plantations during the first ten-20 years has succeeded in establishing many commercial forests in high-density deer range. However, deer fences present a number of problems including the killing of significant number of birds (especially rare woodland grouse), access difficulties, landscape impacts and, not least, high cost. The importance of the presence of low densities of native deer as keystone species has been referred to earlier and the complete exclusion of deer is another important disadvantage of fences.

The size, complexity and differences in the objectives of individual owners are very variable between the five cSACs. For example, at Taynish, most of the area is owned and managed by SNH as nature reserve. High quality data is available for the deer population and monitoring is underway. Conversely, the woodlands of Loch Etive, Loch Lomond, Loch Maree and Sunart are woodland patches dispersed in a landscape of upland farms, with adjacent sporting estates and numerous different owners.

At Sunart, Loch Etive, Loch Maree and Loch Lomond many areas of previously unenclosed woodland have recently been fenced under this LIFE project. This is an acceptable form of management aimed at rapidly 'kick-starting' woodland regeneration in the face of high densities of deer. However, it is unacceptable in the longer term as a way of achieving favourable condition. Deer management strategies must develop ideas accordingly, aimed at a large reduction of fences in ten to 15 years time.

Funding packages directing public funding toward delivering public policies are currently inefficient and short-term. Private owners and occupiers cannot gain financial benefit from providing non-market benefits. Alternative income streams and the support required to develop them are often not available.

Delivering the vision

- Natura 2000 sites are, by definition, the highest quality representatives in the UK. Nature conservation must take priority aimed at achieving favourable condition within ten to

20 years (compare the Sandford principle applied in Scottish National Parks). In this context the DCS should broker the development of Deer Management Plans incorporating voluntary control agreements (Section 7, Deer Act, 1996), supported by compulsory powers (Section 8), if required.

- Deer densities must be reduced to two to six deer *per km²* within existing cSAC woodlands and in the proposed extension zones adjacent to them (making use of maps showing potential woodland cover, *etc.*) In the short term this may require a combination of fences and deer control, but, within 15 years, plans should be agreed for substantial reductions in deer numbers to achieve the Natura 2000 objectives with minimal deer fences.

- A strategic, large-scale approach to planning fencing needs may facilitate a net reduction in the length of fences compared with many smaller fenced areas that have developed in an ad hoc fashion. There is a need to reduce deer numbers to compensate for the loss of range when large areas are fenced. Areas that are currently fenced, and those that have been recently fenced, should be the subject of early discussion aimed at agreeing alternative approaches well before these fences require maintenance and renewal (15-20 years).

- Initiating a dialogue with all stakeholders, especially neighbours, as soon as possible (and certainly within two years) with a view to an unhurried, uninterrupted and constructive debate, should facilitate a shift from the present situation toward the achievement of the Natura 2000 objectives. This should focus on the management requirements to deliver a pattern of woodland at the landscape scale that reflects the management regimes discussed earlier, and aimed at delivering the vision. It must also consider appropriate alternative income streams and incentives to provide public benefits.

- Individual deer management strategies need to consider how this can be achieved at a local level and to examine local constraints. Specifically, they need to address the problems arising from discrete deer populations whose ranges encompass a highly variable mix of habitats, land ownerships and management objectives. These strategies need to consider alternative income streams relevant to local socio-economic conditions.

- Many of the desired benefits from this LIFE project will only be achieved by restoring connectivity and sufficiently large patch sizes (relating to representative species) of woodlands. The concept of catchment management should be applied. Expansion zones based on the presence of appropriate precursor vegetation



need to be identified for all SACs. Equally, continuity (temporal) of large old, senescing and dead trees is important and old growth core areas need to be identified on maps as soon as possible within a wide range of current age classes.

- Implicit in the DCS's vision for wild deer in Scotland is a shift toward higher quality deer on better quality land. The DCS envisages that a growing proportion of the red deer population will live in woodlands or use woodlands for much of the year. Deer populations will be managed locally so that their management is fully integrated with all local land-use objectives and plays a constructive role in the long-term stewardship of natural habitats. The realisation of this vision will require reduced densities in many places and will require the involvement of local communities and other interests as envisaged by the DCS.
- The development of a hierarchical approach to deer management planning coupled with habitat condition assessments will provide important information to inform the dialogue on deer management requirements. It is important that public funding is made available to support this and mentions of funding to support various forms of management planning within the new National Park framework is welcomed. This would certainly assist in meeting the SAC objectives at Loch Lomond and may create an important precedent elsewhere.
- Management strategies should be developed from the basis already provided through Deer Management Groups, especially those with Deer Management Plans (within three years). The analysis of Forest Enterprise's approach to deer management in Glen Affric (Staines 2001) provides a useful appraisal of the problems caused by conflicting management objectives on adjacent land ownerships. It also provides a useful approach to beginning a dialogue aimed at reconciliation.
- Significant reductions in deer numbers and local densities impacting on native woodlands may be achieved with relatively small reductions to the numbers of stags available for sport. When younger stags achieve high body weights and large antler growth as a result of reduced densities, and sporting clients are willing to take these and hinds as legitimate quarry animals, this can also reduce the total population size required to provide an economically sustainable number of animals for sport. The sporting trophy is a relatively modern innovation in hunting. A shift in ethos from the trophy as the main reward from a day's stalking toward the hunting experience itself, could significantly change market expectations and lower the necessary

population sizes required to deliver objectives. SNH and DCS should make positive steps to introduce this concept within one year. Deer management strategies should provide examples of modelling to show examples of population sizes/sex ratios required for sporting animals.

- A significantly reduced reliance on deer fencing to protect trees from deer damage in the future is a fundamental principle. However, this will not be achieved immediately as many private estates do not have sufficient resources to guarantee successful tree establishment in the presence of high densities of deer on adjacent land. In addition, alternative income streams are required to replace lost income from reduced deer stalking enterprises. Deer fences to separate high-density populations (>ten deer *per km*²) on sporting estates from woodlands are still necessary in some places.
- Individual deer management strategies should be drafted for sub-areas within each of the larger SAC areas within three years. Existing Deer Management Groups may facilitate this.
- Funding packages directing public funding toward delivering public policies are required. This is necessary to ensure that private owners and occupiers gain financial benefit from providing non-market benefits and from developing alternative income streams to replace unsustainable land-uses.
- DCS, SNH and the FC should formalise arrangements to present coordinated incentives for approval by government within two years.
- Capital values of sporting estates are currently aligned to sporting outputs that encourage over-stocking of deer. A change in ethos toward rewarding good stewardship of the land and a reconsideration of tax incentives, inheritance and capital land values is necessary. SNH, in particular, should pursue this policy.

References

- Palmer, S. C. F., Truscott, A. M., Mitchell & Welch, D. (2001) *Grazing in Atlantic oakwoods: final report*. Caledonian Partnership.
- Peterken, G. F. & Worrell, R. (2001) *Conservation management of the Sunart oak woodland SAC and the potential for supporting rural development*. A report by SNH and Highland Birchwoods for the Caledonian Partnership.
- Ratcliffe, P. R., Peterken, G. F. & Hampson, A. (1998) *A Forest Habitat Network for the Cairngorms*. SNH Research, Survey & Monitoring Report No 114.
- Staines, B. W. (2001) *The red deer management strategy for Glen Affric*. Unpublished report, Forest Enterprise.



Sweden — Integrating Natura and Community Aspirations

Erik Sandström

National Board of Forestry, Environmental Department, S-551, 83 Jonkping, Sweden

- *This paper is adapted from a PowerPoint presentation given at the conference*



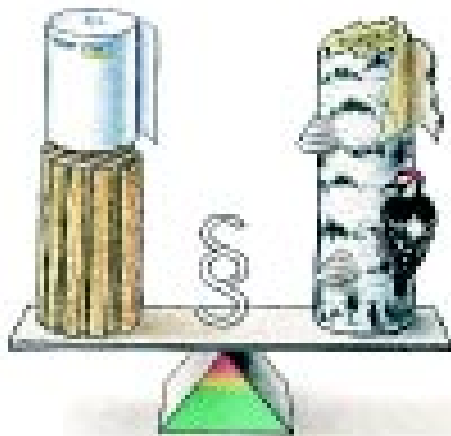
Conditions for forestry are very different between Sweden and Scotland; 50% of the forests in Sweden, for instance, are family holdings. The total area of forest, and other wooded land, per person is more than 80 times that enjoyed in the UK. The National Board of Forestry is the agency, that on behalf of the government co-ordinates the work of ten Regional Forestry Boards with almost 100 forest districts. This organisation is in charge of the implementation of forest policy in Sweden and cooperates with LIFE Environment projects.

Tradition of co-operation with forest owners

This photograph (right) illustrates the most determining factor for our way of implementing the forest policy. Regeneration cuttings are performed on some 40,000 locations every year, totalling some 200,000 hectares. We don't know when these cuttings take place. For perhaps another 150,000 forest operations, we don't even know where they take place. Thus, forest policy can only be implemented to the extent that it is supported by the forest owners, as well as other organisations.



Accordingly, forest policy is developed in consensus with representatives of owners of small and of very large holdings. The basic means for implementation is the competent local personnel. They adopt a problem-solving attitude. The means at their disposal are advice, contractual services, inventories, subsidies and the Forestry Act.



Production and environment are equal

How is it possible to achieve a balance between lumber and paper on the one hand and decaying wood, fungi and woodpeckers on the other? The scales are a symbol of the policy of the Swedish National Board of Forestry (Skogsstyrelsen), balancing environmental and production objectives;

"...forests must be managed so that plant and animal species, which exist naturally in the forest ecosystems, can survive under natural conditions and in viable populations..."



Greener Forests Extension

The Greener Forests Information and Training programme visualises and implements the forest policy goals. During 1999-2001, it involved more than 100,000 participants, one third of whom were full-time; almost 70% of them spent more than ten hours studying the subject without any economic compensation. This photograph (right) illustrates a typical training session in the forest.



White-backed woodpecker, landscapes and new nature reserves

To the left is pictured the cover of the National Board of Forestry booklet on the white-backed woodpecker. It dates from 1983. This was one of the first LIFE-Nature projects in Sweden and included the National Board of Forestry, Swedish Environmental Protection Agency and 11 regional authorities. It took place on private land between 1996 and 1999 and cost 3m euros.

At this time, Sweden's Natura 2000 lists had not yet been proposed to the government. The Commission made an effort to be able to include this project. This made it possible to include quite some innovative approaches to co-operation with farmers and a diversity of instruments were combined in core areas.

Strategy for approach to forest owners

The project concentrated on ten core areas important for the woodpecker. In these areas, every forest owner was invited to information meetings. An information leaflet was developed and distributed to the landowners.

Landscape analysis was used to identify the most important sites in the core areas. These crucial sites were visited together with the landowner, often several visits being made to the same site. During these visits, the district forester discussed every aspect of production and environment in the forests on the holding.

How did the forest owners react?





The project and forest owners

Some forest owners were rather sceptical about the project; many, however, were interested. They were attracted by the use of positive, active measures to promote the environmental objectives in the forest. Woodpeckers depend on habitats with lots of dead and decaying deciduous wood, preferably in small dimensions. Such habitats used to be created by forest fires and flooding, both of which have almost disappeared from Swedish forests. However, suitable habitats can be created through controlled fires or by removing the conifers from mixed stands.

Time is needed for the forest owners to accept the idea of giving up land or to deliberately decrease their wood production. However, a spirit of confidence, trust and patience may, in the end, lead to success. It is an advantage to work intensively in an area, as the landowners tend to inform each other.



Local participation in sustainable forest management

This was the National Board of Forestry's first LIFE Environment project. Local participation in sustainable forest management, based on landscape analysis, was used to find ways to reconcile economic, ecological and social claims on primarily private forest land. We have certainly learnt a lot from the project.

The map (left) shows the location of the demonstration areas in Sweden and Finland. The project took place from 1997 to 2000 and cost 2.2 million euros.

Implementation of landscape analysis

A step-wise model for landscape analysis is to study the constraints, establish the present state; base goals on facts and visions; propose measures and to evaluate the effects.

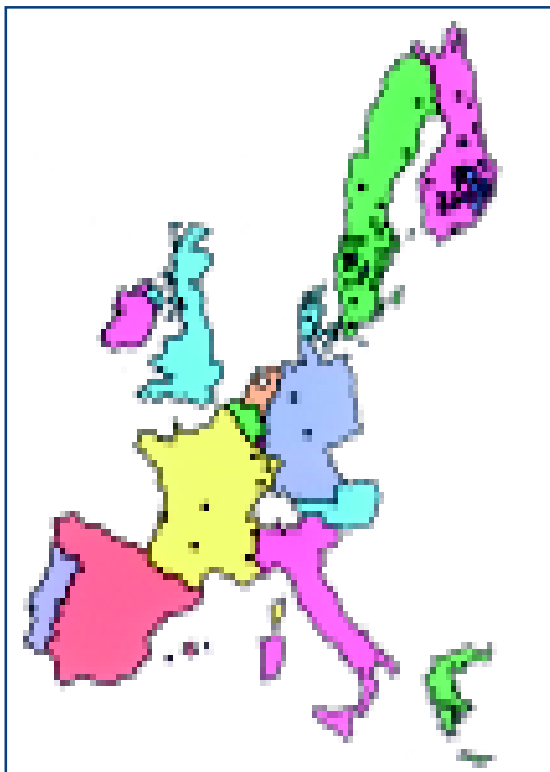
A major learning experience was that it takes a long time to arrive at participation. Thus, the effects could not be evaluated since the participatory process had taken too long.



Local participation

Local participation should be voluntary, honest and open and is developed where issues concern the participants. A good leader is needed; this project involved almost 3,000 individuals. The participatory process proved to be very time consuming but the groups respected the forest owners' responsibility for decisions.

Recommendations and observations based on the project experiences can be found in the report on: www.svo.se/life/participation



Other LIFE projects

The Swedish Forest Administration is co-operating in six additional LIFE projects, which include monitoring methods; bio-cultural heritage; liming the whole catchment; water quality and aquatic biodiversity; urban woods for people and satellite images to protect the environment.

The UK Forestry Commission is involved in the *Demonstration of Sustainable Forestry to protect Water Quality and Aquatic Biodiversity*. The project manager is Peter G. Hopkins; for further information see: www.creevalley.org.uk

Demonstration of use of satellite images, estimations and www in forestry to protect nature and prevent environmental accidents. The leader of the UK component for this project is Dr. Danny Donoghue of Durham University.

The LIFE fund has made it possible to create and enjoy partnerships between 31 different organisations in Sweden and 14 organisations in other Member States. The map shows the location of the demonstration areas involved.

Further information is available at: www.svo.se/life



Sunart conservation and rural development

Michael Foxley, Highland Councillor

Dun Farnh 2, Achaphubuil, Tresleig PH33 7AL

I hope that I will be able to do justice to the strength of the Sunart Oakwood steering group partnership and also to the amazing beauty of the woods themselves. This contribution is entitled *Conservation and rural development*, but I really want to focus on woodlands and people, and by people I mean the culture. I want to transmit the enthusiasm everyone has for the project, the strength of the partnership and the key role of European money. I mention money because that's the most important part of it. There is also a big issue of the wheel starting to finally turn as regards to the woodlands in the area around Loch Sunart. I am going to focus on what it was like, what it became and what we are intent on putting back.

To put the matter in perspective, it started with a small pilot project involving the Forest Commission and private owners, basically between Strontian and Glenborrodale. The project then grew to the watershed around Loch Sunart, up to Acharacle. Because of the strength of what was happening, and the fact that some of us are expansionists, we are now up as far as Moidart, and down to the Sound of Mull. We have kept the title 'The Sunart Oakwoods' because it has a certain sort of cachet and the name is becoming known; we are now covering an area of almost 80,000 hectares in the overall project. Sunart is unique, being a multi-partnership/ownership initiative encompassing lots of different projects. The project needs more European money; I would like to emulate the Irish habit of getting up to 75/90% funding!

These are very beautiful oakwoods; it's what makes living and working in this area such a joy because we have such good native woodland around us. To put this in perspective, the Ice Age retreated 12,000 years ago and the oakwoods were well established 6,500 years ago. In this area are some of the oldest settlements in Scotland; Rum, for instance, has settlement going back to 9,000 years ago. The area is extremely rich in archaeology. I am particularly interested in the archaeological research in this area because it is warping some perspectives about woodland management. There are some people who thought that culture just arrived with Victorian private owners or with the advent of the Forestry Commission, but in

fact it had been around for millennia before that. In terms of the last 2,000 years and, in particular, the impact of culture on the trees, the formidable force of Calum Cireadh and the Celtic church spread out from the West Highlands throughout Europe. One of the ironies is that Calum Cireadh and his followers are more famous in Prague than they are in Fort William, but that's one of the things we intend to redress in the years to come.

A further formidable force, the Norsemen, then arrived. Strontian Glen was called Glen Egadale (the oak valley), by the Vikings and the wood was used for their boats — they needed a 15 metre trunk for the keel of one of their boats. The Norsemen, assumed to be managing woodlands appropriately at the time they held power, had an enormous impact. Despite the fact that their influence disappeared about 1,000 years ago, some place names are derived from the Norse so there must have been a steady assimilation with the indigenous population.

The next major phase was the Lordship of the Isles. This had a formidable influence in terms of music, poetry and buildings. This was a time of pasture land, with pollarding of trees and coppicing. In the Sunart Oakwoods, coppicing was thought to have started in the 17th century. I was told this morning that it must have been going on for hundreds if not thousands of years prior to that. So there is a long established history of woodland management. About 250 years ago, the system started to collapse, partly due to a collapse of management. Hugh Cheape is researching the Clan Ranald management of woodlands, but a great deal happened in 1746 apart from the butchery at Culloden and the genocide that followed. The clan system was already starting to break up, and was followed by the demise of communal management, the clearances, the arrival of sheep and overgrazing and the establishment of deer forests.

The first Forestry Commission acquisitions followed, together with the public/private partnerships. Many of the magnificent oaks at Loch Sunart were felled to waste about 40 years ago. The public authorities cannot be held totally to blame; the private landowners were planting rhododendrons all over the place. This seemed



like a good idea at the time except that they spread tremendously. The main threat to the woodlands was thus grazing, conifer planting and the spread of rhododendrons.

I knew, as a regional councillor since the mid-1980s, that most people living around Loch Sunart really enjoyed the oakwoods, and the richness of the geology and habitat of the area. All 25 designations that went through from the mid 1980s to mid 1990s were all supported by the community. They were all supported, though, on the basis that there was a pay-back. Local jobs were required, and jobs were to be created for interpretation and countryside rangers. Sadly these jobs failed to materialise. LIFE is starting to deliver what we asked for a decade ago. Scottish Natural Heritage refers to designations as an accolade, but you have to give things back to the community and that is related to work. Local people are struggling to survive in agriculture or tourism and you really need to know that your son or daughter has the prospect of a job in a project such as this. There used to be 40 jobs in the Forest Commission in Acharacle and now it is down to zero and employment is needed.

The Sunart Oakwoods were put forward as a candidate SAC. Forest Enterprise carried out a scoping exercise for that oakwood survey and that was the start of the project. The Caledonian Partnership brought in LIFE-Nature funding from the European Union (EU), and there was a successful Millennium Forest for Scotland bid. In 1998, there was a meeting at Glenborrodale to discuss the work underway to restore habitats. This included rhododendron clearance and felling out the conifers. This was impressive habitat restoration and the work was done through the Caledonian Partnership, a partnership of Highland Birchwoods, Forestry Commission (including the 'Authority', as it was then, and Forest Enterprise), a group of private landowners, Scottish Natural Heritage and RSPB.

The element that was missing was community involvement. There had been a bid for EU Objective 1 funding for interpretation at the same time as the successful LIFE bid, but for various reasons it had failed. The scope of the membership was expanded and the Sunart steering group was formed. This is now a formidable, positive and friendly partnership, involving Forest Enterprise, the Forestry Commission, Scottish Natural Heritage, representatives from the communities in Morven, Acharacle and Kilchoan, Highland Council, the local enterprise company and Highland Birchwoods (not LIFE). We all work very well together to expand the project. We've also started to meet with the private landowners

to give them the vision of this 500 square miles of woodland and community involvement. Many have pledged their support in principle.

What are we getting out of it? There are cattlegrids and fencing providing work for the local contractors; logging operations for the extraction of timber and local timber has been used for boat building purposes.

The overall Sunart project has received about two and half million. Habitat work is taking place, with around 200 people trained in various skills including using a chainsaw and pesticides. Ten people have now got full-time jobs as forestry workers in the project and what we're trying to do is all the time look for work in the woodland. There are four rangers, working part-time and full-time, and that number is expected to grow. Interpretation is to be expanded, with Gaelic place-names and panels involving local, historical features. There has been quite a lot of opposition to the interpretation in the carpark being too high-profile and we intend to continue with low key interpretation and small-scale paths and trails.

It is very important to involve the next generation in as many ways as possible; they are formidably interested in all of this.

There are those in the project who are trying to expand the oakwoods a hundred thousand, ten thousand-fold before the oaks are used, while there are other people who are very concerned to see any oak felling before the regeneration expansion was under way. At a community level, we thought we must be able to use the oakwoods for boats. The new High School, at Strontian features local woods.

A huge designation exercise is underway on the cSAC for Loch Sunart and the terrestrial environment. The community is concerned in principle as well as in detail. There are big issues about planning development. People still wish to be able to live and work in the woodland, so within the woodland and adjoining the woodland we've met with planning difficulties.

There are serious issues about deer culling. The steering group has asked Highland Council for community input into deer management plans. These should be publicly available and should state how they intend to implement the cull. If the cSAC designation comes through and the community has to immediately fulfil the requirements, in terms of designation for planning, I would expect the Deer Commission for Scotland to immediately implement the measures required to reduce the deer levels to acceptable levels, which in many cases they're very clearly not. I don't find a cull in two years or ten to 15 years acceptable.





A charcoal hearth

There is a massive amount of habitat restoration work to be done and much continuing training. The group is also looking to improve the access and particularly want to major on re-establishing the rightful place of the seriously damaged Gaelic language and culture within the area and to help archaeology. There is a huge story to be told here involving reconstructions of vernacular buildings. Continuing interpretation and attention to otter hides is needed, so that we can monitor the otters in the woods. A visitor centre is needed. Timber, both timber cuttings and the redundant sitka spruce, can be used as wood fuel.

Several other issues need to be flagged up:

- i. In the past, European support measures such as the Countryside Premium Scheme (CPS) and the Rural Stewardship Scheme (RSS) are virtually useless in assisting the average farmer in this area. There has been not one single successful bidder for the RSS pot. A new way must be found to deliver these environmental measures in landscapes such as this because they are not working at the moment. I know that faults lie with the British government, but that's something that could be addressed.
- ii. At the moment, we have public woodlands through the Forestry Commission, and private woods. I would like to see a future where there is much closer cooperation. It would be good to see some stakeholders and partnership arrangements. For example, if Forestry

Enterprise and the local community jointly owned and managed woodland, then we would start to recover some of the rights previously available to communities.

- iii. We need fewer and longer well-planned fences compared with many smaller fenced areas that have developed in an *ad hoc* fashion. There is a need to reduce deer numbers to compensate for the loss of range when large areas are fenced. Areas that are currently fenced, and those that have been recently fenced, should be the subject of some early discussion aimed at agreeing alternative approaches, well before these fences require maintenance and renewal (in 15-20 years).

- iv. Communication is very important; a lot of ground has been gained through the steering group but there are still gaps. There is a need to initiate dialogue with all stakeholders, especially neighbours, as soon as possible.



New LIFE and the way ahead

Alistair Sim, SEERAD

Scottish Executive Environment and Rural Affairs Department,
Pentland House, 47 Robb's Lane, Edinburgh EH14 1TY

I have been responsible, for the past nearly three years, within the Scottish Executive for management to ensure a Natura program. I am taking this opportunity, as I move on from this task, to look at lessons that I've taken away from my appointment with Natura. I was first involved in 1992 when I was private secretary to the Environment Minister. I was subsequently involved in implementing the Habitats and Birds Directives before going on to work briefly for the European Commissioner in Scotland. After a gap, I've come back and I have had three very satisfying years taking forward Natura 2000.

Over that relatively long period of engagement in Natura 2000, I think I see both problems and opportunities in Natura 2000. The balance between problems and opportunities has moved greatly towards the opportunity side over the period of my engagement. There are still problems and I think there always will be some problems, but I think that great efforts have been made by many people to categorise all the opportunities which Natura 2000 is bringing us. There is a structural and inevitable controversy in setting up Natura 2000. We are taking action which says that some places are so important for Europe's nature that they must be kept that way and that there is an effective cap on the possibility of development projects which affect these places. That is not necessarily popular. Scottish Natural Heritage is working with the people on these sites to engage them with the positive opportunities that Natura 2000 brings. In situations of conflict, SNH has to have the courage to stand up, be unpopular and state that the site is of such major importance that it

must be managed in a special way, which may not be the way that it has been previously managed. When first proposing Natura 2000 designations, people were very suspicious. As experience has been gained, they have realized that the world does not fall apart and that these places are important for Europe's nature. The LIFE project has been very, very successful in providing a lot of money to help people benefit from protected areas. The availability of EU funding to help people manage Natura sites and other internationally important protected areas is an opportunity.

In an ideal world, consensus, shared vision and opportunity-seeking would be built with the stakeholders that these places affect, before they were the subject of designations. We have had to learn so much from other countries. For instance, the conventional, shockingly complacent wisdom back in 1992 when this Directive was included, was that Natura 2000 was something for other European countries to implement, as the UK was great at conservation already .

Working in the United Kingdom through Natura 2000 and through LIFE, I have realised that we have things to be proud of but we also have things to learn. This has been a catalyst for partnerships like that from Sunart. These must be built up in the future. Interpretation is important. One final lesson drawn from experience with LIFE. It was unlikely that any other mechanism could have achieved the same degree of stakeholder involvement since nothing catalyses enthusiasm as much as the prospect of getting money for doing something worthwhile to benefit habitats and the people who depend on them.



Multi-objective Natura: Conclusions

John Markland, SNH

Scottish Natural Heritage, 12 Hope Terrace, Edinburgh EH9 2AS



I have five points in conclusion. These are not comprehensive, but I've tried to encapsulate what was said. The first theme is quite brief; it's about variety, about diversity. Nobody who has been here today could fail to be impressed by the diversity of what's going on, not just in Scotland but in a variety of European countries.

The second theme is about the potential for policy integration Micheal O'Briain mentioned this early on in the conference and it has been a recurring theme throughout. A few examples spring to mind. The first one, for example, is the possibility of linking with ecotourism or activity-based tourism, both growth areas in United Kingdom tourism at the present time. Scotland week in Brussels, for example, devotes a half day to 'tourism and the environment'. Not two separate days, but a single session dealing with tourism and the environment. We have to see how we can integrate Natura into regional and rural development policies, including agriculture. There is going to be a huge review of the Common Agricultural Policy (CAP) in the years that lie ahead. The present way that the CAP operates cannot be sustained with the addition of new countries to the community. The Scottish Agricultural Strategy was launched in June 2001. It links three key issues; agriculture as a profitable business entity along with the environment and rural development. Integration does need a maturity in government and in governmental organisations; partnerships require compromises.

The third point is very closely linked with the second and that is saleable use of forests. The

conference has discussed semi-natural woodland; there has been a valuable debate about what is natural and what is not, what is semi-natural and so on. Managing for conservation can still recognise that a legitimate economic return can come from forestry. Not only that, a proper outcome is actually a desirable outcome if it gives an incentive for the people who are managing the forest. Even better, of course, if this can be linked with downstream jobs in manufacturing. Highland Birchwoods is the prime example. Michael Foxley, talking about Sunart, was quite right to remind us that wider benefits have to be real.

My fourth point is that concerning multiple objective forest. Restoring forest habitats, for example, could mean, in biodiversity terms, positive outcomes for plants. John Parrott mentioned the impact on species such as birds, mosses and lichens. Capercallie, red squirrels and wild cats are already in the forest; other species are not and should be! The benefit of greater recreational opportunities and the forthcoming access legislation in the Scottish parliament is something that should be considered.

My fifth, and final, point is a quite discrete area and concerns favourable conservation status and how we move towards it. Essential in this is a common and agreed understanding of what we mean by favourable conservation status as well as the dedicated funding streams available to secure its achievement.



Wet Woods Site Visit

Jack Mackay, Forest Enterprise

Inverness Forest District Office, Mill Yard, Smithton, Inverness IV2 7NL

Inshriach (Allt Mharcaidh) (FE);

Hosted by Forest District Manager, David Jardine

The background to planning at a strategic level within the area was introduced. The Forest Design Plan for Inshriach Forest clearly defines the management zones, including those with conservation as a priority objective. The background to Forestry Enterprise's (FE) involvement through the Wet Woods project, at Monadh Mor and at this site at Allt Mharcaidh was presented. The site is adjacent to the Cairngorm cSAC, and was proposed as an extension to that cSAC in January 2001. The findings of the hydrological survey were summarised.

A discussion ensued on the history of site and the likely past management practices such as peat cutting and burning, as well as the typical forestry operations, resulting in the ecological condition seen today. FE's past management was also discussed; objectives were different, following timber stock depletion after two world wars, which resulted in drainage, ploughing, planting of non-native species.

Restoration practices during the period of the project were outlined. This included felling of non-native trees, the re-wetting of area through damming of watercourses (but not main the Allt Mharcaidh burn), and the raking together of wooded debris, and burning of same. It was suggested that some unburned brush stacks could be left as 'exhibits' but also for small birds.

A comparison of leaching and/or quality of nutrients on the site following burning was made with similar work in Finland and was shown to be negligible. The Finnish findings showed that most are dispersed within the smoke. Ash leachate into the water table is minimal because of the phasing of burning process in Scotland.

There followed a discussion on the age of the stunted Scots pine. Research on such trees nearby shows peat depth is greater than one metre and the water table is high. Even on the most 'unspoilt' area, the tree age is therefore unlikely to exceed 50 years.

The possibility of lifting the water table on the vegetation-bare area was discussed and on the timing of ecological recovery.

Abernethy Forest Reserve (RSPB)

Hosted by RSPB Reserve Manager, Stewart Taylor

A total of £200,000 had been spent on bog woodland restoration during the life of the project against a budget of £98,000, and the work is not yet completed. Restoration practices during the period of the project include the removal of exotic tree species, re-wetting of areas through damming of watercourses and the filling in of plough lines. A discussion took place on the ability of Scots pine to continue growing in high water table, low nutrient soil areas. Genetic differences in bog pine and 'normal' Scots pine were mentioned.

Dragonfly have been recorded at Abernethy of which three of the twelve are of national importance; *Coenagrion hastulatum* (RDB 2), *Somatochlora arctica* (RDB 3) and *Leucorrhinia dubia* (nationally notable). All are associated with bog woodlands.

North Abernethy contains the most heavily damaged wet woodland sites within the core of the native pinewood area at Abernethy. It was within this area that trials with heavy machinery started in an effort to dam up and re-wet the sites. Delegates visited a site which has seen three phases of restoration involving a six tonne Hymac digger, designed to be of low ground impact. Initially, peat dams were installed at ten metre intervals in the main drains. The planted and naturally regenerated trees were then removed and, finally, the main drains and plough-lines were all completely filled. The last operation took place in autumn 1999.

At North Abernethy, the peat layer is over four metres in depth. The oldest bog pine found, to date, at Abernethy is around 375 years of age.

There was a discussion on the monitoring of water levels and vegetation recovery on all Wet Woods project sites. Good aerial photographic records, and some fixed point photographs along with some vegetation monitoring were recommended. Future monitoring is an issue for the steering group.

The future ecological commitment to the project sites when the period of the LIFE project expires was raised. At North Abernethy, RSPB have financial commitments for at least the next ten years.



Loch Garten

The delegates stopped briefly at a relatively intact roadside bog. The definition of the type of bog was discussed and 'wooded bog' was offered. The area had been cut over for peat. The age of bog pines has not been recorded but it is estimated that one metre high saplings are around 40 years old.

Loch Garten has the same water catchment/bog system as Mondhuie (see below), 2.5 km away. It is very wet down as far as Loch Garten, but with mature Scots pine growing well in between. It has proved to be an ideal spot for dragonfly 'twitchers' in the old peat workings. The area is the main site type for *Leucorrhinia dubia*. A discussion followed on improving habitat for dragonflies. The harvesting of timber from the Abernethy sites was mentioned.

Deer management issues were discussed regarding natural regeneration on the wider reserve area. Roe deer are more of an issue than red on this site, for broadleaves. It was pointed out that very few rowan were re-seeding. Scots pine regeneration sites within the forest are so slow growing that it may take 20 years before the leaders are no longer vulnerable to browsing damage.

Garten Wood

At the time of purchase in 1983, this section of the reserve comprised a 20 year old Scots pine plantation with many scattered drained bogs planted up with exotic conifers. Early thinning of the plantation favoured pines with large crown development potential as well as retention of birch trees, a tree species rare on the reserve as a whole. Deadwood was created by totem-poling whole trees and creating "high" stumps, favouring invertebrates and providing crested tit nesting sites.

Bog restoration work also started at this time involving both staff and job creation teams. All dams within this 274 hectare section of the reserve have been installed by hand using small round wood posts and peat, and the site visited by delegates showed how the restored bog had developed over the last 15 years.

The effect of raising the water table in the wider context is unknown, but in the immediate vicinity results are impressive. The depth of peat here is unrecorded.

Delegates debated the tensions between planning for individual taxa, and/or for local biodiversity in its widest sense. Should the abundant aquatic vegetation be removed to maintain some open water in the key pools (e.g. for goldeneye or the dragonfly *Coenagrion hastulatum* [RDB 2]). The current plan is leave the area to natural processes.

Mondhuie

This 347 hectare site was bought by the RSPB in 1994, being roughly half bog and half Scots pine woodland. About 90 hectares of site was formerly part of croft stock grazing area with main drains already present on first Ordnance Survey map of 1870.

All of the bog areas were drained, ploughed and planted, mainly with lodgepole pine, in the early 1970s. All the trees were removed from these sites between 1998 and 2001, with drain blocking operations starting in 1999. The trees were of very poor form with bent stems and heavy branched. Within the old grazed area, it cost £2500 per hectare to remove by hand felling. Aerial photographs, taken in the mid 1960s, show an intact bog within part of this area. The brash from all the tree removal has been left *in situ* across the restoration sites.

Smaller drains were blocked along their lengths. The bigger drains were dammed, with large peat dams, every ten metres or so. All work was carried out by a low ground pressure six tonne Hymac digger. There was discussion on the effect of the brash decaying into the bog and the pros and cons of its removal. At this late stage, removal is probably not an option considering it is spread over about 90 hectares; forestry operations also resulted in compaction. Delegates discussed the allowance of realistic management costs into the project at inception.

It was suggested that the RSPB and FE staff should meet and exchange ideas as similar work has taken place at Border Forest Mires.

Further work on many of the plough lines on the sites may continue by selective blocking or selecting appropriate areas for shallow bunding. This work would need to await a softening of the remains of tree stumps along the plough-lines. A whole site levels survey has been undertaken as part of the LIFE project which will be very useful for this part of the work.

The site visited showed good areas of re-wetted ground close to the main drain, with sedge and cotton grass appearing in abundance within the first full year after drain blocking.

This site has been highly damaged. The vision is that ongoing work over the next decade will slow down the run off from the site. Re-wetting of more of the area is planned, by plough-line filling with a slow return of the bog forming flora. A working bog, with trees, will be created in the next 100 years.



Borrowdale Woodland Complex

Maurice Pankhurst, National Trust

National Trust North West Region, Unit 7-13, High Hill, Keswick, Cumbria CA2 5LY



Borrowdale Woodland Complex cSAC

Within the Lake District National Park in England, six ancient oak woods in Borrowdale and Buttermere, covering 368 hectares, comprise the Borrowdale Woodland Complex candidate Special Area of Conservation (cSAC). These woods are renowned for their rich assemblages of lichens, mosses and liverworts and were intensively managed until about 150 years ago. Since then, their management has been neglected; the main threats to the woodlands are fragmentation, even-age structures, overgrazing preventing natural regeneration, planting of some areas with exotic conifers and high public pressure.

The work under the LIFE-Nature project aimed to address some of these threats through new fencing, management plans, removal of exotics and diversification of the age structure, measures to mitigate visitor pressure and awareness-raising activities, both for the public and for schools.

Due to the diversity of project types, many National Trust staff were called upon for assistance and advice. These included; archaeologists, biologists, Historic Building representatives, Area Managers, the Marketing & Communication department, Property Managers, Land Agents and finally Forest Wardens and Forestry teams. The fact that one project can involve so many departments is, to some extent, quite unusual for this organisation.

The woodlands of Borrowdale remain some of the most important protected by the National Trust in the UK today. While some more

enlightened members of staff were aware of the importance and unique nature of these woodlands, others understandably perceived them simply as woodland in the 'great outdoors'. The titles afforded these oak woodlands are often quite confusing; upland Oakwoods, hill woodlands, Atlantic oakwood and many other local terms. It was, however, the reference to 'temperate rainforest' that turned many heads in the Trust. The suggestion that 'rainforest' was a UK habitat was not readily understood or accepted, especially within the local community.

Surveys

The subsequent bryological surveys that were carried out during the project demonstrated the unique nature of these woodlands. An example are the high numbers of species recorded for the Lodore - Troutdale complex; in all some 213 species are reported, this being extremely high compared to other woodlands in the British Isles (Averis 2002). Of particular interest here are the numbers of oceanic species, which have strongly western distributions in Europe (Ratcliffe 1968).

Three years on, the project has brought about a considerable change in the status of the Borrowdale Oakwoods and the way they are viewed and managed.

Education

Lifelong learning and education form a major part of the National Trust Strategic Plan (2001-2204). The Borrowdale Valley remains an extremely popular venue for many local schools and colleges, furthermore as a teaching resource it ranks as one of the most popular sites in the Lake District. During 2002 there were over 20 arranged school/college visits to the valley. Important here is the unknown number of educational visits that take place, which probably run into the hundreds.

During these educational visits, every opportunity is taken to introduce students to the unique nature of the woodlands and their importance in a European context. On-going and future management is often a major point of discussion, especially with university groups. The cSAC designation has been extremely useful in developing the theme of sustainable management in the uplands.



Whilst it may be difficult to measure the success of the visits in terms of raising awareness, many schools and colleges request return visits. Probably the most successful of these is an ongoing partnership with Oxford University and its Environmental Change Unit. Each year around 35 MSc students spend the day in the valley and are introduced to several of the LIFE projects that have taken place. This particular group of students is truly international and the SAC/LIFE message has now been scattered to all corners of the globe as far as the Galapagos Islands, India and China.

Public Relations

The National Trust is a charity with some three million active members of whom some are not so active. When work affecting the landscape takes place, a considerable period of consultation is required in order to placate the concerns of all stakeholders.

During the three years of the project considerable consultation took place involving the National Trust regional committees, National Park Forestry Planning Committee, local and district authorities, English Nature, the Environment Agency and the Forestry Commission.

Changes in landscape or woodland composition in the valley required considerable consultation with most of the above bodies. The planning regulations within the Lake District National Park are perhaps some of the most tightly regulated in England.

Planning for the car park had been under discussion within the Trust for some six years. The LIFE project added the impetus to finally gain approval from all stakeholders and successfully implement the scheme.

Interpretation

Most of the major projects undertaken were given considerable publicity including on-site interpretation. An example can be seen at Falcon Crag where some 30 hectares of feel land have been enclosed in order to link two cSAC woodland sites.

The project was truly European

One of the most successful elements of this LIFE project was the de-coniferisation of some eight hectares of ancient Atlantic oakwood at Ashness. The plan was to fell all non-native species and to extract by horse; however, the topography within this small woodland was such that it soon became clear that the use of horses was not a realistic option.

Conventional forest machinery would not operate over this terrain or would have caused considerable damage to soils and the oak component of the woodland.



Great Wood Car Park work starts in 2001



Finally completed in June 2001



Removal of exotic trees from an Oakwood habitat at Skelly Close in Ashness Woods, using a 'High-Line' to minimise ground disturbance

Conventional skyline systems were considered but no available or willing contractor could be found within the north of England or southern Scotland. The contract was eventually offered to a Slovakian company, COMI, from the small town of Stropkov close to the Ukrainian border. COMI have developed a multi-functional low impact forestry machine. This machine, the Lesan 50, can be used as a skidder, mini-tractor and pond dredger. However, its most interesting feature is that it can function as a mini-skyline system for extracting timber from difficult sites without causing any major environmental impact.

Skelly Close is an important site for *Formica lugubris*, (the northern hairy wood ant), a red



data book species whose nests would be easily damaged or destroyed by conventional forest machinery. Three machines were employed in-line over the site allowing skyline extraction for a distance of 300 metres.

Since completion in 2001, the site has been fenced against both red and roe deer. In 2002, considerable natural regeneration of most native species has been recorded.

Future Planning

The 20-year forest plans drawn up during the project period incorporated many of the LIFE Project objectives and brought about serious changes in long-term woodland management in Borrowdale. The issues and arguments for increases in both standing and fallen dead wood have been considerably strengthened as a result of the project and associated cSAC designations. The process by which favourable condition is monitored, put in place by English Nature, will itself bring about an assessment of the long-term effectiveness of National Trust woodland management in Borrowdale and facilitate any management changes needed in the future.

Since the completion of the project, further areas have been identified for the expansion and enhancement of existing cSAC sites. At Seathwaite, in the south of the valley, a further 100 hectares will be ring-fenced and stock excluded from 60 hectares, allowing the regeneration of adjacent moribund woodland.

At Stonethwaite, a further 50 hectares is being studied and may become the focus of yet another woodland expansion project in the valley.

References

Averis, B. (2002) *Bryophyte survey of Lodore Woods*. Unpublished report, National Trust.

Ratcliffe, D. (1968) Unpublished report, National Trust.



Johnny Wood. New sheep-fenced plot to monitor regeneration in a group felled area

Fig. 1: The restoration of Atlantic Oakwoods in Borrowdale

Great Wood:	<i>New car park New boundary fences Project/site interpretation Removal of conifers</i>
Troutdale-Lodore:	<i>Felling of larch & beech Stock exclusion</i>
Johnny Wood:	<i>Regeneration enclosures Bryophyte survey</i>
Stonethwaite Wood:	<i>Woodland enclosure Lichen survey</i>
Falcon Crag:	<i>Enclosure of 30ha of open fell linking Great Wood & Troutdale-Lodore</i>
All sites:	<i>Mobile information display & interpretation leaflets; management plans written for all sites; all sites incorporated into 20-year forest plans</i>



Great Wood to Ashness Woods. New stock fence excluding sheep from a 30 hectare area linking two separate oak woods



LOCATION OF ATLANTIC OAKWOODS AND WET WOODS PROJECT SITES

