

WET WOODS RESTORATION PROJECT

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Photo: Jack Mackay, Forest Enterprise

FINAL TECHNICAL REPORT

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REPORT COMPILED BY:

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On behalf of

Scottish Natural Heritage
Forest Enterprise
Forestry Commission
The Royal Society for the Protection of Birds
Highland Birchwoods



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1. INTRODUCTION

1.1 Background to the Project.

'Wet Woods' is the collective name for two priority habitats as defined in Annex 1 of the Habitats and Species Directives:

Bog Woodland
Residual Alluvial Forest

Bog woodland is an extremely rare habitat type in the UK and 7¹ Scottish sites have been submitted to Europe as candidate Special Areas of Conservation (cSAC)² under Council Directive 92/43/EEC. They occur under rare combinations of physical circumstances and typically have scattered trees across the surface of the bog, forming open woodland in a relatively stable ecological relationship, without the loss of bog species. In Scotland, bog woodlands normally form part of the mosaic of natural forest types within the wider Caledonian Pinewood habitat and are important for a number of bird species listed on Annex I of the Birds Directive including Scottish crossbill, osprey, capercaillie and crested tit.

Residual alluvial forest is also a very rare habitat type in the UK and 10³ Scottish sites have been submitted to Europe as cSACs under Council Directive 92/43/EEC. Often dominated by *Alnus glutinosa*, residual alluvial forests are found on floodplains in a range of situations from islands in river channels to low-lying wetlands alongside these channels. Many alder woods are part of a dynamic system, being in some cases part of a successional series of habitats. In such cases, their structure and function are best maintained within a larger unit that includes the open communities of earlier successional stages. The habitat also supports otter (listed on Annex II of the Habitats Directive) and a wide range of Annex I (of the Birds Directive) bird species including kingfisher *Alcedo atthis* and osprey *Pandion haliaetus*.

Despite the cSAC sites being amongst the best examples of wet woods habitats in the UK, all have experienced some interference with the hydrological systems upon which they depend. Some bog woodland sites have been drained for agriculture, forestry and other land uses and similar changes to their immediate water catchment can influence the quantity and quality of water coming into the bog. The fertile sites of residual alluvial forests have also been cleared for arable farming and grazing or planted with commercial trees. In some cases, the presence of exotic shrubs has displaced the natural vegetation communities.

In May 1998, a partnership of Scottish Natural Heritage (SNH), Forest Enterprise (FE), the Forestry Commission (FC), the Royal Society for the Protection of Birds (RSPB) and Highland Birchwoods (HB) received funding from the European Union's LIFE - Nature Programme to undertake a series of conservation initiatives on four wet woods cSACs in the UK.

1.2 Overview of the main conservation issues being addressed

The project aimed to provide restorative management to wet woods habitats in five of the cSACs listed for these habitats in the UK (Map 1.2.a) by working in partnership with conservation agencies, public sector forestry, private landowners, non-governmental

¹ The number at the time of submission of the bid was 5

² cSAC is a UK term that equates to pSCI (proposed Site of Community Importance)

³ The number at the time of submission of the bid was 7

organisations and research institutions. The general aim was to remove or mitigate existing threats to these rare habitat types.

1.3 Summary of the project's objectives and expected results

- to restore significant areas of wet wood habitat on or adjacent to sites that are candidate Special Areas of Conservation to a more favourable condition;
- to undertake scientific research to inform restoration, management and monitoring plans for wet woods habitats;
- to disseminate the information gained throughout the project through the existing network of partner institutions by demonstration and promotion to encourage an integrated approach to the conservation of wet woods; and
- to support the ongoing work of developing partnerships between public agencies and private landowners.

2. OVERALL PROJECT SUMMARY

2.1 Actions undertaken

2.1.1 Management of Project

At the beginning of the Project a Steering Group was set up under the auspices of the Caledonian Partnership with members from the Project partners (Scottish Natural Heritage, Forest Authority, Forest Enterprise, Royal Society for the Protection of Birds, and Highland Birchwoods) with a representative from the Scottish Executive Environment and Rural Affairs Department. The group met 20 times and was chaired by a SNH member of staff. A full time Project Officer and part-time Administrative Officer were employed in the SNH Dingwall office. The Project Officer left in June 2001 and as at that time there was no indication that the project would continue beyond the end of October it was decided that there was not sufficient time to recruit and train a new person. The duties of the Project Officer were taken on by SNH staff members.

This was supported at the site level by the establishment of Local Operational Planning Teams (LOPT) which met as required.

Three interim reports were submitted to Europe on 12 November 1999, 20 November 2000 and 18 December 2001. An interim financial claim was submitted in November 2000 with the second Interim report. This claim was submitted using Agency rates to calculate staff costs rather than actual costs and subsequent consideration and correspondence with the EC have resulted in the claim being recalculated and resubmitted with the final claim. The interim claim figure has therefore dropped from £300,641.42 to £251,925.74. This is discussed more fully in Section 4.

2.1.2 Project Outputs.

Habitat Restoration

One of the main outputs of the Project has been the habitat and hydrological restoration work carried out on two bog woodland candidate Special Areas of Conservation (cSACs) and one alluvial woodland cSAC as follows:

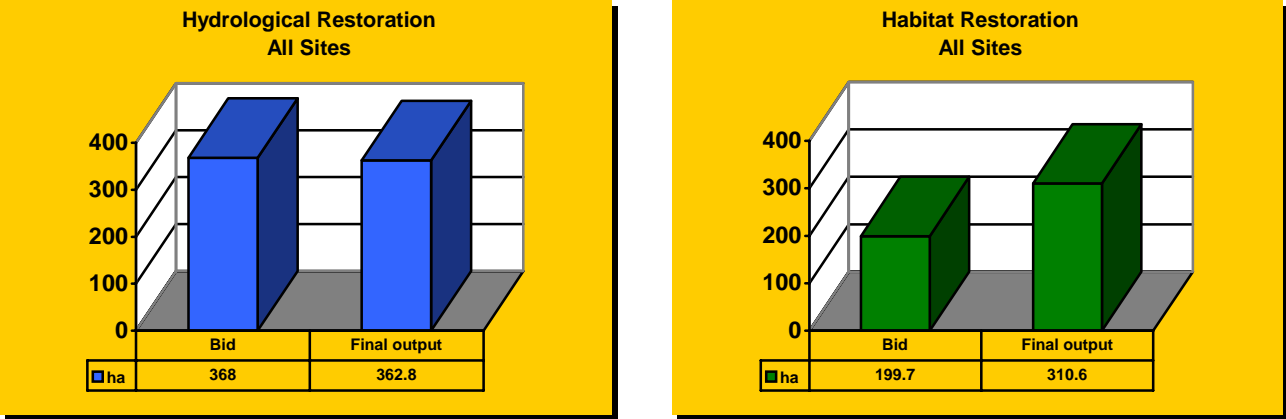
Bog woodland restoration

Site	Habitat Restoration (ha)	Hydrological Restoration(ha)
Monadh Mor	142.6	103.3
Cairngorm (Inshriach)	52	52
Cairngorm (Mondhuie)	102.3	133
Cairngorm (North Abernethy)	10.2	35.1
Cairngorm (Dell Wood)	4.3	14
Cairngorm (Garten Wood)	0	25.4
Total	311.4	362.8

This can be compared against the Project bid targets. Unfortunately there appears to be a discrepancy in the bid as reference to page 98-16/1 claims that an area of 400 hectares will

be restored which includes 296 ha in the Cairngorm sites. However reference to Map 2 of the same document (repeated here in its original form as Map 2.1.2.a) shows the Cairngorm component, minus Inshriach, as 224 hectares which, when added to Inshriach (40 hectares) gives 264 hectares. Similarly comparison for the figures for habitat restoration show that page 98-16/2 gives a Cairngorm total of 116 hectares whereas Map 2 gives a total of 116.7 hectares. It has been assumed that the maps best represent what the actual targets are and that the text reflects an earlier version of the application. These figures can be expressed thus:

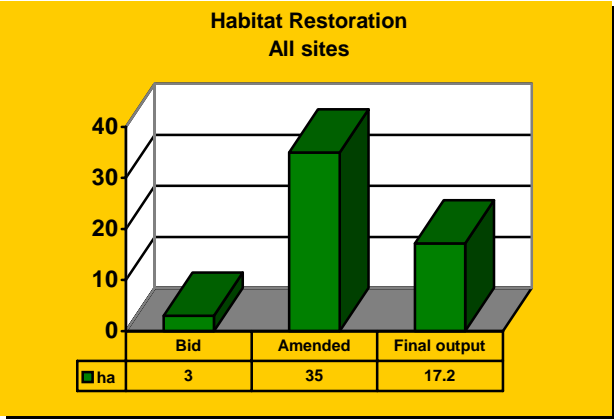
Fig 1: Bog Woodland restoration work



It can therefore be seen that the total for hydrological restoration was slightly lower than the bid and that for habitat restoration the total achieved was over 50% higher than proposed.

It is not as easy to calculate similar figures for the alluvial woodland restoration component as the target was amended following the acceptance of a bid to carry out additional work on the River Conon and an additional site (Lower Spey Bay). However as permission to undertake this work took longer than anticipated some of the work on the Spey had been undertaken before permission was granted and was not therefore eligible for project costs. Less work than anticipated was carried out on the Conon 'extension' area due to a combination of very poor weather conditions and a reassessment of the immediate management needs. This is described more fully in section 3.2.8.

Fig 2: Alluvial Woodland restoration work



Research

Research undertaken can be divided into three main groups. The first were helpful in the project planning and understanding of what has happened. A hydrological and historical survey was undertaken for all of the bog woodland sites. These informed the management undertaken at all of the bog woodland sites except for Pitmaduthy Moss. For this site the report suggested that no onsite work was required and that an investigation into nutrient inputs was required. This was subsequently carried out and it formed the basis for a successful application for sympathetic management under the Rural Stewardship Scheme.

A second group helped to provide a better understanding of bog woodland classification. The final group looked at the River Conon and its management history in detail to inform the development of the River Strategy.

All of the above studies with three exceptions are available on the Wet Woods website. The three exceptions have been left off as they contain information which could be considered to reflect the position of individuals.

Dissemination

A variety of ways have been used to promote the Project and the support of the LIFE Nature funding. There are a number of general visitors to the areas as they come to walk along the Speyside Way or visit the Forestry Visitor Centre at Glenmore or the RSPB at Abernethy. All of the sites with the exception of Pitmaduthy have free access and are well provided for by footpaths. Visitor interpretation of these areas has been catered for by 7 display panels at strategic points. The visitor centre at Glenmore is very popular with tourists and a display based on a "Spey Wifie" of Scottish folklore has proved to be very popular. More targeted guided walks and specialist groups have focussed on the RSPB reserve at Abernethy and the Forest Enterprise land at Monadh Mor and Inshriach.

A major output was the Conference held in October 2001 in conjunction with the Atlantic oakwoods LIFE Project under the banner of the Caledonian Partnership. This was attended by over 100 people with representatives from all over the UK, Finland, Sweden and DGXI. The conference proceedings will be produced and will be made available on the wet woods website.

Although not part of the original bid it was felt that it would be a good use of technology to disseminate the work of the Project via a website (<http://www.wetwoods.org>). This includes the background to the Project and details of what was achieved, and how, and also the research reports, conference proceedings and final report. Copies will also be available on CD for those who do not have web access.

Monitoring

Monitoring is obviously an essential part of any site management work. Scottish Natural Heritage has a programme that involves the monitoring of all designated sites as part of a six year rolling programme. This is based on common standards that apply throughout the UK. However no specific guidance existed for wet woods and a methodology was devised as part of the Project. In addition to the standard site condition monitoring more targeted monitoring will be undertaken as necessary e.g. the RSPB work at Mondhuie (cf. Section 3.5).

2.2 Overall assessment

The Project has achieved all that it set out to do with the exception of the hydrological restoration, which achieved 98% of the target, and it should be noted that this has been

achieved with considerable savings against the predicted spend. It is inevitable that there will need to be some flexibility as Projects develop, particularly when some of the planned work is dependent on the result of work undertaken by the Project. It is of course essential that any changes are managed as efficiently as possible to ensure best value for money. The projected cost for the work was £661,560 but actual spend was £551,959.36 which is an underspend of £109,600.65. The main reason for this is the use of actual costs as opposed to agency rates for staff cost calculations. The main outputs, and Project chronology, are summarised on Table 1 which follows this section

2.3 Future

Over 95% of the areas that have been worked on lie within the ownership of Forest Enterprise, Scottish Natural Heritage or the RSPB. All of these bodies are committed to the continued positive management of their sites. FE and RSPB will monitor and manage their sites as part of their ongoing management. All sites will be monitored as part of SNH's monitoring programme and the necessary provisions are in place to ensure that these sites continue to develop natural vegetation types suitable to the conditions.

As a result of the management activities three of the areas (Monadh Mor [Map 3.2.1.f], Inshriach [Map 3.2.2.e] and Mondhuie [Map 3.2.3.g]) were submitted to the EC as additions to their relevant candidate SACs on 29 January 2001.

3. DETAILED REPORT OF ACTIVITIES

3.1 Preparatory actions and management plans

The project was managed by Scottish Natural Heritage (SNH) on behalf of the Caledonian Partnership - a partnership of non-governmental conservation organisations, government forestry, conservation and research agencies - all with a wide experience of native woodland restoration. SNH is the public agency responsible for nature conservation in Scotland and provided the project secretariat for the partnership.

The day to day running of the project was carried out by a full-time project manager assisted by an administrative support. Both were based in SNH's East Highland Area office in Dingwall, Ross-Shire.

The project reported to, and was guided by, a **Steering Group** of representatives of each of the partnership organisations:

- **Scottish Natural Heritage;**
- **Forest Enterprise;**
- **Forestry Commission;**
- **RSPB Scotland; and**
- **Highland Birchwoods.**

The Scottish Executive was also represented on the group. During the period under consideration, the Steering Group met 20 times. In addition to attendance at the conference there were three visits from Ecosystem and DG ENV staff as follows:

- 20 July 1999 - Beatrix Richards (Ecosystems)
- 26 July 2000 - Angelo Salsi (DG ENV) and Neil Fletcher (Ecosystems)
- 13 May 2002 - John Houston (Ecosystems)

In order to enable co-ordinated management planning and to facilitate management assistance and reporting, the Steering Group set up a local management structure for site based operational planning. This consisted of a **Local Operational Planning Team (LOPT)** for each of the project sites each with 3 - 5 key people. The project manager chaired each of the LOPTs and reported on their actions directly to the Steering Group on a quarterly basis. Typically, a LOPT included:

- **the relevant SNH Area Officer** (for that site);
- **Forest Enterprise District Foresters** (for FE sites);
- **RSPB Reserve staff** (for RSPB sites);
- **FC Woodland Officers** (on private sites); and
- **other key landowners** (on private sites).

The LOPT was responsible for planning all restoration work at each site and for drawing up a detailed Operational Plan. This indicated all work to be undertaken, when and by whom. Work was either undertaken directly by a project partner, or indirectly by employed contractors or through an agreed contract with a landowner or agent. The LOPTs were also responsible for integrating monitoring and dissemination activities into each site's Operational Plan. All Operational Plans were required to be endorsed by the Project Steering Group.

Restoration work carried out on privately owned land received match funding from the Forestry Commission's Woodland Grant Scheme. Applications for WGS were submitted by the owner in the normal manner with the assistance of the local FC Woodland Officer.

As this project contained an element of research and survey work, the Steering Group also appointed a **Research Working Group** (RWG) to provide inter-agency support to the project on all aspects of research work. The group was chaired by the project manager and consisted of key individuals from the partner organisations with a relevant research background and knowledge.

All of the sites were within or near to candidate Special Areas of Conservation and the Abernethy sites were also within or adjacent to the Abernethy Special Protection Area and therefore all work had to comply with the requirements of the Habitats Directive. Although the proposals were directly connected with or necessary to the management of the sites and therefore covered by Article 6.3 in that they did not need an appropriate assessment, care was taken to ensure that no other qualifying habitats or species were compromised as a result of the management works. No European Protected Species were directly affected although it is expected that local otter populations will make use of the rewetted areas.

SNH is the agency with the lead role for management planning and monitoring for cSAC sites in Scotland. Through the project guidelines for monitoring the habitats were refined to form a key output of the project. Management planning and monitoring was undertaken by local area staff as a part of project activities. The final output is a planned and realistic process for long term future monitoring to inform management.

3.1.1 River Conon Strategy

Although the cSAC is limited to the series of wooded islands towards the mouth of the River Conon, it is essential to understand that the extent and distribution of alluvial woodland is dependent on the dynamics of the river system as a whole. Many of the floodplain sites have been protected from flooding by embankments and bunds to allow for agriculture and grazing. Stretches of the riverbanks have been strengthened preventing the natural dynamics of the river. There is a need to restore the context in which these woods originally developed, which requires consideration of land use and woodland communities outside the designated boundaries. It is thus considered essential for the future management of the cSAC to develop an integrated management plan for the wider river system which will, as far as possible, allow the natural hydrology to be restored.

Due to the diverse interests on the floodplain it was felt that it would be unrealistic to produce a fully costed and agreed management strategy during the lifetime of the project. Instead it was decided that a more visionary document should be produced to initiate discussions between the stakeholders. The document produced during the project is SNH's view of what is required for the sustainable management of the Residual Alluvial Woodland in the Conon Islands cSAC. The survival of the woodlands on the floodplain is dependent on a number of factors external to the cSAC and in some cases external to the floodplain. By producing this strategy SNH hopes to raise the awareness of the importance of the wet woodlands with other stakeholders. SNH sees this document as a starting point on the road towards the sustainable management of the cSAC by assisting those stakeholders integrate the needs of the cSAC with their own activities. SNH will be distributing the Strategy to the other stakeholders during 2003 and seeking their opinions. It is hoped this consultation process will lead to the formation of a management forum or partnership of groups and individuals who are willing to take forward the aims of the strategy.

3.2 Non-recurring biotope management

The areas in the summary charts relate to the figures in the original bid, amended figures from the second Interim Report (unless stated otherwise) and the final outputs. Normally several maps are included for each site. The first show the final outputs and these are followed by new digitised versions of maps shown in the initial bid, the first Interim Report, and the second Interim Report as appropriate. It should be noted that the earlier figures were not based on computer generated maps and therefore some of the figures were not accurate. Where the discrepancies are minor they have been ignored; where they are more significant some explanation is given in the text. The operations undertaken have been summarised, and sometimes discussed separately, as habitat and hydrological restoration. The former refers to management works which generally relate to some form of woodland management which can include clear-felling, removal of non-natives and thinning to various degrees. Hydrological restoration refers to works that are generally aimed at restoring the natural water-table. This can include a range of management prescriptions from infilling plough lines to the construction of dams. The type of works undertaken are described within the individual accounts as necessary.

3.2.1 Monadh Mor

Background

Monadh Mor originated as an area of pools, channels and ridges left by melting ice at the end of last ice-age. The area supports a complex of habitats, including transition mire, which are more akin to the Scandinavian wooded bogs than any habitat in the UK. Most of the mire communities are associated with the channels within which local conditions depend on the extent of hydrosere succession. Thus, the deeper channels retain open water but many are now dominated by oligotrophic swamp communities of *Carex lasiocarpa*, *C. rostrata* and *Equisetum fluviatile*. In other areas where the succession is further developed there are extensive *Sphagnum* carpets with *Menyanthes trifoliata*. In other areas a complex of wet heath and blanket/raised mire has developed, dominated by *Calluna vulgaris*, *Erica tetralix*, *Trichophorum cespitosum*, *Eriophorum vaginatum*, *Polytrichum commune* and extensive areas of *Sphagnum* spp.

The main feature of this habitat is the presence of stunted *Pinus sylvestris* growing on the surface and margins of the bog and mire area. Few trees grow taller than 3 metres. Finally, the morainic ridges and mounds are dominated by coniferous woodland which has been present for at least 250 years. Here, *Pinus sylvestris*, *Betula pubescens* and *Juniperus communis* predominate over a typical northern pinewood flora, including *Empetrum nigrum*, *Goodyera repens*, *Vaccinium myrtillus* and *Calluna vulgaris*.

The variation in topography, nutrient status and hydrological conditions on this site has also resulted in the development of a rich invertebrate community including nationally rare species such as the northern damselfly *Coenagrion hastulatum*. The site is also important for a range of breeding woodland bird species. These include Scottish crossbill *Loxia scotica* and osprey *Pandion haliaetus*.

Although the biological interest of the site focuses on the woodland and peatland habitats, it is important to stress that the mixture of habitats throughout the site, and how the species that they support interact, is also a very important part of the sites interest.

Recent investigations have shown that the Monadh Mor cSAC is all that is left of a much more extensive area of bog woodland which would have once stretched across the Millbuie ridge - a distance of perhaps 20 miles. Immediately adjacent to the north-east of the cSAC is undoubtedly the best area of former bog woodland which was planted in the mid 1960s with

a conifer crop. Although maturing fast, this area still retains many similar habitats where the conservation interest has stayed largely intact.

Management undertaken:

Restoration work based around a hydrological survey focused on an 82 hectare plantation planted on bog woodland to the north-east and directly adjacent to the Monadh Mor cSAC. The plantation contained a mix of exotic conifers (principally *Pinus contorta*) with lesser amounts of planted *Pinus sylvestris* planted on the drier areas. The restoration prescriptions were as follows:

- fell all non-native conifers;
- fell all trees planted on wet areas with the exception of natural form Scots pines at the fringes;
- heavily thin remaining planted Scots pine; and
- blockage of selected key drainage systems.

For the forestry work, two main harvesting/felling methods were used. For trees of marketable size, felling and delimiting was by harvester with extraction by forwarder. [A harvester is a purpose-built machine which can fell, delimit and cross-cut a tree in one continuous operation. A forwarder is an all-wheel drive vehicle which can load itself with logs and transport them to roadside]. For trees of non-marketable size, felling was done by chain-saw with felled trees cut into shorter lengths to assist brash breakdown. On the wettest, most sensitive areas, felled trees were carefully extracted either manually or by winch.

The first phase of the restoration programme began in February 1999 with the harvester/forwarder extraction method carried out by Forest Enterprise's (FE) own staff and machines. The harvester was particularly effective as it had the ability to concentrate brash material allowing the early recovery of a greater proportion of the vegetation. Damage through machine use was impressively minimal. As conditions got wetter into winter, machines with wider than normal tyres to reduce ground damage were used as they were less damaging. It was necessary to move brash to protect the ground. Throughout the harvesting operation, watercourses were bridged using timber/brash bridges with piping to allow waterflow. On completion of the extraction and following a detailed hydrological assessment, these bridging points were altered where necessary to become drain blocking dams.

The second phase of the restoration was carried out by a local contractor and began in early August 1999 with the first attempts of dealing with the thinning of the planted Scots pine on the drier knolls. LOPT discussions agreed on the following points of guidance for the forester:

- overall thinning intensity of c. 50%;
- reduce uniformity by leaving some thicker clumps i.e. some areas 30%, some 70%;
- sculpt straight edges;
- lose rides and thinning racks; and
- generally aim to take out the straighter 'pole' trees and leave those with a more natural form.

For both phases of work, supervision of work was largely by FE with LOPT meetings on site as required to assess the work. By the 1st October 1999, a total of 36 hectares had been completed.

The third phase of the work was the 'fell to recycle' programme for Area 2 (Map 3.2.1.a). This again was carried out by a local contractor and concentrated on many of the more sensitive wetter areas where machines could not work. The original bid (reproduced at Map 3.4.1.e)

stated that 22 ha in Area 1 would be restored as would 82 ha in Area 2: the map shows that the two areas are 24 and 112 ha respectively. In the Second Interim Report it was claimed that 120 hectares had been cleared (see Map 3.2.1.c which shows the areas concerned totalling 136.3 ha). Subsequent re-measuring of the site, and the inclusion of a small additional area in the SW corner of Area 1, shows that **the final output for habitat restoration was 142.6 ha** which significantly exceeded the target in the original bid. This includes two areas (A & B on Map 3.2.1.a) that were not included in the amended cSAC boundary that was submitted: see below for further discussion.

Much of the tree felling restoration work at Monadh Mor actually yielded a high volume of timber. However, due to the poor state of the timber market, Forest Enterprise's income from timber sales from both project sites only just covered the costs of the harvesting / extraction work. Thus the harvesting operations were ultimately excluded from the project costs. Although this had implications for the overall budget forecast it represented a considerable savings in Project expenditure and therefore represented good value for money.

The fourth phase of the work was the hydrological re-instatement (or drain blocking) work. This management was informed by the Hydrological Survey of the site (see section 3.4.1) The principal technique was machine dug peat dams spaced approximately 10 metres apart. The digger (6 tonne, Hymac) constructed the dams by digging out saturated peat from the side or bottom of the drain and using that as the bulk of the dam. The turf scraped off to access the saturated peat was then used as a 'top' for the dam. In areas of shallow peat, dams had to be made out of the mineral soil. As much of the underlying soil at Monadh Mor is clay, the dams are so far holding up very well; however, experience from previous LIFE projects has shown that dams of the more porous sandy soils can be much less effective. Overall, the drain blocking at Monadh Mor has worked well with, again, much emphasis on the importance of a skilled operator and close quality control. All the drain blocking work was completed by a local contractor who also carried out some essential road / track improvements to facilitate access for monitoring and light recreation.

The restoration work in the smaller area within the original cSAC (Area 1, Map 3.2.1.b) was completed in January / February 2000 and amounted to a combination of tree removal and drain blocking. The tree removal was largely lodgepole pine and sitka spruce regeneration principally near the edge of a once afforested morainic peninsula which juts out on the southern boundary of the cSAC. These trees were of small non-marketable size and this type of operation is known as 'fell to recycle'. As much of the regeneration was on very wet bog, there were problems in separating out the non-native lodgepole pine with the native Scots pine. In high water table conditions both species can look very similar.

For the first half of this project feedback from the local community was largely positive with some individuals actually phoning up to commend the work. However, this was subsequently countered by some negative reaction from a number of neighbouring farmers and householders who claimed that the work caused flooding problems on their properties. At a meeting with the National Farmers Union (representing the farmers) on 4th August 2000 it was collectively agreed that the project would commission an independent Impact Assessment of the restoration work to cover both the restoration area and the neighbouring agricultural land. This, it was agreed, would help determine whether the work of the project has had any effect on the land of any of the neighbouring farmers, and if so, present a series of costed options of how to mitigate the problem without undermining the Natura interest of the site. This report is covered in Section 3.4.3.

The final year was one of mainly care and maintenance with some tidying up completed and improvements made as necessary. 1km of redundant internal fencing was removed. This has not only improved the visual aspects but has also removed a potential threat of birdstrike. Another unplanned activity was the removal of the remains of 3 wrecked vehicles from the site.

Locally minor movements of brash was done by hand to bring it back from the side of the rewetted areas. This also helped to open up the views of the worked areas.

Although outwith the Project area consideration was given to the felling of lodgepole pine along the A9 which runs along the north side of the site. This would open up the view of the site to passing motorists and reduce the potential for lodgepole pine seed colonisation but it was felt that it would be best done when the site has had time to recover. It is likely that Forest Enterprise will do this at some point in the future.

Localised flooding (as indicated as an issue above) caused concern to some of the neighbouring landowners. Although it was felt that the work on site was not the cause, as was subsequently confirmed (cf. Section 3.4.3). 500m of public roadside ditch was cleared on a good neighbour basis to ease the local community concerns. This seemingly minor act was the most significant in restoring good neighbour relations with farmers who had originally (incorrectly) thought that the project was the cause of their flooding problems.

As a result of the work undertaken an extension of 96.5 hectares to the original cSAC was proposed to the European Commission on 29/01/2001 (Map 3.2.1.f). The **output of 103.3 ha of hydrological restoration** is consistent with the original bid (104 ha) and the claimed output in the second Interim Report (104 ha). However this does not include Areas A & B on final output maps (Map 3.2.1.b) as the work here was primarily removal of the seed source. Although it was necessary to work within these areas to remove seed sources and to protect the hydrology of the site they were not at the time of the submission to Europe felt to be of SAC quality. However the areas will be monitored and if they develop into bog woodland within a Scots pine woodland landscape consideration will be given to submitting them as appropriate.

Fig 3: Monadh Mor restoration work

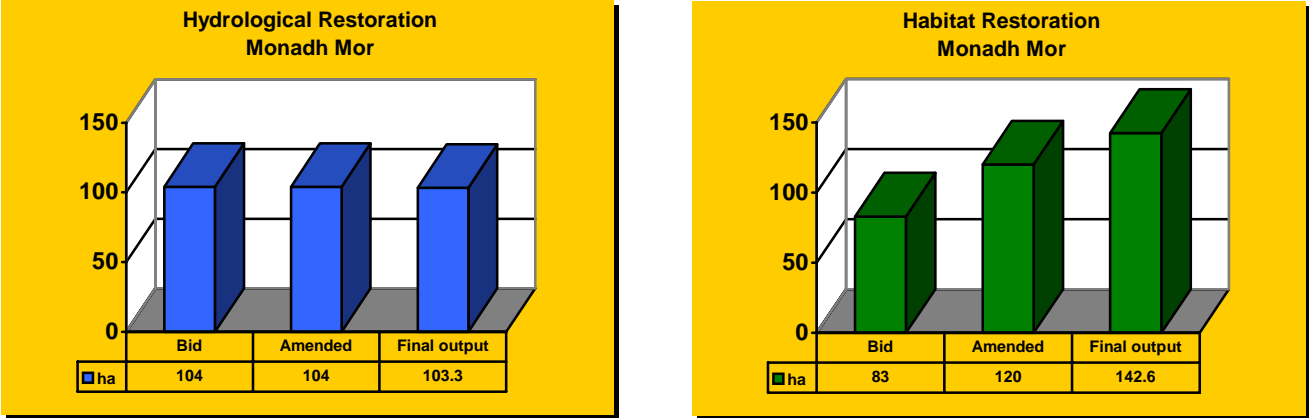


Table 2: Monadh Mor summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																	
		1998			1999				2000				2001				2002		
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May	
A: Management plan preparation and other preparatory actions	1. Management planning																		
	a) Establish LOPT	EstLOPT																	
	b) Complete Local Operational Plan	Complete LOP																	
	2. Survey																		
C: Non-recurring biotope management	a) Undertake hydrological survey					Hydrological survey													
	b) Monadh Mor impact study											Impact study							
E: Public awareness and dissemination of results	1. Habitat restoration (104 ha)				142.6 ha														
	2. Hydrological restoration (83 ha)								103.3 ha										
F: Overall Project Management	1. Dissemination visits/open days	Open access at all times																	
F: Overall Project Management	1. Supervision	Supervision																	
	a) Works supervision; contract management	Supervision																	
	b) Liaison with LOPT/Proj. manager; qual control	Supervision																	
F: Overall Project Management	2. Monitoring																		
	a) Set up monitoring programme							monprog											
b) Monitor effects of restoration work											monitor				monitor				

3.2.2 Inshriach

Background:

Inshriach was acquired by the Forestry Commission in 1954, and lies on the eastern flank of Strathspey at the entrance to Glenfeshie on the western boundary of the Cairngorms cSAC. The area contains the largest expanse of Caledonian pinewood in the UK, lying on the gently undulating glacial deposits in the foothills of the Cairngorms. Bog woodland is found in peaty hollows where the nutrient-poor water table is at the surface, allowing the mire communities to develop within the pinewood.

The Inshriach forest is largely composed of young *Pinus contorta* and *Pinus sylvestris* plantation, but also contains significant remnants of bog woodland of variable condition. These combine to give a unique range of habitats from inactive, degraded peatland, through planted waterlogged nutrient poor soils, to active, relatively unspoilt, bog woodland.

Management undertaken:

Restoration work originally focused on an area of mixed conifer and non-native regeneration which bordered a canalised and relatively fast flowing watercourse (Allt á Mharcaidh). The area was originally considered to be approximately 40 ha (see Map 3.2.2.d which shows a considerably larger area although the original bid referred to 40 ha at 98-16/2). The Inshriach LOPT agreed the following prescriptions which were informed by the hydrological survey (Section 3.4.1):

- fell all non-native conifers;
- fell all trees planted in wet areas;
- heavily thin remaining planted Scots pine; and
- blockage of key drains.

The first phase of the work concentrated on the larger trees of marketable size which were felled and delimbed by a purpose built harvester with low ground pressure and extracted by forwarder. Areas of pure planted Scots pine on the drier morainic deposits were retained, but thinned to a more natural structure and to increase the chances of recovery of the ground vegetation.

The restoration programme began in July 1999 with the harvester/forwarder extraction method. Progress was excellent with completion of the 20 hectare contract by the end of August 1999. The harvester was particularly effective as it had an ability to concentrate brush material allowing the early recovery of a greater proportion of the vegetation. Damage through machine use was impressively minimal although this was helped by a good dry spell of weather. Throughout the harvesting operation, watercourses were bridged using timber/brush bridges with piping to allow waterflow. On completion of the extraction and following a detailed hydrological assessment, these bridging points were altered where necessary to become drain blocking dams. All work was carried out by a local contractor. Supervision has been largely by FE with LOPT meetings on site as required to assess the work.

The second phase of the work was the 'fell to recycle' programme which was carried out in January 2000 and felled trees over an area of 20 hectares. This work concentrated largely on lodgepole pine which had failed to reach any marketable size in such boggy conditions. Again, this was carried out by a local contractor.

With over three quarters of the tree felling completed, the digger was able to carry out the hydrological re-instatement work in May 2000. Conveniently, the LOPT was able to employ

the same local contractor who has been doing much of the drain blocking work at the neighbouring Cairngorms cSAC site of Abernethy. Continuity of work for such firms greatly helped to develop a highly skilled workforce for this type of work in the area.

During the final year of the project a number of small areas totalling c0.5ha were felled to tidy up missed individual trees. During the spring of 2001 brash, over the entire area, was raked into approximately 200 piles located on mineral soils. It is estimated that approximately 80% of the available brash was treated.

The majority of these were burnt during the early winter of 2001, but some will were left as controls to see whether they will be beneficial to invertebrates or provide cover for birds and mammals.

By the end of the Project the **conditions for the development of bog woodland covering 52 hectares had been restored** at this site (Map 3.2.2.a). As stated in the third Interim Report the map contained within the second Interim Report (Map 2.2a of that report) erroneously referred to an additional area of 48 ha that would be clear felled within the Project area. The area it should have referred to is outwith the current project area but is within the extended cSAC. No bog woodland is involved and as with the rest of the extension area it is covered with Scots pine which is one of the main qualifying features of the Cairngorm cSAC (global score of A). The whole area will be managed by Forest Enterprise with nature conservation as one of the main aims. As a result of the Project the habitat and hydrology of 52 hectares has been restored to a condition that will allow bog woodland habitat to develop naturally within a natural pinewood on this site. This forms part of a larger 146 ha area which was submitted to the European Commission on 29 January 2001 as a mixture of bog woodland and Caledonian Forest (see Map 3.2.2.e).

Fig 4: Inshriach restoration work

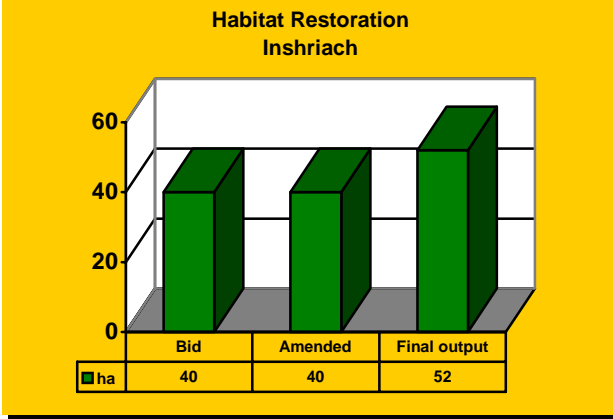
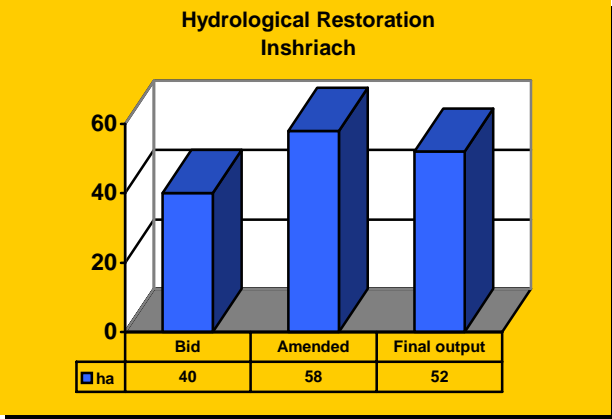


Table 3: Inshriach summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																
		1998			1999				2000				2001			2002		
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May
A: Management plan preparation and other preparatory actions	1. Management planning																	
	a) Establish LOPT	EstLOPT																
	b) Complete Local Operational Plan	Complete LOP																
C: Non-recurring biotope management	2. Survey																	
	a) Undertake hydrological survey					Hydrological survey												
	1. Habitat restoration (40 ha)						26 ha		26 ha									
	2. Hydrological restoration (40 ha)									52 ha								
	3. Brash raking and burning																	
E: Public awareness and dissemination of results	1. Dissemination visits/open days	Open access at all times																
	2. Conference visit																	
F: Overall Project Management	1. Supervision	Supervision																
	a) Works supervision; contract management	Supervision																
	b) Liaison with LOPT/Proj. manager; qual control	Supervision																
	2. Monitoring																	
	a) Set up monitoring programme						Monprog											
	b) Monitor effects of restoration work									Monitor					Monitor			
	3. Habitat review and classification			Review														

3.2.3 Mondhuie

Background:

As explained in the third Interim Report (Section 3.2) this area forms part of the area referred to as the Cairngorm SAC in the original bid. At that stage part of the area of Mondhuie was outwith the Cairngorm cSAC. It is also adjacent to the Abernethy Forest SPA. The Abernethy Forest forms the southern part of the extensive pine/birch forest which at one time dominated Strathspey, the lower Cairngorms and much of the Central Highlands. Of the 16,046 ha of Caledonian pine forest left intact today, Abernethy Forest, at 2,063 ha is, the largest remnant and the best example.

Bog woodland has developed at Abernethy because of the irregular glacial topography, which has allowed marked variations in geomorphology and drainage pattern. The drier slopes and knolls support mature pine woodland and the hollows between support wet mires with abundant stunted bog pine woodland. These stands are composed of mire vegetation with a scattering of stunted pine trees and saplings. In total, the hollows form an extensive area representing the largest example of this habitat in Scotland.

Much of the bog woodland on the Cairngorms cSAC has been damaged to varying degrees by man. As well as plantation forestry and the associated extensive drainage systems, this area of the Cairngorms cSAC has suffered particularly badly from further drainage outwith these plantations. A common feature indeed for Abernethy has been the deepening and straightening of many existing natural drainage channels. The effect of this, of course, is to remove very rapidly, higher volumes of water off the bog leading to a long term overall decline in the habitat.

Use of aerial photographs, historic maps and estate records show a long term record of changes in the land use and cover history of the site. Commercial forestry has had a significant impact on the site, particularly in the last 30 years with the planting of Lodgepole pine on the peatland soils. This has resulted in a loss of both flora and fauna of the original habitat as well as a drying out effect of this and adjacent areas of peatland. The area has also suffered from a long term programme of drainage - associated with both the plantations and the more open ground. Many of the drains on the open ground are former natural watercourses which have been deepened and widened to take more water off the site.

Management undertaken:

Unlike the first two project sites reported on above, Mondhuie has two different levels of damaged bog woodland:

- afforested and drained; and
- drained only.

For the forestry work, the area was originally divided into three main areas (Map 3.2.3.e). Area 1 (most of which is known locally as 'the fields' due to its agricultural history) amounts to approximately 39 hectares, is almost entirely on peat, and is adjacent to the original cSAC. Due to its soil this area was planted mostly with Lodgepole pine. There was an extensive network of artificial drains in this area dating back through both its forestry and agricultural periods in history. Area 2, within the cSAC, directly to the south of 'the fields', has a more varied rolling topography with drier morainic knolls between the areas of bog woodland which covers an area of approximately 18 hectares. Again, drains had been dug throughout these wet areas in an attempt to dry out the bog woodland. Area 3, within the cSAC, to the west of Area 2, is largely on peat and, hence, was widely planted with Lodgepole pine.

The 'drained only' area extends to the south and east of the plantation areas and really exists as two separate drainage systems. The main system, which extends out of the drains within the plantation, extends over a mile south through less damaged bog woodland. The smaller system, to the east, runs out of a relatively intact habitat. Both of these systems show evidence of having sections of highly altered natural drainage channels. These drained only areas were not specifically mapped on the original bid but were referred to in the first Interim Report and repeated in the second (Map 3.2.3.d).

As this was the most advanced Local Operational Plan, the first phase (Map 3.2.3.a) of the restoration programme was able to commence within weeks of the start of the project. Tree felling started on 'the fields' area in early July 1998 on a plantation of predominantly south coastal provenance Lodgepole pine and by March 1999 21.7 hectares had been cleared. Although the quality of work was high, progress was slow due to the appalling shape and form of the trees - in many cases, trees would have several main stems and very heavy branching. Consequently, hand felling by chain-saw was the only felling method that could be used which cost significantly more than a harvester/forwarder operation would. Felled trees were extracted by forwarder.

The second phase (Map 3.2.3.a) of the tree removal work began in November 1998 with a harvester/forwarder contract to take out areas of less severely branched trees - from both within and outwith the cSAC area of Mondhuie. Harvesting was halted for the 1999 breeding season with work re-starting in September 1999 and this phase of felling was completed in December 1999. Completion of this phase of work allowed the first area of drains to be dammed. The area felled amounted to 24 hectares.

The hand felling contract recommenced as phase 3 in August 1999 and continued until all tree felling work on the 'fields' section of Mondhuie was completed in March 2000. The area felled was 24 hectares taking the total by this stage to 69.7 hectares.

The fourth phase of tree felling on the only remaining area of Mondhuie in the original bid (Area 3 of Map 3.2.3.e) got underway in February 2000. A harvester/forwarder contract was signed to allow as much of the machine harvestable timber as possible to be removed from the site. This was a no-cost operation, the extracted timber covering the cost of the machines involved in carrying out the work. An area of 18.5 hectares was cleared by the time the felling ended in April 2000.

A final contract was signed covering phase 6 in September 2000 to complete the felling within this area and involved the felling by hand of approximately 14.1 hectares of lodgepole pine left by the harvester, comprising the last 4 areas. The contract was completed in February 2001.

The large scale of the tree felling has meant that there is a considerable area covered with brash. In view of the scale of the removal task it was decided that it would be left on site. However, this will allow the development of this area to be compared with those areas outwith Abernethy where some brash removal (mainly by burning on site) has been undertaken. Map 3.2.3.f shows the areas that were either machine or hand cut

Accurate mapping and measuring at the end of the Project show **that the total area of habitat restoration in Mondhuie is 102.3 hectares** which considerably exceeded the target. This adds to the work carried out by the RSPB just before the Project began and therefore the total habitat restored area is 113.6 hectares. A detailed monitoring programme has been developed by the RSPB for this area. This is summarised in Section 3.5 and the monitoring report, which indicates that the early signs of recovery are very encouraging, is one of the separate products of the Project.

The first phase of drain blocking at Abernethy (Map 3.2.3.b) within the Project started on 6 March 1999 with an external contract to dam the two main drainage systems to the south of Mondhuie. The principal technique was machine dug peat dams spaced approximately 10 metres apart. The digger (a 6 tonne Hymac) constructed the dams by cleaning the sides of the drain to expose wet, saturated peat and then digging out saturated peat from adjacent to the drain and using that as the bulk of the dam. The turf scraped off to access the saturated peat was then used as a 'top' for the dam. [This is just one of the techniques featured in the RSPB-led LIFE Project: "Conservation of Active Blanket Bogs in Scotland and Northern Ireland" (Contract No: B4 - 3200/94/770)] This technique was very effective though experience of the aforementioned project points out the importance of a skilled operator and close quality control. By 1 April 1999, this contract had dammed both systems of drains - an estimated affected area of approximately 47 hectares. Part of this contract also covered some of the work in North Abernethy.

Phase 2 of the drain blocking programme concentrated largely on the 'fields' area of Mondhuie and was a major piece of work. This was carried out to a very high standard in quite harsh weather conditions in February / March 2000 and totalled an area of 40 hectares. Following several days of very heavy rain in November 2000, 14 peat dams along the main exit drain collapsed. Immediate remedial work involved local contractors removing peat debris from drains in the site and from two culverts running under the "B" class county road. Although this was just considered to be the result of the unsuitability of peat dams to control such large volumes of water, the neighbouring tenant farmers and landowner were generally concerned by perceived recent wetting of their ground as a result of the work carried out on site. Therefore the Scottish Agricultural College were contracted to review the impact of the work undertaken on the local hydrology. Their report (cf. Section 3.4.6) showed that although the tree felling had increased the water run-off this was to be expected and that the main problems were the general recent increase in November rainfall and lack of maintenance of field drains. These are exacerbated by the low lying surrounding terrain of the fields which lies adjacent to the River Spey cSAC. As a result field drains affected by the collapse were cleaned and it was recommended that 3 metal pile dams should be constructed in the main drain where the collapse occurred to ensure that no further peat movement occurs. An additional fourth metal pile dam was installed in March 2002 to consolidate the earlier work.

The final phase of drain work started in February 2002 within areas to the east of the "fields" with the complete infilling of all the forestry drains within the site, followed by trial filling of the main plough-lines running across the site at about 20 metre intervals. The latter distance was determined by the brash mats left on the site from the timber harvesting operations. The plough-line filling involved blocking each furrow with wet peat right across the site to try to reduce any run off from the increased water table brought about by the drain filling. In addition, approximately 800 metres of small drains were blocked by installing plastic pile dams along their lengths: these dams were given a severe test with this summers very heavy rain which caused considerable damage and disruption in the local area but the dams remained intact.

All restoration work was carried out by a local contractor who developed a high level of expertise for this type of work in the Cairngorms area. Supervision has been largely by RSPB with LOPT meetings as required. By the end of the Project **133 hectares had been hydrologically restored** which was 31.2 hectares less than the bid. However reference to the original bid (Map 3.2.3.e) shows that the total area was only 141.2 hectares. Local landforms restrict the areas where the bog woodland can be restored and the rewetted areas shown in Map 3.2.3.b more accurately define these areas. It is possible that some of the rewetting will be delayed and will express itself at some stage in the future. However it is felt that all that could have been done has been done in this area. The removal of all the non-

native trees in the vicinity which are on the drier ground will directly benefit the adjoining wet areas as well as now providing suitable conditions that will allow for the development of natural woodland which will complement the rest of the cSAC.

As a result of the work that was undertaken by the Project that the part of the Project area that was originally outwith the original cSAC boundary was proposed to Europe as an extension to the Cairngorm cSAC on 29 January 2001.

Fig 5: Mondhuie restoration work

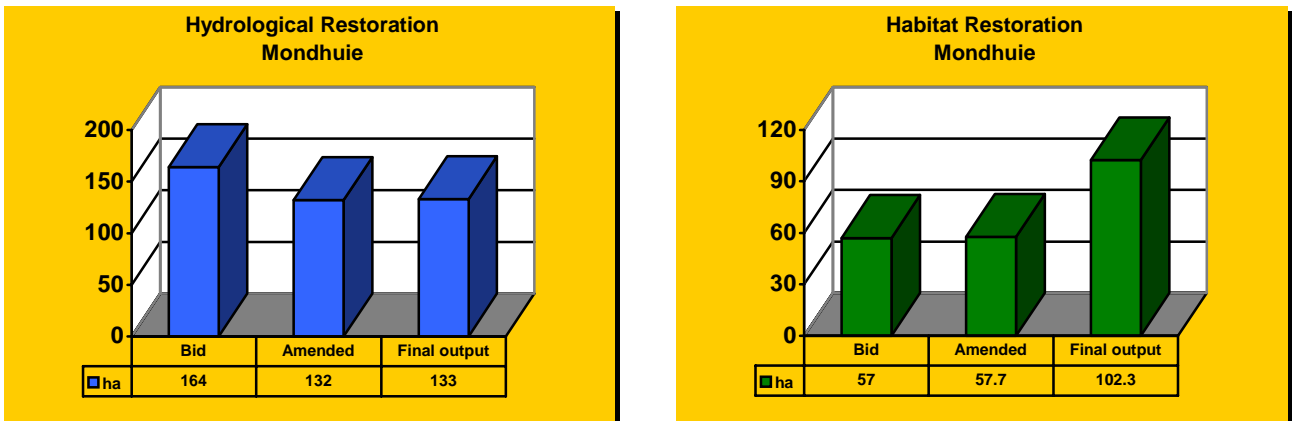


Table 4: Mondhuie summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																		
		1998			1999				2000				2001				2002			
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May		
A: Management plan preparation and other preparatory actions	1. Management planning																			
	a) Establish LOPT	EstLOPT																		
	b) Complete Local Operational Plan	Complete LOP																		
C: Non-recurring biotope management	1. Habitat restoration (67 ha)	Phase 1 – 21.7 ha			Phase 2 – 24 ha				Phase 3 – 24 ha				Phase 4 - 18.5 ha				Phase 5 – 14.1 ha			
	2. Hydrological restoration (40 ha)		47 ha						40 ha									40 ha		
E: Public awareness and dissemination of results	1. Dissemination visits/open days	Open access at all times																		
	2. Conference visit																			
F: Overall Project Management	1. Supervision	Supervision																		
	a) Works supervision; contract management	Supervision																		
	b) Liaison with LOPT/Proj. manager; qual control																			
	2. Monitoring																			
	a) Set up monitoring programme						Monprog													
	b) Monitor effects of restoration work									Monitor					Monitor					
	3. Habitat review and classification			Review																

3.2.4 North Abernethy

Background

As explained in the third Interim Report (Section 3.2) this area forms part of the area referred to as the Cairngorm cSAC in the original bid and lies just to the south of Dell Wood NNR and is owned by the RSPB. Most of the work here involved drain blocking, focusing on a number of areas where earlier restoration work had seen large areas of planted trees removed and areas of drains blocked. To facilitate plough-line filling, an additional area of Scots pine plantation was removed, and in an adjacent site, natural Scots pine regeneration which had become established on the site due to earlier drainage work, was also removed.

Management undertaken:

There was not thought to be any need for habitat restoration at the time of the original bid but subsequent closer investigation of the ground, including the work carried out as part of the hydrological survey, highlighted the need for some tree removal. This was referred to in the second Interim Report although when measured accurately as shown on Map 3.2.4.c the area was shown to be 10.8 hectares rather than the 15 hectares referred to. These areas were subsequently mapped more accurately at the end of the Project. Local contractors removed planted Scots pine from 1.6 hectares of ploughed and planted peatland in August 1999, along with 8.7 hectares of dense, naturally regenerated Scots pine from a drained peatland site, to enable wetland restoration work to be undertaken. Planted Scots pine had also been removed from all of the other sites where drains were to be filled prior to this Project starting via earlier RSPB contracts. This means that a total of **10.3 hectares were restored** during the Project (Map 3.2.4.a).

The first phase of drain blocking started in March 1999 as a continuation to the contract in Mondhuie (Map 3.2.4.b). The work covered two types of techniques, complete filling of drains in the northern and western sites, and installation of peat dams at intervals along drains at the other two sites. In all, 13.6 hectares of peatland was restored by the end of the contract which was completed before the start of the bird breeding season in April.

The second phase of restoration work re-visited areas where earlier attempts at re-wetting the sites had not achieved their objectives, and was carried out in autumn 1999. The earlier work had involved the installation of peat dams in the main drains, but, because of the gentle, sloping topography of the site, these had failed to raise the water-table close enough to the surface of the peatland to allow natural peatland processes to develop, and over most of the sites, heather was still dominant. The objective on this visit for the two large eastern sites was to fill in all the plough-lines across the sites using 6 tonne Hymacs. Because of the scale of the task, two machines were operating, following and filling all the plough-lines, end to end. At the smallest, western site where ploughing had not taken place, main drains were filled end to end. Initial results at these site has been very encouraging. This phase of work saw 21.5 hectares of wetland restored using a technique not previously tried at Abernethy.

The complexity of this area of North Abernethy resulted in the LOPT slightly changing its specific target areas from that originally proposed. As can be seen from Map 3.2.4.f the original bid area represented a general area within which specific work was to be carried out. It is also quite featureless and therefore quite difficult to map accurately. When digitised the projected area in the second Interim Report should have been 40.8 hectares (Map 3.2.4.d). It would also appear that some of the earlier figures actually involved work undertaken by the RSPB in the years before the Project (Map 3.2.4.b). This area of 22.4 hectares, added to the **Project hydrological restoration area of 35.1 hectares**, brings the total restored in recent

years to 57.5 hectares. This represents a significant piece of restoration work in a very rich and diverse landscape of bog woodland in natural Caledonian woodland.

Fig 6: North Abernethy restoration work

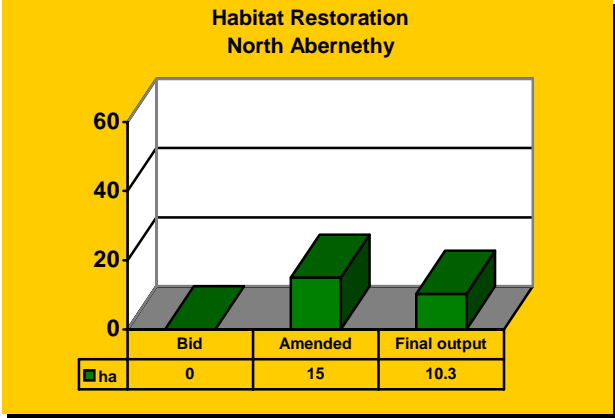
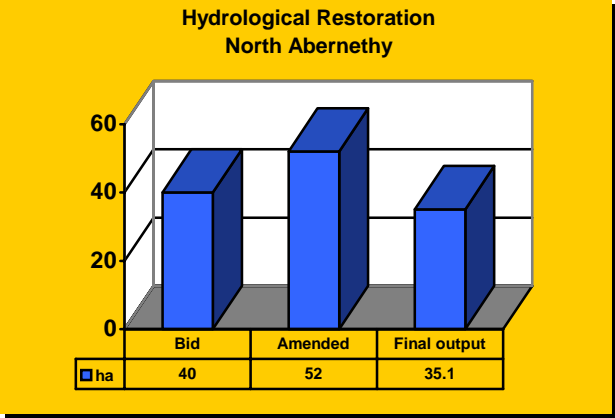


Table 5: North Abernethy summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																	
		1998			1999				2000				2001			2002			
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May	
A: Management plan preparation and other preparatory actions	1. Management planning																		
	a) Establish LOPT	EstLOPT																	
	b) Complete Local Operational Plan	Complete LOP																	
C: Non-recurring biotope management	2. Survey																		
	a) Undertake Hydrological survey																		
C: Non-recurring biotope management	1. Habitat restoration (0 ha)						10.3 ha												
	2. Hydrological restoration (40 ha)				13.6 ha			21.5 ha											
E: Public awareness and dissemination of results	1. Dissemination visits/open days	Open access at all times																	
	2. Conference visit																		
F: Overall Project Management	1. Supervision	Supervision																	
	a) Works supervision; contract management	Supervision																	
	b) Liaison with LOPT/Proj manager; qual control	Supervision																	
	2. Monitoring																		
	a) Set up monitoring programme							Monproj											
b) Monitor effects of restoration work										Monitor					Monitor				
3. Habitat review and classification				Review															

3.2.5 Dell Wood

Background:

Dell Wood is part of the Abernethy Dell Wood National Nature Reserve. 266.6 hectares are owned and managed by Scottish Natural Heritage with another 108.4 hectares leased from the RSPB. It contains extensive areas of bog woodland with marked variations in the water table due to the irregular topography. Many of these bogs have been subjected to drainage/forestry, particularly during the last 30 years, and have lost (or are losing) some of their intrinsic biological features.

Similar to Mondhuie, Dell Wood has both 'afforested and drained' and 'drained only' damaged bog woodland. The 'afforested and drained' area lies on the south side of Nethy Bridge and was drained and planted with Lodgepole pine in the early 1970s. The area planted on peatland amounts to approximately 5 hectares. The area is used locally for light recreational purposes and therefore the community of Nethy Bridge was fully consulted over the project's proposals. There was no adverse reaction. The 'drained only' areas lie about a mile south of Nethy Bridge among more intact bog woodland habitat and is estimated to affect an area of approximately 32 hectares. The total area of drain blocking at Dell Wood will, thus, be 37 hectares.

Management Undertaken:

As with North Abernethy it was not originally thought that any tree removal would be needed. However closer investigation showed that some was required. The restoration work at Dell Wood was planned in two phases. The first phase, the tree felling, was carried out September / October 1999 and completed an area of **just under 5 hectares of bog woodland restoration** (Map 3.2.5.a). The work was actually part of a 17 hectare tree felling programme in which the main target habitat is Caledonian Pinewood – of which, of course bog woodland is an integral part. As an attempt to demonstrate an alternative brash disposal technique, it was decided by the Dell Wood LOPT to instruct the contractor to gather up the brash into large heaps. Given some time for this to decay and some appropriate weather the idea was to set fire to the piles of brash in a controlled manner. A start was made on the brash burning in November 2000, and continued when weather and ground conditions allowed. Foot and mouth restrictions were imposed in February 2001 which delayed operations. SNH labour was used for the brash burning, augmented by contractors. Although no dams were built the felled timber was used to infill the drains and this, in conjunction with the removal of tree cover and subsequent reduced evapotranspiration, has resulted in the area becoming rewetted. This area will be monitored by SNH to see if further work is necessary.

A contractor was employed during August – September 2001 to install 30 hand built dams on the main drains to the south of the electricity supply wayleave. The effect of these dams has been to impede the drainage and it is estimated that the area that is currently showing signs of rewetting is just under 10 hectares. In total the area that has been **rewetted as a result of the project is 14 hectares** (Map 3.2.5.b).

A third area of proposed hydrological restoration was referred to in the second Interim Report (Area 3 on Map 3.2.5.d). This was not managed as part of the Project as recent work has shown that this is prime capercaillie habitat. The original bid for hydrological restoration in North Abernethy and Dell Wood (Area 5 on Original bid: Maps 2.1.2.a & 3.2.5.e) was for a total of c 40 hectares. **The combined total for the two areas restored by the Project is 49.1 hectares.**

Fig 7: Dell Wood restoration work

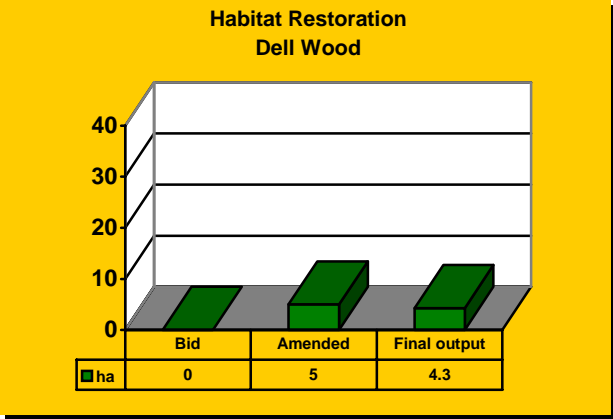
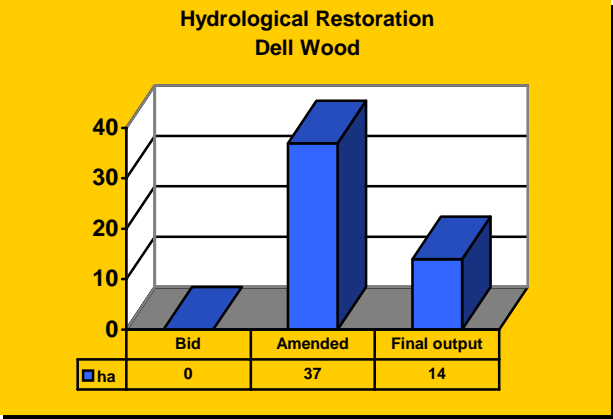


Table 6: Dell Wood summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																	
		1998			1999				2000				2001				2002		
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May	
A: Management plan preparation and other preparatory actions	1. Management planning																		
	a) Establish LOPT	EstLOPT																	
	b) Complete Local Operational Plan	Complete LOP																	
C: Non-recurring biotope management	2. Survey																		
	a) Undertake hydrological survey																		
	1. Habitat restoration (c. 5 ha)							4.3 ha											
E: Public awareness and dissemination of results	2. Hydrological restoration (0 ha)							14 ha											
	1. Dissemination visits/open days		Open access at all times																
	2. Conference visit																		
F: Overall Project Management	1. Supervision		Supervision																
	a) Works supervision; contract management		Supervision																
	b) Liaison with LOPT/Proj. manager; qual control		Supervision																
	2. Monitoring																		
	a) Set up monitoring programme							Monprog											
b) Monitor effects of restoration work										Monitor					Monitor				
3. Habitat review and classification				Review															

3.2.6 Garten Wood

Background:

Garten Wood contains areas of superb pinewood and bog woodland habitat and is situated between the village of Boat of Garten and Loch Garten on the western side of the RSPB Abernethy Forest Nature Reserve. The hydrology of the area has been severely interfered with over the years through an extensive programme of deepening, widening and/or straightening existing watercourses, as well as the digging of new drains. The result was a severely altered habitat draining off a consistently higher volume of water than before - seriously reducing the conservation value of this part of the Cairngorms cSAC.

RSPB has already been active in wet wood habitat restoration in Garten Wood over the last 15 years damming many of the key drains. Recent investigation has shown the need to consolidate a lot of that work as well as extend the drain blocking programme to a wider part of the wood.

Management Undertaken:

The bulk of the work in Garten Wood was carried out in November / December 1999 and covered an area that was estimated at that time to be approximately 40 hectares. However reference to Map 3.2.6.b shows that the actual mapped area of work undertaken was 56.9 hectares. Subsequent more accurate mapping using orthorectified aerial photographs, GPS equipment and finally digital mapping shows **the area that has been hydrologically restored is 25.4 hectares** (Map 3.2.6.a) and brings the total area that has been subject to hydrological reinstatement in recent times to 39.8 hectares. In areas of consolidation, new dams were build next to the originals, effectively doubling the size of the dam, and ensuring that no collapse or leakage would occur in the future. In these areas new dams were constructed by hand using Scots pine logs with a locally dug peat infill and a vegetated top. It would be very difficult to take machinery to these sites without causing excessive damage. Behind the original dams there is now a well established forest bog, this recent work will ensure that the natural bog formation processes continue.

In the area where new dams were installed these were again installed by hand but using interlocking plastic piles supported at some sites with a wooden cross-member. Again, many of the lessons learned in the previously mentioned Scottish and Irish blanket bog LIFE Projects were used here.

Fig 8: Garten Wood restoration work

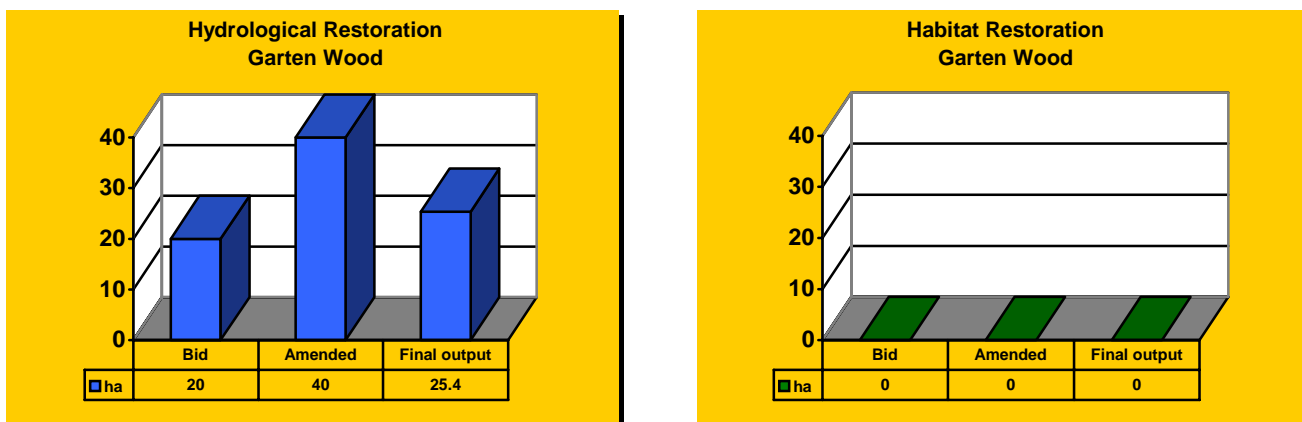


Table 7: Garten Wood summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																
		1998			1999				2000				2001			2002		
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May
A: Management plan preparation and other preparatory actions	1. Management planning																	
	a) Establish LOPT	EstLOPT																
	b) Complete Local Operational Plan	Complete LOP																
	2. Survey																	
C: Non-recurring biotope management	1. Habitat restoration (0 ha)																	
	2. Hydrological restoration (c. 20 ha)							25.4 ha										
E: Public awareness and dissemination of results	1. Dissemination visits/open days	Open access at all times																
	2. Conference visit																	
F: Overall Project Management	1. Supervision	Supervision																
	a) Works supervision; contract management	Supervision																
	b) Liaison with LOPT/Proj manager; qual control	Supervision																
	2. Monitoring																	
	a) Set up monitoring programme						Monprog											
	b) Monitor effects of restoration work									Monitor					Monitor			
	3. Habitat review and classification			review														

3.2.7 Pitmaduthy

Background:

Pitmaduthy Moss in Easter Ross lies in a shallow depression 4km to the south of Tain and to the west of the A9 trunk road. The mire habitats are part of a wider area of semi-natural habitat some of which has only recently been affected by drainage, afforestation and reclamation. The site is surrounded by plantation woodland, agricultural land and a small area of heathland.

The site supports a range of ecological conditions which are very unusual and rare in Scotland showing strong affinities to the wooded mires of Scandinavia. The raised bog system consists of a series of pools in a hollow bounded by drier ridges. The hydrological balance allows for slow tree growth on the ridges and other drier areas with *Sphagnum* moss bog communities dominating the ground flora. Scots pine (*Pinus sylvestris*) is the dominant of the scattered tree species. It is larger and more abundant where the bog is drier where birch (*Betula pubescens*), rowan (*Sorbus aucuparia*), and willows (*Salix spp.*) are also found. Willow scrub (*Salix spp.*) is found to the west of the site where there is a degree of nutrient enrichment amongst more characteristic richer mire communities. A total of 19 species of *Sphagnum* have been recorded on this site, of which two, *S. imbricatum* and *S. fuscum* are of national importance. This is also the only site in Easter Ross where the white beak-sedge (*Rhynchospora alba*) is recorded.

The site is important for breeding woodland bird species including osprey (*Pandion haliaetus*). The diversity of habitats has promoted a wide range of invertebrate fauna including some nationally rare species including the northern damselfly (*Coenagrion hastulatum*).

Habitat Restoration:

It was thought that there may have been two main threats to Pitmaduthy cSAC. Firstly, and similar to the other project sites, it appeared that the site was under some degree of threat from the drying out effect of an adjacent plantation. Furthermore, it was believed that this plantation would provide a seed source for invasion of the site. Secondly, the northern side of the site is directly adjacent to agricultural land leading to increasing amounts of nutrient enrichment through fertiliser drift or run-off from fields. This could significantly increase the growth of existing trees, encourage tree regeneration and alter the vegetation structure typical of nutrient-poor bog woodland. The results of the hydrological survey of this site helped to guide the LOPT as to what exactly were the main threats to this site and what management would be required to ensure its favourable condition.

It was originally proposed that restoration/protection work would focus on two strips of land directly adjacent to the cSAC. On the north side, the planting of a native woodland of some 12 hectares was considered. The aim of this would be for it to act as a buffer zone by protecting the site from continued agricultural run-off. This new native woodland would also have been fenced to allow the trees to establish.

Directly adjacent to the southern boundary of the site is a plantation of mixed Lodgepole and planted Scots pine. To reduce the impact of this plantation on the site (mainly drying and seeding), it was thought that it may be necessary to fell the trees 30 - 50 metres back from the bog followed by a further zone of 'feathering' i.e. the trees are progressively thinned to soften the edge and create a more natural transition from pinewood to bog woodland.

The hydrological survey of this site which was subsequently carried out in June / July 1999 concluded that there is already a healthy semi-native pinewood buffer zone between the

plantation and the bog and, thus, there is no evidence of any negative effect on the cSAC. Consequently, the project board was advised by the LOPT to remove this particular output from the project and use the resources on alternative higher priority work on other cSACs.

The survey did, however, agree that there is a nutrient enrichment issue coming from the agricultural run-off on the north side of the site and recommended to the LOPT that a feasibility study should be carried out to present a series of costed options on how to mitigate this particular problem.

Following consideration of the Nutrient Enrichment Mitigation Feasibility Study, which was commissioned in June 2000 (see Section 3.4.2), and discussions with the landowner it was decided that the best way forward would be to submit a Rural Stewardship Scheme application. This has now been approved and as well as the creation of 26 hectares of species-rich grassland a further 4 hectares will be managed as extensive cropping. The presence and importance of the adjacent cSAC was an important contributory factor in the approval of this scheme which will not only benefit the cSAC but will also provide other nature conservation benefits and perhaps equally importantly provide support measures that are suited to the needs of the neighbouring farmer which is an important consideration in rural areas such as this.

3.2.8 Conon

Background:

The Conon Islands cSAC is situated at the mouth of the River Conon and is an excellent example of a relatively unmodified dynamic alluvial woodland system with transitions from woodland, through scrub and fen, to brackish and finally saltmarsh communities. The inundated alder-dominated woodland (*Alnus glutinosa*) is found on the islands of the lower River Conon. In the wet alder woods *Salix pentandra* and *Salix cinerea* are often abundant with a sedge-rich ground flora including greater tussock sedge (*Carex paniculata*) at the northern limit of its range. On the slightly higher ground ash (*Fraxinus excelsior*) and bird cherry (*Prunus padus*) tend to be the more dominant species. Adjacent to the woodland, there are transitional areas of tall sedge swamps through tall herb fen to neutral grassland where the flooding is more seasonal. Here the ground flora includes wood crane's-bill (*Geranium sylvaticum*), northern bedstraw (*Galium boreale*) and the lesser butterfly orchid (*Platanthera bifolia*). These habitats and abundance of available food support a local otter population.

The site supports a wide range of breeding birds including red-breasted merganser (*Mergus serrator*) as well as good populations of more common breeding species. Osprey (*Pandion haliaetus*) and red kite (*Milvus milvus*) use the site for foraging. The site is also important for overwintering migrants.

Within the last century or so, a number of species of exotic shrubs have been introduced to gardens and policy woodlands as ornamentals. The reduced intensity of management of many estates and woodlands has allowed these shrubs to become established within floodplain woodlands and occasionally on bog woodlands too. On the Conon Islands cSAC, the woody perennial shrub *Physocarpus opulifolia* is extensively present and is displacing significant amounts of native flora.

The Conon Islands cSAC incorporates areas where riverside walks are a feature. This is encouraged by SNH and the project as a whole where there is no threat or damage to the site. In some areas, however, it was accepted that there was a threat of damage to the site so, consequently, it was proposed to upgrade a section of existing path as a means of diverting walkers away from the most sensitive and threatened areas of the site.

As stated in our letter to the Commission of 18 April 00, the project board agreed that it would be more appropriate for the Local Operational Planning Team (LOPT) to take the place of the originally proposed Management Forum.

Management Undertaken:

The original objectives were to

- restore 3 hectares of residual alluvial woodland by removing an invasive exotic shrub and thus encourage more natural processes;
- reduce the current threat of damage by walkers to the cSAC by upgrading 200m of the existing footpath as a means of diverting them away from sensitive areas of the site; and
- fence areas where stock access was considered to be causing damage to the sites qualifying features.

In March 2001 the Project applied for an extension in time to allow for additional work to be carried out within the cSAC which had been extended in 26 March 1998. Approval was given in October 2001 and consequently the restoration target was increased to 27 hectares.

The first phase of restoration work on the Conon was completed in June 2000 with the felling of 3 hectares of sycamore from the Kildun Farm area of the cSAC. This was part of a WGS Woodland Improvement Grant which also included the maintenance of existing stock fencing as well as the improvement of the public footpath to continue to allow light public access. This area was revisited in the 2001 when the *Physocarpus* was cut and in 2002 when the *Physocarpus* regrowth was sprayed.

Work on the clearance of exotic trees within Garrie Island began in Autumn 2000 and by May 2001 approximately 5.9 hectare of sycamore had been cleared. The *Physocarpus* was then cut and, as above, the regrowth was sprayed in 2002.

Further upstream a strip of 8.3 hectares, which was dominated by sycamore and rhododendron, was cleared and the regrowth treated in 2002. This means that a total of **just over 17 hectares (Map 3.2.8.a) has been restored** to allow for the development of natural alluvial woodlands. Although this is slightly less than the hoped for target at the time of the extension it does represent a significant piece of work in this delicate ecosystem. Work in this potentially very wet environment can mean that windows for opportunity are restricted, particularly in wet winters such as occurred in 2001/02. Furthermore the area that has been left mainly consists of poplar dominated areas. Although these are not native their removal would leave a vacuum for the return of non-native species. It is felt that it would be better to concentrate on ensuring that the areas that have been cleared by the LIFE Project are monitored and maintained appropriately. Once these areas have stabilised consideration will be given to what can and should be done in other areas. This will also be informed to some extent by the development of the Conon Strategy.

Fig 9: Conon restoration work

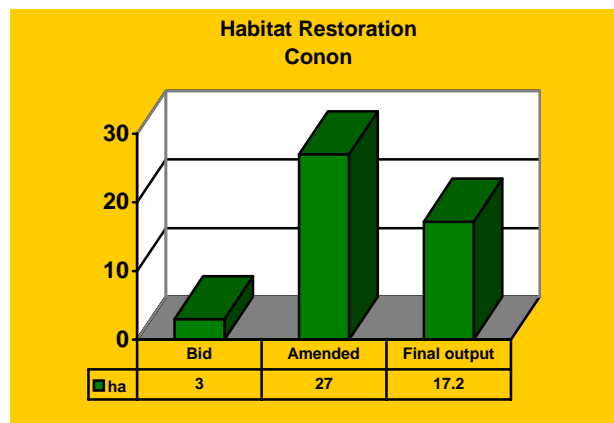


Table 8: Conon Islands summary of actions

Activity period

OPERATIONAL PLAN		PROGRESS																
		1998			1999				2000				2001			2002		
		May-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-May
A: Management plan preparation and other preparatory actions	1. Management planning																	
	a) Establish LOPT	EstLOPT																
	b) Complete Local Operational Plan	Complete LOP											Rev.plan					
	2. Survey																	
C: Non-recurring biotope management	1. Habitat restoration (3 ha)																	
E: Public awareness and dissemination of results	1. Dissemination visits/open days																	
F: Overall Project Management	1. Supervision																	
	a) Works supervision; contract management																	
	b) Liaison with LOPT/Proj manager; qual control																	
	2. Monitoring																	
3. Habitat review and classification	a) Set up monitoring programme																	
	b) Monitor effects of restoration work																	

3.2.9 Lower Spey Bay

This was not part of the original bid but as a result of predicted Project underspend a bid to undertake work in part of this cSAC was submitted in March 2001 to continue with the work that was being undertaken on this site. Map 3.3.6.a shows the area that contained a mix of exotic conifers that has been clear felled since 1998 and the proposal was to encourage natural regeneration within 8 hectares of the site. Work on this site is ongoing but it is constrained by weather conditions as this part of the Spey is prone to flooding and therefore it is important to work when the weather conditions are suitable. Therefore as permission to include this work was not given until October 2001 the season's work had already been undertaken and no claim has been submitted for management work.

Nevertheless the sympathetic management of this woodland area will continue to be undertaken by Forest Enterprise as owners. There will continue to be a dialogue between FE and SNH over future proposals to ensure that the alluvial woodland is restored.

3.2.10 Management of Brash

Although brash is dealt with as appropriate in some of the site sections an overview is included here. Several options are available as follows and are discussed here in general terms:

- removal and disposal offsite;
- chipping on site;
- burning; and
- leaving to rot naturally.

Removal and disposal offsite. This is perhaps at first the most desirable as potentially a large volume of artificial vegetation structure and nutrients are removed. However there are a number of potential drawbacks including cost, time, increased damage due to tracking of vehicles, increased period of disturbance and total removal of cover in the initial phase. In practice it is impossible to totally remove all the brash.

Chipping on site. This has the advantage of removing the unwanted vegetation with a reduced need for traffic movement compared to the above. Therefore all of the above drawbacks apart from cost and disturbance time are reduced. Brash chipping was viewed when Project members visited the Borders Mires Project. Initial hopes that this could also be used on Project sites were soon lowered when the local conditions were considered. The Borders Project tended to be cutting smaller, younger timber which was handcut and could easily be fed into a chipper. The Wet Wood situation differed in that the size of the timber meant that machine harvesting was required and this produces more brash which is very labour intensive to handle. In addition the waterlogged soils meant that machines needed brash mats for access. Once the brash has lain on the ground and has become waterlogged it becomes unsuitable for chipping.

Burning. Burning requires the brash to be first collected into piles. Care needs to be taken where brash piles are located as fire can damage the vegetation locally. It should ideally be undertaken on mineral soils that have been cleared as part of the work. Although there is a considerable amount of work involved in collecting the brash into piles the subsequent burning does result in the removal of the majority of the nutrients into the atmosphere.

Leaving to rot naturally. This has the obvious advantage of being the least disturbing and cheapest. On the downside there is the potential for the brash to interfere with recolonisation by natural vegetation and a prolonged period of nutrient input.

In view of the above it was decided that the latter two should be used in varying degrees and is described above where work has been undertaken in the report period.

3.3 Public awareness and dissemination of results

3.3.1 Monadh Mor

Map 3.3.1.a shows the access to the area which is used informally to a small extent by local people. The provision of two new gates erected to allow access on foot or cycle and the addition of waymarkers to the route through the restored areas have improved the access facilities for visitors. Waymarkers for the cycle route were replaced following the completion of harvesting. An on site interpretation panel was erected during March 2002.

Although formal groups visits are more limited the site was visited by a group from 12 Eastern European and Baltic states as part of the Darwin Initiative Peatland Biodiversity Programme in August 1998. More locally the Inverness Botany Group were given a guided tour in August 2001 as a follow up to a talk given to them on bog woodlands earlier in the year. A group of junior rangers (12 – 17 year olds) from various country parks in Glasgow were also shown round in August 2001. Forest Enterprise have now introduced a guided visit to the site as part of their "What's On" annual programme.

3.3.2 Inshriach

Inshriach has a well developed forest road system which is open to walkers (Map 3.3.2.a). Although some use is made by the small local community most of the visitors will be tourists who are visiting the general Cairngorm area which is a very popular area for tourists. As part of the information for visitors two interpretative panels were erected in March 2002 at the locations shown on the map.

Interaction with the Border Mires project occurred with one Forest Enterprise staff member visiting Kielder on 15 November 2000 and the Border Mires project staff reciprocated with a visit to Inshriach in October 2001. The site was also visited by staff from the Centre for Ecology & Hydrology during August 2001 and by participants at the Final Conference (see 3.4.3) in October 2001

3.3.3 Abernethy (all sites including Mondhuie, Garten Wood, Dell Wood and North Abernethy)

These sites are dealt with together as they all lie within RSPB or SNH reserves in the Abernethy area. The local communities are larger than at Inshriach and therefore the use of the area by locals is more frequent than there. However the area is also more heavily used by visitors as it is close to the very popular RSPB Osprey viewing area at Loch Garten and the Speyside Way passes through the area. Two new information panels were installed at each end of the Speyside Way as it passes through the main restoration area in Mondhuie. Standard wooden display stands to RSPB design were installed in September 2001 each containing five A3 information panels. The panels provide information that explains the need for tree removal and drain blocking, and highlights the wildlife that is benefiting from the work that has been undertaken. The access routes and panel locations are shown on Map 3.3.3.a

The site was visited by participants at the Final Conference (see below) in October 2001. Throughout the period 1998 to 2002, 875 people in 62 groups visited areas worked on as part of the LIFE Wet Woods Project, mostly North Abernethy and Mondhuie and occasionally Garten Wood. RSPB staff at Abernethy were honoured to show Prince Charles, his Balmoral Factor and close staff the work undertaken in Mondhuie. The Prince is partly responsible for

managing the Ballochbuie native pinewood on Deeside which is also a candidate Special Area of Conservation. The importance of the wet areas within pinewoods for woodland grouse and overall biodiversity were main topics as well as deer control. Nikki Munro (Head of SEERAD Environment Group) again was visiting to look at large scale pinewood restoration work along with wider capercaillie & black grouse conservation. The Native Woodland HAP visited specifically to look at bog woodland in Garten Wood and Mondhuie and the Border Mires LIFE team to look at relatively undisturbed wooded bog close to Loch Garten and the large scale work in Mondhuie. As with Inshriach, delegates from the Final Conference visited North Abernethy, Garten Wood and Mondhuie where the EU delegates were lucky enough to see a capercaillie!

A number of other groups have visited the area including representatives from the National Trust for Scotland, FWAG advisers, the Scottish Gamekeepers Association and a number of private estate staffs.

3.3.4 Pitmaduthy

There is no public access to this site.

3.3.5 Conon

One of the main visitor attractions within the area is Brahan Estate which is used for informal recreation. SNH provides financial support for the part-time ranger service on the Estate and the rangers are employed as the gamekeeper and the forester on the Estate and undertake visitor welcome activities and footpath maintenance during the summer months. This work includes leading approximately 15 guided walks each summer. Although primarily about their work on the Estate the walks include natural heritage information and many include the riverside woodlands within the cSAC. The rangers are aware of the international importance of the woodlands and the restoration work that has taken place.

The footpaths within the cSAC were in place prior to the designation of the site. Most of the paths are now part of the Mid-Ross Paths network which was established by the Footpath Trust in the late 1990's. Establishment of the network was co-funded by various public bodies, including SNH, and the European Regional Development Fund (ERDF). There are maintenance arrangements for the network and funding in place for the next 10 years. The paths at Kildun and Garrie Island are not part of the network and have had some maintenance undertaken as part of the WGS and SNH grant respectively. However as both areas are regularly inundated by the tide no major improvements have been possible. Work within the LIFE Project relating to access has therefore been restricted to the installation of two interpretative panels, the locations of which are shown on Map 3.2.8.a.⁴

3.3.6 Lower Spey Bay

This area lies adjacent to the Speyside Way (see below) and it was felt that it would be of benefit to explain the importance of the work that has been, and will be, undertaken and the general interest of the Natura features in the area and they relate to the landscape and cultural history. Therefore two panels were erected as shown on Map 3.3.6.a.

The Speyside Way is one of four Long Distance Routes in Scotland. It was first opened in the early 80's with additional parts being added through the 80's and 90's. The final part of the route, which runs from Buckie to Aviemore covering a distance of 64 miles, was officially opened by the then Minister for the Transport and the Environment in April 2000. Work has

⁴ There have been delays in getting planning permission for these signs but it is now anticipated that they will be erected before the end of December.

been carried out by the Moray and Highland Councils with financial support from the European Regional Development Fund, Scottish Natural Heritage, local Enterprise companies and the two councils. The two councils manage the route and the ranger service is supported by SNH.

3.3.7 General

The Project Manager attended the New Forest LIFE Project Conference in February 2001: an end of LIFE Project conference to disseminate results and lessons learned. This was felt to be a very useful event with a wide range of delegates from across Europe to share experiences in habitat restoration management including bog woodland. Issues covered included restoration techniques, monitoring and community consultation / liaison.

An interactive Bog Woodlands interpretative display has been developed at the Forest Enterprise Visitor Centre at Glenmore and was officially opened by Rhona Brankin, the then Scottish Executive Deputy Environment Minister, in November 2001. The opening received good publicity and the display was highlighted on Grampian TV 'North Tonight'. The Glenmore Visitor Centre lies in the heart of the Glenmore Forest Park and is visited by around 72,000 people a year. The Bog Woodland exhibit includes a model depicting a 'Spey Wifie' from Scottish folklore, which has the face of an old woman carved into a tree stump. A Spey Wifie was a wise old woman, who told stories of a local nature.

A Forest Enterprise staff member also participated in the 'Green Week' conference and exhibition in Brussels in April 2001. Central to the exhibit on Life Nature funded projects involving FE in the UK, was the 'Spey Wifie' sculpture.

3.3.8 Conference

The main dissemination activity during the period was the end of Project conference. It was agreed that it would be beneficial to arrange a joint conference with the Atlantic oakwoods LIFE Project under the banner of the Caledonian Partnership. The conference was originally planned for August but poor bookings necessitated its postponement. Following consideration by the two Project Boards it was decided to hold a two day event in October with the first an indoor event and the second in the field either looking at Sunart (Atlantic oakwoods Project) or Inshriach and Abernethy (Wet Woods).

Over 100 people attended the indoor part with an introduction from David Henderson Howatt (Forest Enterprise) and summing up by John Markland (Scottish Natural Heritage). In between were a number of varied speakers and of particular note were the inputs from our guests from Sweden and Finland. On the following day about 20 delegates visited Inshriach and Abernethy. This was a fairly mixed group with one SNH Board member (Alice Lambert), Micheal O'Briain (DG Environment), Kerstin Sundseth (Ecosystems) and assorted others. It was very useful to have our Finnish guest (Raimo Hekkila) with us as he was able to provide views from a Finnish perspective and, perhaps more importantly, was able to confirm that we were undertaking the correct actions to ensure that the necessary improvements are achieved. The morning was spent at Inshriach where David Jardine and Jack Mackay (FE) provided a very enthusiastic introduction to the Bog Woodland project and how the objective of restoring the conditions for Bog Woodland recovery dovetailed with the other objectives of management in this multi-benefit forest. Also outlined was FE's ongoing commitment to managing the existing and adjacent areas covered by the cSAC. In the afternoon we moved to Abernethy where Stewart Taylor (RSPB) provided an equally enthusiastic introduction and interesting afternoon. Conference Proceedings have been produced and will be publicised and made available via the Wet Woods and Highland Birchwoods websites.

3.3.9 Wet Woods Web Site

One of the principle aims of the Wet Woods LIFE project was the dissemination of information gained throughout the project in order to demonstrate and promote an integrated approach to the conservation of wet woodlands. The wet woods website was conceived as an ideal method of reaching as wide an audience as possible, particularly people outwith the partner organisations and those who would not normally have access to the results of research undertaken, or the project reports. Material for the website was contributed by all the main partners and the website was constructed by an independent contractor in liaison with SNH.

The website is designed to appeal to casual visitors as well as those seeking specific information on the conservation of wet woods. The language employed is mostly non-technical, especially in the introductory sections, and much use has been made of photographs to illustrate the work of the project. Images also serve to highlight the important and special nature of the project's two habitat types, alluvial woodland and bog woodland. The more specialist visitor to the website is catered for too, with a quick access facility to site accounts where details of the targets set, the management undertaken and the results achieved on individual project sites are provided. In addition, there is a library section where summaries and full texts of the research reports can be found. The final report on the Wet Woods LIFE project will also be available here. Other sections include a brief introduction to the partner organisations and summary information on LIFE funding, along with links to relevant websites.

Although not part of the original bid it was felt that the development of a Wet Woods web site (<http://www.wetwoods.org>) would be a useful way of disseminating information to the widest possible audience. It will also allow updates to be added as appropriate over the next few years.

3.3.10 Overview.

Raising public awareness and dissemination of results has been considered a major part of the Project outputs. The habitats concerned do not lend themselves to concentrated visitor use as they are both fragile and at times dangerous. However most of the sites, with the exception of Pitmaduthy, are within sites that are open to the public and indeed some are very well visited by general tourists who are taking advantage of the scenic and natural beauty of the areas. The general visitor has been accommodated for by the installation of interpretative panels at strategic locations and the display at Glenmore. More specialist groups can take advantage of the local staff of SNH, RSPB and FE who arrange guided tours as required.

The conference was a very successful event and the production and dissemination of the results is an efficient way of encouraging exchanges of information. The development of the Wet Woods website has also provided a very useful way of providing dissemination at the widest scale

3.4 Research

3.4.1 Hydrological and historical survey of Project bog woodland sites

Throughout the summer of 1999, the project commissioned an extensive hydrological survey of all bog woodland project sites. As well as researching the history of management of the cSAC, the plantation and the surrounding area, the team of external consultants provided a detailed picture of the hydrological condition of the whole area. The findings of the survey were presented at a seminar on 1st November 1999 which was well attended by project partners, land managers and Research Working Group members. The results of the hydrological survey together with the findings of the RSPB led "Conservation of Active Blanket Bogs in Scotland and Northern Ireland" LIFE Nature project (Contract No: B4 - 3200/94/770) are greatly helping partners to specify the appropriate management prescriptions for the long term benefit of the site.

Full references are given in Section 5 and a brief overview of the principal findings for each site or project are provided below:

Monadh Mor cSAC:

A study of aerial photographs and maps for a period between 1946 and 1989 indicate the loch-side mire vegetation on the site has been slowly changing in what is possibly a cyclical pattern. This is evidenced by fluctuations in vegetation cover and area of open water in the smaller lochans. On the western side of the site, there has been a definite lowering of the water table in the lochans. This trend appears to have been exacerbated by the completion of the widening of the A835 Tore-Maryburgh road. Field research in 1999 indicates that the rest of the site is becoming wetter since a NVC survey was undertaken at the site in 1994. Some recorded changes are due to differences in cartographic procedures used in the current and 1994 surveys and these have been taken into consideration. All the recorded changes indicate a rising water table with a corresponding change in the plant community along the hydrosere gradient. Directly to the north-east of the site is an area of former bog woodland which is now under a conifer plantation. The survey revealed many areas of largely intact habitat within this area which show good potential for restoration. Furthermore, the survey confirmed the strong possibility of there being a sub-surface hydrological link between this restoration area and the cSAC. Finally, the team also identified another mire macrotope directly adjacent to this plantation which is less damaged and, thus, represents another good example of a wooded ombrotrophic bog.

Inshriach (Cairngorms cSAC):

The study of aerial photographs and early maps clearly shows that five of the six mire mesotopes identified on this site are much reduced in size and status since 1906. This, again, has been caused through the combined effects of forestry and drainage. The sixth mire, Lochan Gorm, has become a mire through the process of terrestrialisation in a 40 year period. The general drying out process is having differential effects upon each hydrological unit: some of the mires are subject to severe degradation and erosion; others are showing less advanced stages of degradation. The restoration proposals under this project, are seen as an essential part of the management which will help recreate the conditions necessary for bog woodland to develop once more.

Abernethy (Cairngorms cSAC):

Use of aerial photographs, historic maps and estate records show a long term record of changes in the land use and cover history of the site. Commercial forestry has had a significant impact on the site, particularly in the last 30 years with the planting of Lodgepole pine on the peatland soils. This has resulted in a loss of both flora and fauna of the original habitat as well as a drying out effect of adjacent areas of peatland. The area has also suffered from a long term programme of drainage - associated with both the plantations and the more open ground. Many of the drains on the open ground are former natural watercourses which have been deepened and widened to take more water off the site. In the last 20 or so years, the area has been in an ongoing programme of habitat restoration - principally through drain blocking. All of the previous restoration work, along with what is currently being carried out, will help to restore this particular area of the Cairngorms cSAC.

Pitmaduthy cSAC:

A study of aerial photographs for the period 1946 - 1989 suggest that the mire on the site has been slowly drying out with a lowering of the water table. There has been a greater rate of desiccation in the western section of the mire drained by Pitmaduthy Burn. Use of historic maps and estate records provide a long term record of changes in the land cover history of the site. The presence of an old road and dyke are influencing mire formation and the current hydrological features of the site. Since 1994, however, there appears to have been a period of the mire becoming wetter which suggests that changes may be following a cyclical pattern. The survey also highlights an area on the north boundary of the site where run-off from agricultural fields is causing enrichment to the site.

3.4.2 Costed Options for Pitmaduthy Moss

Following on from the Hydrological impact study referred to in Section 3.4.3 it was decided that it was necessary to investigate ways of reducing nutrient input from the adjacent agricultural land. SAC Conservation Services, the Farm Woodland Unit and Plant and Crops Division were contracted to identify a series of costed options of actions that aim to alleviate the nutrient enrichment from the existing agricultural fields onto the bog woodland and make recommendations on subsequent management to maintain or improve site conditions as appropriate. The likely implications for the farm business, water quality and wildlife were considered for each scenario. It was important that a number of options were considered to be suitable and any final decision would need to be made by the landowner, as the farm economics had to be considered. Three main options were proposed:

- to remove 18ha of arable land from farming for 30 years by planting trees and access annual payments;
- to continue to farm the 18 ha site but under low intensity management, with either little or no fertiliser applications through agri-environment options, the Rural Stewardship Scheme or the Organic Aid Scheme or both; and
- to continue to farm the site under present practice by applying nutrient budgeting techniques.

All three options were thought to offer significant reductions in nutrient run-off and some also offered other benefits. For example the woodland scheme would enhance the overall woodland area and have landscape as well as other natural heritage benefits whereas species rich grassland would not only benefit the flora but would also benefit ground nesting birds as well. See section 3.2.7 for the actions taken.

3.4.3 Monadh Mor: Impact of bog woodland restoration on adjacent land surrounding the Newlands of Ferrintosh

As reported in Section 3.2 local landowners were concerned by a perceived increase in the periods and amount of flooding which they linked to the works carried out as part of the bog restoration. The Scottish Agricultural College were commissioned to undertake a study to assess the impact of the work. This showed that the damming work had been successful in increasing the area of wetland. Also, as expected after clear felling operations, surface water run-off had increased, although this had been to some extent reduced by the water retention measures. The main problem on the adjacent land was the increased rainfall and state of the drainage system. Recommendations were made to ensure that the Project area does not pose a problem in future. These would form part of normal good management and do not require work at this stage but will be reviewed as an integral part of site management. Most of the recommendations referred to the adjacent farms. A copy of the report is attached.

3.4.4 Impact of bog woodland restoration on adjacent land surrounding Mondhuie

As reported in Section 3.2 this study was a direct result of the peat dams in the main outflow drain at Mondhuie collapsing with subsequent flooding of the B970 road along with deposition of peat, from the dams, in some of the adjacent field drains. However this merely added to the concerns of the neighbouring agricultural tenants who perceived that there was an increase in high water flows associated with the work undertaken as part of the Project. The Scottish Agricultural College were commissioned to undertake a study to assess the impact of the work. This showed that apart from the collapse of the peat dams the damming work had been successful in wetting parts of the site that are low lying and have shallow surface gradients. Also, as expected after clear felling operations, surface water run-off had increased, although this had been to some extent reduced by the water retention measures. Therefore apart from the collapse of the dams the main problem is the increased rainfall and state of the drainage system outwith the restoration area. Recommendations were made to ensure that the Project area does not pose a problem in future. Those that require immediate work will be done before the end of the Project whereas others will be undertaken as an integral part of the longer term site management. Several other recommendations referred to the adjacent farms. A copy of the report is attached. Two Scottish Agriculture College staff gave a presentation to about 30 interested Mondhuie neighbours on 2 August 2001.

3.4.5 Classification of bog woodland habitat and review and analysis of restoration management at the RSPB Abernethy Forest Reserve

This is an amalgamation of two activities that had previously been referred to in the Project interim reports as:

- a) Review and analysis of past restoration management carried out at Abernethy; and
- b) Development of a sub-classification of bog woodland types.

Bog woodlands constitute one of the UK's rarest and least understood natural ecosystems. Whilst both mires and native woodland are relatively widespread and well-researched, the concept of the forested mire or bog has only been considered occasionally and is missing from many British classifications of semi-natural habitats.

At the outset of the project, the Steering Group agreed that, in any habitat restoration work, there is a clear need to define the target environment or vegetation type. Thus, it was seen as a priority to survey and identify the main mire communities present on at least one of the

project sites with a view to developing an appropriate vegetation classification. This work was commissioned to The Institute of Ecology and Resource Management of Edinburgh University and was carried out in conjunction with their review and analysis of past restoration work at Abernethy.

At Abernethy, the contractors have identified three sub-classes within this generic term 'bog woodland'. These are wooded bogs, bog woodland and woodland bogs.

The first category, **wooded bogs**, features bogs on which the pine trees are mature, but with stunted growth, rarely more than 4 - 5 metres high and at a rather low density leaving an open canopy. Pine is, here, an important and distinctive component of the vegetation, though the flora is predominantly one of an open mire vegetation. There appears to be an uneven-aged population structure and the pine is regenerating as a permanent component of the vegetation.

Where the peat has become drier for one reason or another, the pines become tall and dense and the ground flora is clearly determined by shade tolerance and association with drier, aerated, acidic soils though with a few remnants of the former mire communities (e.g. *Eriophorum vaginatum*). In this case the vegetation seems to be more characteristic of woodlands even though it is developed on deep peat. This vegetation type has been classed as **bog woodland**.

The opposite end of the spectrum, however, concerns mires, usually with a high water table, in which pine seedlings are abundant and form a characteristic component of the ground flora, though these rarely survive to maturity. The saplings are stunted to no more than one or two metres high with yellowish needles and are usually heavily infested with fungal diseases. Few of the pines reach maturity and it seems that this is a 'sink' population maintained entirely by the heavy seed rain from the surrounding forest. In this case the vegetation should be considered a typical mire community with the presence of pine entirely due to the surrounding vegetation, rather than the particular environmental conditions of the bog itself. The term **woodland bog** is proposed to describe these habitats.

As part of an on-going programme of Caledonian Pinewood habitat restoration, the RSPB has been involved in two main phases of restoration at their Abernethy Reserve: one in the mid 1980s, the other in the early 1990s. With generally very little experience of deliberate management for the conservation of wet woods, it was seen as a priority to review any available wet wood restoration work carried out to date.

The work focused on data taken from permanent quadrats recorded in 1992 and 1997 which were collated in a database. These quadrats were established to monitor the development of vegetation following restoration work on drained and ploughed land following removal of exotic conifers. The data were analysed to identify trends in development of the vegetation and responses to the restoration treatments. This report is still in draft form and, thus, will be included in the project's next activity report.

3.4.6 A survey of the peat stratigraphy of seven bog woodland sites in Scotland

The peat stratigraphy of seven bog woodland sites was surveyed. The sites were located across a bioclimatic gradient from the west Highlands through Speyside to the Black Isle. All of the sites bar one were characterised by pine. The tree growth at every site was established on genuine mire peat and did not represent tree growth on mineral substrates masked by superficial cover of fresh Sphagnum, or trees restricted to peripheral mineral ground transitions to mires.

All of the sites with the exception of Mar Lodge were considered to fall within the compass of the definition of 'bog woodland' adopted for the survey. The latter was excepted because it appeared to represent invasive colonisation of desiccating peats by trees, rather than a stable bog-wood system.

The sites exhibited marked stratigraphical variation. A common feature of many of the eastern Highland sites was the disturbed nature of the upper peat stratigraphy. Monadh Mor, Pitmaduthy and Inshriach appear to exhibit the most extensive and systematic disturbance to the peat stratigraphy, probably from ancient peat cutting. It is therefore possible that some of the bog woodlands, or parts of them, are therefore comparatively recent in origin (i.e. <150 years old). The Western Highland sites of Loch Maree islands and Lònn Lèanachain appeared to be the exceptions, as here no truncation to the peat stratigraphy was detectable.

The Rothiemurchus peatland sites might also represent areas which are returning to some kind of wooded equilibrium after centuries of intense grazing pressure and burning (as well as some peat cutting), following recent changes in management practice.

3.4.7 Age structure of Scots pine woodland

The age structure of Scots pine (*Pinus sylvestris* L.) bog woodland was investigated at four sites in NE Scotland to clarify whether these examples of the habitat are stable or transient. Individual tree age cannot be predicted from general equations relating age to height or diameter. The sampling sites at Pitmaduthy Moss, Abernethy Forest and Inshriach Forest had been severely impacted by human activities, some of which were reflected in the age structure of the pine population. Much of the Monadh Mor site appeared to be undisturbed. The site at Abernethy Forest supported 'bog pines' up to 335 years old and a ground flora including *Sphagnum fuscum* and abundant *Sphagnum austinii*. This combination suggests that the site has supported open bog woodland for several centuries. These results are consistent with a process of bog woodland development on bogs in response to natural or anthropogenic disturbance. Tree growth rates and branching may be used as indicators of the degree of alteration caused by the disturbance and of whether the site is likely to succeed to closed-canopy woodland.

3.4.8 Historical survey of the River Conon

The distribution of alluvial woodland is obviously related to the River Conon. This survey looked at three main issues that could alter river hydrology. The impact of deforestation is difficult to assess accurately although the overall impact is likely to be an increased rate and level of flooding. Dams for hydroelectric production were built between 1946 and 1961. This involves water transfer, storage and controlled release for power generation and has had obvious impacts on river flow. At a more local level construction of floodbanks and the installation of field drainage systems has had an impact. The report considers management options which relate to local impacts. These, along with other an assessment of the residual woodland resource will inform the development of a strategy for the area.

3.4.9 The Residual Alluvial Woodlands of the River Conon

The purpose of this report was to identify the distribution, structure, composition and connectivity of residual alluvial woodland on the lower Conon and ultimately to determine activities which will maximise the conservation value of the residual alluvial woodlands in this location.

Active geo-morphological processes are fundamental to the natural development of residual alluvial woodland in the long-term. Woodland structure and composition within some

woodland compartments support transition to other woodland types via succession as a result of the taming of the river. The residual alluvial woodland fragments of the Lower Conon equate to 170 ha with 72 ha recorded as Ancient in origin and 13 ha as Roy woods. (Roy Woods are ones which were shown on maps produced in 1750 and modern ones but were not shown as wooded in 1850.) The woodland "location" has been drawn into three categories: "dynamic alluvial" woodland, "wet" woodland and "transitional wet" woodland. Transitional woods account for 78 ha and dynamic alluvial and wet woodland combined to cover an area of 94 hectares

Within the floodplain woodland composition, alder woodland remains the main ingredient covering 90 ha, with spruce / broad-leaved transitional woods occupying 52ha of the Lower Conon. In fitting with the policy to remove exotics within the Lower Conon, some 44 ha of the transitional woodland have been identified for felling to restructure. The remainder of the transitional woodland type supports alder to varying degrees.

A complex mixture of valuable habitat types associated with residual alluvial woodlands prevails on the lower Conon. Many of the natural habitat corridors have fully or partially eroded and natural woodland patterns are missing from the landscape. In many areas the alien plant species within the Lower Conon are out-competing native species. Sycamore and Himalayan balsam are main points of concern and eradication is a management preference.

The habitats provided by the floodplain woodland support many birds, mammals and invertebrates. Some of these are specialist species and some are listed as Red-data book species. Recent survey work conducted by the district fishery board suggests that many riparian habitats have degraded and require improvement. Dunglass Island and Coille Uisge offer opportunities to open up old river channels and re-instate these as part of the river system. This would provide an opportunity for the expansion of residual alluvial woodland and would benefit local fish populations, including salmon, at the same time.

3.4.10 Research Overview

The four hydrological reports were commissioned with a view to assessing the condition of the bog woodland habitat at the four bog woodland sites and identifying short, medium and long term management prescriptions to retain or, where possible, enhance that interest. These confirmed that the management proposals that were being considered were sound and were therefore useful preliminary studies to inform management. Similarly the costed options at Pitmaduthy also provided useful information that was invaluable in the decision making process.

The need for the two impact studies arose as a result of local concerns about the work that was being undertaken, particularly on the perceived flooding problems. This independent work proved invaluable in allaying local concerns.

The next two studies involved the complex and difficult subject of bog wood classification. The understanding of bog woodland was further informed by the age structure study. The above studies have identified the following broad principles regarding the nature, development and management of bog woodland:

- a number of different vegetation types contribute to 'bog woodland'
- these vegetation types are rarely, if ever, distinguished by their tree component, i.e. the trees are incidental to the classification albeit that it is the trees that distinguish bog woodland from open mire.
- many sites currently supporting bog woodland have been subject to human disturbance, most notably peat cutting, drainage and tree planting

- few, if any, sites have supported bog woodland throughout their history. They have undergone open mire phases.
- fire has been a regular feature during the history of most bog woodland sites
- restoring bog woodland by means of felling alien trees and blocking drains can have a significant impact on the local hydrology, but relatively little impact on the hydrology of adjacent mineral soils.
- trees can survive on bogs for a long time – up to several hundred years.

As all sites have been subject to management for purposes other than maintenance of the natural heritage interest, there is inevitably a degree of uncertainty regarding the appropriate management to conserve that interest in perpetuity. That said, there is also a degree of comfort in knowing that the habitat can continue to develop or recover following limited disturbance. Perhaps the most appropriate management for the future is to create conditions which exclude or nullify impacts which adversely affect site hydrology and nutrient status and to encourage natural processes to predominate.

It should not, however, be assumed that all that needs to be known about this habitat is known. Even at the purely descriptive level, only a limited range of the total diversity of vegetation and, presumably, associated water chemistries, have been described and analysed. Extension of this work to encompass the full expression of the habitat would put it on a par with other, better known, habitats.

More detailed stratigraphical work at some key sites should help clarify some of the habitat development issues, perhaps identifying the relative importance of climate, off-site and on-site management in determining the direction and rate of change. This will partly be covered by a PhD looking at peat core analysis which is due to start in October 2002 and will be jointly supervised by the RSPB, University of Hull and the University of Edinburgh.

There might be scope for some genetic work on ‘bog trees’ to determine whether they are genetically distinct from their mineral soil neighbours – as suggested from work in Sweden. This might help inform restoration management when either the tree cover has been lost or ‘polluted’ by alien genotypes.

Clearly there is no end to the list of potential research projects, looking at all aspects of site chemistry, biology and hydrology. The above examples are, however, among those which might contribute most directly to habitat safeguard and management. Given that individual bog woodlands tend to be small and scattered, a balance will always have to be reached between intensive and extensive studies. Extensive studies are clearly required to give individual sites some context. However, without some intensive, multi-disciplinary studies on a small number of key sites, our understanding of the developmental history and dynamics of this habitat will continue to be patchy and superficial.

The final studies looked at a different habitat type and provided valuable insight into the historical background of the alluvial woodlands associated with the River Conon and the pressures and threats that they face. This was the basis for the development of the River Strategy.

3.5 Monitoring

One of the special functions of the country agencies, which includes Scottish Natural Heritage, is to establish common standards throughout Great Britain for the monitoring of nature conservation. As a first step towards fulfilling this requirement the agencies have developed a framework for site condition monitoring within which all SSSIs, SACs, SPAs and

Ramsar sites will be assessed and reported on over a six-year cycle. It should be noted that this is a part of an indefinite commitment to monitor all designated sites.

The aims of approach developed by the conservation agencies are:

- to determine the current condition of the feature(s) of interest for which each site was designated, and whether current management of the site is likely to be appropriate in the long-term;
- to enable managers and policy makers to determine whether current legal measures and incentives are proving effective in protecting the features for which sites have been designated; and
- to detect trends in the condition of threatened habitats and species within national and international site series.

Guidance is provided on monitoring habitats which are divided into broad groups such as woodlands and wetlands and then sometimes subdivided into more specific habitats such as raised bogs. Unfortunately there was nothing specific for bog woodlands and therefore it was felt appropriate for guidance to be developed within the life of the Project. The draft guidance, attached at Annex A, was produced following discussions with Project partners and made use of work carried out by the Project. It focuses on four main attributes that are felt to be the best indicators. These are: area, i.e. is the overall extent being maintained; structure, which includes tree cover (and age) and microtopography; degree of wetness; and species composition. It is currently being reviewed by the specialists from the other country agencies (English Nature, Countryside Council for Wales and the Joint Nature Conservation Committee) with a view to it being formally adopted.

There are occasions when a more targeted approach to monitoring is required and a good example of this is the work that has recently been carried out by the RSPB at Mondhuie (McHaffie H: Baseline survey of potential bog woodland habitats following removal of lodgepole pine and sitka spruce plantation at Mondhuie, Abernethy Forest Reserve. RSPB Scotland, March 2002). The survey sets out a detailed methodology for assessing the re-vegetation of Mondhuie following the restoration management undertaken as part of the LIFE project. The method provides a thorough baseline description of conditions and communities. Of particular note will be the noting of remnants of mire communities from which mire/fen may be expected to recover. In the long term this monitoring will help to establish the extent to which the re-wetting has been successful in different parts of Mondhuie and under the different treatments: brash/ brash removal. As acknowledged the NVC classifications described are likely to be tentative at this early stage in the site's recovery, but they provide an indication of the range of communities that are likely to establish. The report shows that there has been good recovery of the areas that were cleared first and that the hydrological restoration appears to be working. The McHaffie vegetation survey will be repeated by the RSPB in 2006. The current results are included as an Appendix to this report.

There will also be more casual, but regular, inspections of the dams and other hydrological reinstatement works as well as recording of some RSPB sites for the presence of rare birds.

The original bid made reference to the possibility of remote sensing being developed as part of another EU funded project called EON2000 (ENV4-CT96-0362). However reference to the results showed that the resolution, accuracy and timescales were not suited to the fine scale monitoring that is required in bog woodlands and alluvial forests.

4. OVERALL PROJECT ASSESSMENT

4.1 Has the project achieved its objectives? Successes and failures

Reference to section 2.1.2 shows that the restoration targets for bog woodland were considerably exceeded (155.5% of target) for habitat restoration and only just fell short (98% of target) with regard to hydrological restoration. The general and site specific research projects produced much useful information that was of benefit during the Project and also adds to our knowledge and understanding of bog woodlands. These reports with wider implications will be available through the Wet Woods web site and the SNH web site: the Age Structure of Scots pine woodland has also been published in Scottish Forestry (Vol. 56 No. 3 2002, p135-243). All of this was achieved well within budget and therefore represents very good value for money.

The early indications are that bog woodland aspects of the Project have been particularly successful in spite of early complications. These illustrated the problems associated with developing programmes such as this. Parts of the areas that have been restored were very degraded and it was difficult to accurately assess before the work began what the situation would be on the ground with respect to its hydrological state. Also it was difficult to assess the ability of machines to carry out the work and for example Map 3.2.3.f shows how much of the work at Mondhuie had to be done manually, which is more expensive and time consuming than machine felling. More accurate preliminary mapping would have reduced the uncertainties and certainly the experience of this project, and the recent improvement in digital mapping techniques, will mean that any future work will be based on a more accurate understanding of the problem. However if, as was the case in parts of the site, the timber was of very poor growth form and had become intertwined and was therefore very difficult to harvest.

Learning from experience and interaction with others was an integral part of the Project. As can be seen from Section 3.3 there was considerable interaction with various groups visiting the sites and the Project Manager and other staff associated with the Project visiting other sites and Projects. The Conference, which was attended by over 100 delegates, provided an excellent forum for interchange of ideas and the presence of speakers from Sweden and Finland gave a valuable insight into the Scandinavian experience. It was particularly heartening to get positive feedback from the Finnish delegate as they have considerably more experience of bog woodland management in their country.

The work on the Conon met the original target and following permission to extend the Project a considerable additional area was restored. Unfortunately delays in getting formal agreement to extend the Project meant that the additional work planned for the Lower Spey Bay did not occur during the required period as management considerations meant that the work had to be undertaken when ground conditions are suitable. Although this had an impact on total Project outputs that part of the site is in the ownership of Forest Enterprise and therefore its continued future positive management is ensured.

Work on the Conon Strategy has perhaps been one of the more difficult tasks. The successful implementation of strategies depends on the willingness of interested parties to sign up to them and this in turn depends on a number of other issues. It was therefore felt that rather than try and produce something that was agreed by all parties, and consequently likely to be quite limited in scope, it would be more useful to provide a framework document that could be used to guide and encourage local initiatives. It is now proposed that a full consultation process will commence in 2003 with a view to having a management forum in place by 2004. Obviously this will depend on the co-operation of partners but as can be seen below informal discussions about the strategy are already paying dividends.

4.2 Conservation benefits

The most obvious benefit is the area that has been restored. Although for bog woodland habitat and hydrological restoration have been measured separately they are of course closely linked and it would not be possible or sensible to achieve one without doing the other. As can be seen the work on some of the sites, e.g. Mondhuie (Map 3.2.3.a) and North Abernethy (Map 3.2.4.b), has built on work that has been undertaken before the Project began but the Project has been instrumental in ensuring that the work has been completed and in a much shorter timescale that would have been possible otherwise. In other sites, e.g. Inshriach, the Project has been the catalyst for the work being undertaken. As a result there are now no major areas within the sites that have been worked that will require further significant areas of work. All will be monitored as part of SNH's SCM programme and some will be subject to more specific local monitoring to measure success and progress and to also see if any remedial work is required and to measure the success of that.

As a result of the Project an additional 214.3 ha of bog woodland habitat was submitted to the EC as additions to the Monadh Mor and Cairngorm cSAC on 29 January 2001.

Although the area associated with the restoration of the Conon is considerably less it has nevertheless been significant and considerably more than originally planned. The problems associated with the Conon are more or less restricted to the presence of exotic species as the component parts of the cSAC are located on areas close to the River Conon where the hydrological regime is less altered than areas back from the river. The presence of exotics within the rest of the catchment will mean that there is a continuing need to monitor the site and take remedial action as necessary. However because of the major work that has been achieved by the Project the need for further work will be considerably reduced. Unlike the bog woodland sites all of the River Conon is in private ownership. However as with other sites it will be monitored as part of SNH's SCM programme and financial aid for management will be available through national programmes such as the Scottish Forestry Grants Scheme, the Rural Stewardship Scheme and SNH's own developing Natural Care Programme which is looking at targeting top up funding to designated sites and Natura sites in particular. The developing Conon strategy already appears to be paying dividends. The work that has been undertaken has raised the profile of the conservation issues and resulted in new proposals being brought forward. The suggested restoration of residual alluvial woodland and the development of a new salmon spawning redd along the old river channel on Dunglass Island is the direct result of discussions about the Conon Strategy. An approach from a land manager about the control of Himalayan Balsam on the lower Conon has also been inspired by the work undertaken as part of the Project to deal with rhododendron and *Physocarpus*. Both these possible future projects show a desire to become involved in partnership working to produce results on the ground.

4.3 Incentive/pump-priming effects and networking

The Project has built on working relations that have developed over a number of years of involvement with LIFE Projects under the umbrella of the Caledonian Partnership. This meant that there were already good working relationships between the partners and the current Project has added to this. This close liaison will be invaluable as other LIFE Projects, such as the Capercaillie Project, and other joint working opportunities arise.

During the Project the Project Manager and a number of key personnel associated with the Project took advantage of opportunities to visit other projects and participate in Green Week. This all adds to the networking opportunities and there have been a number of corresponding visits from a diverse range of interested parties. Overall these exchanges have had a

significant role in developing contacts and raising interest and awareness that will prove to be useful in the future.

The pump-priming aspect of the Project has been of great importance in promoting the management of Wet Wood habitats. Bog woodlands by their very nature have little inherent socio-economic benefits, apart from the perceived gains associated with agricultural or silvicultural improvement, and are therefore often overlooked. The Project has raised the awareness of the need to manage these areas and has demonstrated that this can be done with the careful application of management techniques that are available. Similarly the impact on the consideration given to the management of alluvial woodlands will be of significant benefit as the experience gained is disseminated.

4.4 Demonstration and benefits of EU funding

Although the partners have some years of experience of managing bog woodlands this Project allowed the lessons learnt and experience gained from elsewhere to be put to use at a scale that was not previously thought to be achievable. This was a direct result of the opportunity to make use of money available under the LIFE Nature programme to undertake proactive work on candidate Special Areas of Conservation. This availability of funds is seen as a very important catalyst in ensuring that work is undertaken and that full advantage is made of the opportunities for networking and dissemination. It is therefore hoped that not only will the sites directly managed benefit from the work undertaken but others will also benefit as a result of the ethos of partnership working that these projects engender and that dissemination of the results will encourage land managers elsewhere.

4.5 Socio-economic effects

The main measurable socio-economic benefit that this Project has brought has been the work that has been carried out by local contractors. All of the Project locations can be considered to be economically vulnerable where opportunities for rural employment are often at a premium. Although much of the work is one off the Project has provided opportunities for local contractors during this period. The nature of the work has often meant that it is labour intensive as shown by the need to hand fell 63 hectares at Mondhuie. Similarly the novel nature of the work has allowed local contractors to develop new skills which will prove to be useful as they seek new contracts. It also benefits the sites directly as there is now an experienced group of contractors who are used to the different requirements of conservation, as opposed to economically, lead management.

4.6 The future: prolonging the effects of the project/further action needed

As has been stated in the main body of the report approximately 95% of the Project area lies within land owned by Forest Enterprise, Scottish Natural Heritage or the RSPB and therefore are covered by existing commitments to manage these areas for nature conservation in the long term. All of the other areas are also underpinned by domestic legislation as they are parts of larger Sites of Special Scientific Interest and therefore will be afforded the protection provided by this designation. All of the sites will be monitored as part of SNH's Site Condition Monitoring programme and some e.g. Mondhuie will be subject to more intensive surveying as outlined above. Although at this stage there are not thought to be any outstanding issues it is felt that there are sufficient systems in place to ensure that any work that is identified as a result of monitoring will be undertaken.

The development of sustainable management for the residual alluvial woodland of the Conon is likely to take several years. The dissemination of SNH's Conon Strategy to the other

stakeholders and the possible formation of a management group over the next two years is the start of the process. The move from merely preventing deterioration of the cSAC habitats to their enhancement and expansion will take several woodland cycles.

The management of alien exotics is also a long-term project. Due to their invasive nature some species may need control over several years or may re-invade following initial eradication. The control of these species will therefore have to continue for several years beyond the life of the project and will need the support of public funding in the form of SFGS, grants and agri-environment schemes.

5 LIST OF IDENTIFIABLE PRODUCTS

This first three sections highlight the research outputs of the Project and each one includes across reference to the relevant section in this report.

5.1 With Second Interim Report October 2000.

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. Institute of Ecology and Resource Management, University of Edinburgh, Edinburgh. **Originally submitted as Appendix 7 to the Second Interim report.** [3.4.5] ***

Egret Consultancy 1999. Wet Woods LIFE Project Hydrological Survey of Pitmaduthy. *Scottish Natural Heritage Commissioned Report F99PA18P*. **Originally submitted as Appendix 8 to the Second Interim report but resubmitted in new format and in CD format.** [3.4.1] *

Egret Consultancy 1999. Wet Woods LIFE Project Hydrological Survey of Abernethy. *Scottish Natural Heritage Commissioned Report F99PA18A*. **Originally submitted as Appendix 8 to the Second Interim report but resubmitted in new format and in CD format.** [3.4.1] *

Egret Consultancy 1999. Wet Woods LIFE Project Hydrological Survey of Monadh Mor. *Scottish Natural Heritage Commissioned Report F99PA18M*. **Originally submitted as Appendix 8 to the Second Interim report but resubmitted in new format and in CD format.** [3.4.1] *

Egret Consultancy 1999. Wet Woods LIFE Project Hydrological Survey of Inshriach. *Scottish Natural Heritage Commissioned Report F99PA18I*. **Originally submitted as Appendix 8 to the Second Interim report but resubmitted in new format and in CD format.** [3.4.1] *

5.2 With Third Interim Report December 2001.

Scottish Agricultural College: November 2000. Costed Options for Pitmaduthy Moss. [3.4.2] ****

Scottish Agricultural College: January 2001. Impact of bog woodland restoration on adjacent land surrounding the Newlands of Ferintosh (Monadh Mor). [3.4.3] ****

Scottish Agricultural College: June 2001. Impact of bog woodland restoration on adjacent land surrounding Mondhuie, Abernethy Forest Reserve. [3.4.4] ****

Mountain Environments (2000). Historical Survey of the River Conon. *Scottish Natural Heritage Commissioned Report F00PA40*. **Originally submitted with the Third Interim report but resubmitted in new format and in CD format.** [3.4.8] *

5.3 With Final Report October 2002-10-21

In addition to those resubmitted as shown in bold above:

Wells, C. 2002 Wet Woods LIFE Project A survey of the peat stratigraphy of seven bog woodland sites in Scotland. *Scottish Natural Heritage Commissioned Report F01PA10* [3.4.6] **

Buskie, S. 2001. Scottish Natural Heritage internal report. The residual alluvial woodlands of the Lower River Conon. [3.4.9] **

Anderson, A.R. & Harding, K.I.M. 2002 The age structure of Scots pine bog woodland Scottish Forestry (Vol. 56 No. 3, p135-143) [3.4.7] *****

SNH 2002. Conon Strategy [3.2.8]**

McHaffie, H. 2002. Baseline survey of potential bog woodland habitats following removal of lodgepole pine and sitka spruce plantation at Mondhuie, Abernethy Forest Reserve. RSPB Scotland. [3.5]**

* Report available on the SNH and Wet Woods websites. CD copies are available from SNH (e-mail ascg@snh.gov.uk) or further details on web (<http://www.snh.org.uk/strategy/sr-frame.htm>)

** Report will be made available on the Wet Woods website in the near future.

*** Report has restricted access as it contains information relating to individuals. Summary available on the Wet Woods website

**** Report available from RSPB.

***** Original paper available from publishers. A copy will be made available on the Wet Woods website in the near future.

5.4 Photographs

A comprehensive set of pictures relevant to the Project are on the Wet Woods website. These will be added to over the next few years so that people will be able to see the development of the sites.

Acknowledgements

This project would not have been possible without the financial support and guidance provided by the European Commission and gratitude must be expressed to Bruno Julien, Micheal O'Briain and Angelo Salsi for their guidance and support.

Day to day guidance and assistance was ably provided by Ecosystems and our thanks go to Kerstin Sundseth, Beatrix Richards, Neil Fletcher and John Houston for all the help and advice that they freely provided.

At a more local level thanks must also be given to the partners and co-financing organisations without whose input the Project would not have been possible: Scottish Natural Heritage, Forest Enterprise and Forest Authority (now Forestry Commission), Royal Society for the Protection of Birds, and Highland Birchwoods.

These organisations provided the personnel for the steering group as follows: Jack Mackay (FC), David Jardine (FC), Ken Sinclair (FC), Bryce Reynard FC), John Kerr (SNH), Nigel Smith (SNH), Tim Clifford (HB), John Kerr (SNH), Anna Morgan (SNH), Stewart Taylor (RSPB). The Scottish Executive took a watching brief and were represented by Graham Clark and Liam Mathers

Although these people formed the working nucleus a number of other personnel from the partners had an input, frequently quite significant, to the successful working of the project as follows:

SNH: Sandy MacLennan, George Hogg, Steve North, Peter Wortham, Simon Cohen, Carol MacGoldrick, Rachel Haines, Andrew Coupar, John Kerr, Nicky Black, Carol Sharp, David Duncan, John Gibson, Neil Harrison, Jenny Bryce, Kate Holl, Katharine Birdshall, Lorne Gill, Bill Taylor, Phillip Immirzi, Deborah Stephenson, David Law, Duncan Stone

RSPB Scotland: Stewart Taylor, Richard Thaxton, Andy Amphlett, Robert Moncrieff, Robert Grant, Neil Cowie, Peter Mayhew, and Richard Johnston

Forestry Commission: David Jardine, Jack Mackay, Ken Sinclair, Donald MacDougall, Ewan Reid, Jim Gillies, Roddy Macleod, Brian Duff, Peter Campbell, Martin MacPherson, Keith Black, Neil McInnes, Steve Jack, Rod Frazer, Malcolm Morrison, Peter Walling, Jimmy Stewart, Alan MacDougall, Ken Haines, Tommy Broadley, Gerald MacDonald, Geoff Stone, Scott Hannah, Anne Baxter, Russell Anderson, Bob Dunsmore, Les Bryson.

Highland Birchwoods: Tim Clifford, Diana Gilbert, Ewan Purser

The overall Project was initially managed by Neil Wilkie until June 2001 and his input was invaluable as was the support provided by Cath Williams throughout the life of the Project.

Final thanks must be given to the many neighbours of the land being managed and especially to Brahan Estates and Mr and Mrs MacNab as the only private landowners where habitat restoration was undertaken by the Project.

Annex A Draft Bog Woodland SCM Methods

Summary table

Attributes	Sub-attributes	Targets	Prescription
Area	Distribution and extent.	'No loss' or where possible 'expansion' through restoration.	Over whole site from aerial photographs at a minimum of 10 year intervals, and ground survey every 6 years.
Structure	Tree cover	Does the woodland have an open structure?	Over whole site Map approximate location and extent of tree cover (where possible delineate areas of similar tree density and height). Take digital photographs to support maps.
	Age-structure	Is there a range of tree ages? Y/N Field trials suggest height may be used to approximate age-classes; i. Old - above head height, ii. Established - under head height and iii. Regeneration - under heather height.	Estimate tree ages (cohorts; regeneration, established, old) recorded at each sample point (10m by 10m), but target assessed over whole site.
	Ground vegetation	Browsing scored as H, M or light. (Browsing should be light to medium across the site).	Assessed at each of 10 sample points (2m by 2m) – Target to be met at 80% of samples
	Micro-topography	Is the hummock/hollow patterning maintained if originally present Y/N a. Bare ground (erosion, peat cutting) should represent less than 5% of the total area or no individual areas >100sqm (0.01 ha).	Assessed at each of 10 sample points (2m by 2m). Over whole site
Water level	Indicators	Water table at, or just below the surface for the majority of the year. Y/N Characterised by: <ul style="list-style-type: none">• Soft ground present• No or few active drains• Peat cutting absent• No/few erosion channels	Assessed at each of 10 sample points (2m by 2m), but target assessed over whole site.
Composition	Exotics	Non-native trees and shrubs which have established for more than 6 years to account for no more than 1% of tree cover.	Over whole site.
	Vegetation	<ul style="list-style-type: none">• No loss of characteristic species. Should include at least three of the following: <i>Calluna vulgaris</i>, <i>Erica tetralix</i>, <i>Trichophorum cespitosum</i>, <i>Eriophorum vaginatum</i>, <i>Eriophorum angustifolium</i>, <i>Narthecium ossifragum</i>, <i>Drosera rotundifolia</i>, <i>Sphagnum spp.</i>• <i>Sphagnum spp.</i> to cover at least 20% of 2m by 2m sample areas.	At each of 10 sample points (2m by 2m) Targets to be met in at least 60% of sample areas.
Quality indicators	Site specific quality	Monitor the presence of special site features or locally rare species.	Over whole site . Map extent, assess frequency or target note occurrence of

	attributes		species.
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Field notes for bog woodland monitoring

1. Scope

This methodology is intended to apply to bog woodland that occurs within the UK as defined in the Interpretation Manual of European Habitats (European Commission 1996), i.e. it embraces pine, birch and willow on ombrotrophic bogs and weakly minerotrophic communities. Bog woodland will be contiguous with woodland and open mire, hence some judgement will need to be made when defining the area to be assessed within the site. Tree spacing and structure and ground vegetation communities should provide useful guides (see 3.1).

Extract from JNCC publication: The Habitats Directive: selection of Special Areas of Conservation in the UK 2nd edition)

Description and ecological characteristics

Under rare combinations of physical circumstances in the UK, scattered trees can occur across the surface of a bog in a relatively stable ecological relationship as open woodland, without the loss of bog species. This true Bog woodland is a much rarer condition than the progressive invasion of bogs by trees, through natural colonisation or afforestation following changes in the drainage pattern which leads eventually to the loss of the bog community. The habitat type has not previously been well described in the UK, and consequently knowledge of its ecological characteristics is limited.

A few examples of this unusual habitat type are found in areas of Scotland where summer drying may permit the establishment and growth of tree roots in the upper peat layers. The structure and function of this habitat type is finely balanced between tree growth and bog development. Tree growth, however, is always slow (or the trees would take over the bog); the trees are likely to be widely-spaced (because much of the surface area is too wet for them to establish), and dead trees may be common even among the fairly small individuals (because their weight depresses the peat locally leading to waterlogging and death). Although stunted in form these trees may be of considerable age, with the oldest individuals in bog woodland in Scotland estimated at 350 years old.

*The principal tree species in this form of Bog woodland is Scots pine *Pinus sylvestris*. Pine bog woodland types are likely to be intermediate in character between NVC type W18 *Pinus sylvestris* – *Hylocomium splendens* woodland and more open mire types such as M18 *Erica tetralix* – *Sphagnum papillosum* mire or M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire.*

*A birch *Betula* spp.-dominated variant of Bog woodland occurs where birch *Betula* spp. or willow *Salix* spp. occur in long-term stable combinations with bog vegetation. These birch/alder/willow types may be close to NVC type W4c *Betula pubescens* – *Molinia caerulea* woodland, *Sphagnum* sub-community or other wet woodland types, such as W2 *Salix cinerea* – *Betula pubescens* – *Phragmites australis* woodland or W3 *Salix cinerea* – *Galium palustre* woodland. Very small fragments occur on New Forest valley bogs and on the fringes of some peat bogs and mere sites in hollows within oakwoods, and other examples in Scotland have developed on M17 *Scirpus cespitosus* – *Eriophorum vaginatum* blanket mire vegetation.*

Secondary birch woodland on degraded bogs, and woodland encroachment resulting from falling water tables, are excluded from the Annex I definition, but may in some circumstances be referable to 7120 Degraded raised bogs still capable of natural regeneration.

2. Methodology

1. Not all pockets of bog woodland will need to be assessed, for example in some of the larger cSAC complexes, e.g. Cairngorms, a sample of pockets of bog woodland could be assessed as representative of the resource within the cSAC. However, distinct hydrological units should be assessed separately.
2. The surveyor should select a representative route around the site, taking in the range of structural variation and record this route on a site map. The attributes should then be assessed at each of approximately 10 sample areas along the route (for each unit of bog woodland assessed).
3. The approximate route should be followed in subsequent assessments, but the sampling does not rely on fixed quadrats.
4. Sample areas for assessing tree age-structure should be approx. 10 by 10m, while for ground vegetation characteristics: browsing, micro-topography and water levels should be 2m by 2m.
5. The best time for surveying bogs is between April and November. For the purpose of picking up broad-leaved saplings in photographs the ideal timing would be June to September.

3. Attributes to be assessed

3.1 Area

The most common target will most likely be for 'no net loss'. Loss of bog woodland area to woodland can be assumed when the trees have a closed canopy and the ground vegetation loses the characteristic Sphagnum sp. dominance. If conditions get wetter, loss of bog woodland to bog might be assumed when there are no trees (including stunted trees), or all trees are dead, within approx. 1/2 hectare (70m by 70m square). Changes in the boundary should be noted on the SCM map.

3.2 Structure

3.2.1 Tree cover –

A second requirement of bog woodland alluded to in 3.1 is that there should be a relatively open canopy. Bog woodland has been defined as the stable condition whereby both the woodland and the bog elements are maintained. This may encompass quite a range of canopy covers from very scattered trees to considerable tree cover, however, canopy closure will lead to the loss of the bog elements. Therefore a change to closed canopy is likely to be considered as evidence of deterioration. In light of such an assessment, we may review the management of the site and choose either to intervene or not to, depending on the factors leading to this change.

An absence of trees could also be interpreted as loss of condition in some instances (assuming they were present, if this site is being assessed as bog woodland). Loss of trees could be attributed to browsing pressure, wind throw, burning or water-logging, however, the loss of trees to bog through natural processes, would not be considered as evidence of deterioration. We are unlikely to want to intervene to make the bog drier to promote tree growth, but we may want to influence grazing pressure. An increase in tree seedling establishment and survival may indicate that the bog is likely to be degraded, hence it would be useful to sketch the area of tree cover and take some digital photographs for reference (approximate locations and directions to be marked on the site map). Comparison of sequential aerial photographs may be useful on sites where the trees are sufficiently large to be detected.

Where possible attempt to zone the map to delineate areas of similar tree height and density. For example, some areas may be dominated by scattered (average spacing 5m) tall trees (3-

5m) with some below heather (20cm depth) regeneration, while others may be largely treeless (average spacing 20m) with trees generally less than the height of the surrounding heather. Where there is a mixture of heights and densities annotations of the range and relative proportions may be made (see Figure 1).

3.2.2 Range of tree ages – Determining the age of bog pines based on physical characteristics is not always simple as some stunted pines are of considerable age. Hence bog trees can be small and stunted or may be over head height. However, recent research¹ has found that there does appear to be a relationship between the age of bog-pines and their height and also between tree age and diameter at breast height (DBH), i.e. even older trees tend to have a low height to diameter ratios. Most bog trees show signs of being limited by waterlogging and/or nutrient deficiency. They are also characterised by irregular branching (especially on small trees), sparse crowns, short needles, small (if any) cones and mature bark relative to the tree's height. On some sites¹ no strong linear relationship was found between height and age, indicating that other factors account for much of the variation in tree size. However, based on this work we might be able to make some broad generalisation. If trees are less than 1.5m in height and less than 5cm DBH, have smooth bark and are relatively lichen free, we might assume they are less than 30 years old.

Regeneration of bog pines may only occur sporadically following a succession of dry summers; therefore we may not expect evidence of regeneration all the time. But in order to ensure some continuity of tree presence, we might want to ensure that there are at least some trees that appear to be in this <30 year old cohort. We would also expect that there are some older trees, either of greater height or diameter and perhaps also some dead trees. Lichens tend to be more abundant on older pine trees, hence older specimens may have significant cover of crustose species. If all trees appear to be dead, this should also be noted. The target may therefore simply be that there should be a range of tree ages. However, a description of what the current balance between these cohorts appears to be, would assist future comparisons (as per Figure 1). Field trials indicated that classifying trees in the categories 'over head height', 'under head height' and 'below heather height', while recording approximate DBH ranges was a relatively simple surrogate for recording the range of age-classes present.

3.2.3 Ground vegetation/ browsing impact– As an indicator of vegetation structure we are likely to want to record trampling and grazing. As with other communities, this could be categorised as high, medium or low.

High – frequent and conspicuous bare peat, may be actively eroding. Conspicuous tracks of sheep or deer. Obvious evidence of grazing in associated flushes. Most saplings with leaders browsed, evidence of browsing of lateral shoots.

Medium – localised bare peat with little active erosion. Localised tracking restricted to ridges or fence lines. Localised evidence of grazing of dwarf shrubs and sedges. Localised browsing of saplings.

Low - bare peat scarce or absent. Paths absent or occasional. Evidence of grazing of dwarf shrubs and sedges scarce. Few saplings browsed.

3.2.4 Micro-topography

Most natural, undisturbed bog surfaces usually show distinctive fine scale variation with small drier hummocks and wetter hollows related to growth of Sphagnum and other plants. We might therefore expect bog woodland sites to contain some of the following. These may be absent or reduced on cut-over or relatively recently formed bogs.

- Hummocks - mounds of Sphagnum which can be up to 1m high and 1-2m in diameter
- High ridges - characterised by a dominance of dwarf shrubs, particularly heather (*Calluna vulgaris*), often growing in a senescent Sphagnum carpet.
- Low ridges - distinguished from high ridge because it tends to be far less dominated by dwarf shrubs. It is characteristic of soft, undamaged mire systems, in which it is the major ridge component.
- Sphagnum hollows - Although free water is often not visible, the dense carpet of Sphagnum sits in an aqueous matrix and cannot support any great weight.
- Mud-bottom hollows – as above but limited in its moss cover, but with a significant occurrence of higher plants.

Many of the cSACs where bog woodland is a qualifying interest have been subject to ancient peat cutting(2), particularly where close to historical settlements, and now support what appear to be stable bog woodland communities. Hence a history of peat cutting and subsequent loss of microtopography may not necessarily preclude the development of bog woodland, however, evidence of recent peat cuttings would be viewed as a negative indicator (under the bare ground target). The presence of hummocks and hollows could be recorded on all sites, but need not contribute to the overall assessment decision, i.e. only where typical bog micro-topography has been lost since the last visit would the site be considered to be deteriorating.

3.2.5 Bare ground – Bare patches in peatlands may be caused by peat cutting or erosion due to herbivore trampling, burning and/or considerable fluctuations in water levels. Deer wallows can create valuable habitats for invertebrates and white beak-sedge (*Rhynchospora alba*) is sometimes found near such wallows. However, expanses of bare ground would generally be perceived as a negative indicator of condition. Therefore, we would want to highlight if this was an issue on a particular site and detail the causes where possible. The target could be for a maximum acceptable area and/or proportion of the site, e.g. no more than 5% of site area and no individual area greater than 100sq m (0.01 ha).

3.3 Water levels

There are long-term natural cycles (decades) of drying and wetting related to natural variations in climate, which cause changes in the bog vegetation. However, we would expect the water table to be just below the surface for the majority of the year. A combination of the following factors can be used to assess if this appears to be the case:

- Sphagnum spp. frequent over the majority of the site (recorded under composition target)
- there are no/few active drains
- peat cutting/extraction is absent
- there are no/few erosion channels which are not vegetated
- ground feels soft/ wet underfoot
- As the water level can vary through the year, the vegetation is probably the best indicator of year round water levels.

3.4 Composition

3.4.1 Exotics – Self-seeding of exotics such as Sitka spruce and Lodgepole pine from adjacent plantations and rhododendron are likely to be the greatest threats to bog woodlands. As tree cover will generally be sparser on bog woodlands than other woodland types and growing conditions harsher, exotic removal will presumably quite realistic. Hence although exotic seedlings may regenerate on the bog surface, we are likely to set a low target for established exotics e.g. exotic saplings established for more than 6 years to form no more than 1% of tree cover of (i.e. spanning monitoring cycles).

3.4.2 Natives - We are unlikely to specify a target for the proportion of native species, e.g. the balance between pine and birch. Changes from ombrotrophic to more minerotrophic or wetter to drier communities will hopefully be highlighted through other sub-attributes (vegetation composition, water levels, tree cover) .

3.4.3 Vegetation composition – The suggested target is that 3 of the 8 species listed should be present in at least 60% of sample points (as per lowland raised bog guidance). It is also suggested that if any other species covers more than 20% of the 2m by 2m quadrat, that it is recorded and its abundance assessed using the DOMIN scale. This may help to detect changes towards a more minerotrophic community, e.g. the spread of *Juncus effuses* and *Polytrichum commune*. Where species indicative of minerotrophic conditions are already present we would also want to monitor any changes in the species balance. Where existing communities tend more towards a fen, the species list may need to be tailored to the site.

Species list: *Calluna vulgaris*, *Erica tetralix*, *Trichophorum cespitosum*, *Eriophorum vaginatum*, *Eriophorum angustifolium*, *Narthecium ossifragum*, *Drosera rotundifolia*, *Sphagnum* spp., *Carex rostrata*

3.5 Quality indicators

These are site specific features, for example rare species or the presence of an intact lagg fen. An example of a rare species might be white beak-sedge (*Rhynchospora alba*) at Pitmaduthy Moss. Rare species can be mapped, highlighted as target notes, or the frequency assessed in each sample area, depending on the species concerned. Targets for acceptable levels of change should be quantified, e.g. mapped area of species distribution should not to drop by more than 5% of current extent in two consecutive monitoring cycles. Targets should be adjusted to accommodate the natural degree of variability experienced by the population.

4. Making the SCM assessment

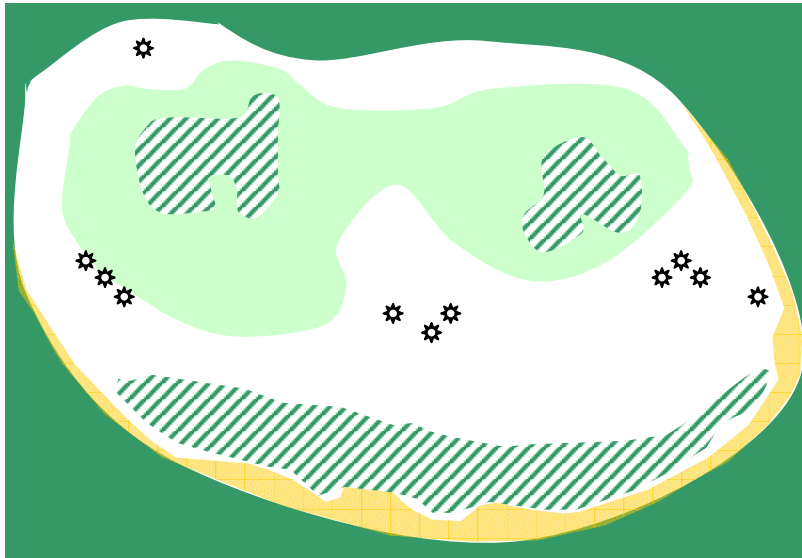
If any one of the 5 attributes that are assessed show signs of deterioration then the position will have to be reviewed and actions, if necessary, taken as appropriate .







References

1 Anderson, A.R. & Harding, K.I.M. (in prep) The age structure of Scots pine bog woodlands.

2 Wells, C. (2002) A Stratigraphical survey of seven Scottish 'bog woodlands'. Contract report to SNH.

Figure 1



	<p>Closed canopy pine</p>		<p>Grassy lagg with large dead Scots pine (30-80 DBH), DAFOR 2</p>
	<p>Dominated by trees over head height, (15-50 DBH), average spacing 5m. Some trees less than heather height DAFOR</p>		<p>Predominantly open mire with scattered trees DAFOR 1 (average spacing 20m) under</p>
	<p>Dominated by trees less than head height (<5cm DBH) average spacing 10m.</p>		<p>Scattered trees over head height (DBH 20-40).</p>

N.B. Health and safety will be an issue on the wetter bog woodland sites. Where it is too wet to venture, map what is possible from whatever vantage can be gained.