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# COMMISSIONED REPORT

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Commissioned Report No. 091

## **Conservation management of the Sunart Oak Woodland Special Area of Conservation (SAC) and the potential for supporting rural development**

(ROAME No. F00LD21)

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# COMMISSIONED REPORT

# Summary

## Conservation management of the Sunart Oak Woodland Special Area of Conservation (SAC) and the potential for supporting rural development

Commissioned Report No. 091 (ROAME No. F00LD21)

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### Background

The oak dominated native woodlands which fringe Loch Sunart are recognised as being of international importance for nature conservation, hence their cSAC designation. This report considers the past management at Sunart, the potential for woodland expansion and recommends management models which will maintain and enhance their value for nature conservation. The report also considers potential uses and markets for any native timber which is felled as a result of this management and also for exotic conifers which are being felled to provide expansion areas for the native woodland.

### Main findings

- Predictive MLURI models for woodland types corresponded reasonably well with woodland types on the ground, suggesting a natural distribution.
- Past management history has had a large bearing on the species composition and structure within the Sunart Woodland.
- Five basic management models can be derived which will maintain the woodlands in favourable condition:
  - 1) Minimum Intervention
  - 2) Long-rotation High Forest
  - 3) Standard-rotation High Forest
  - 4) Wood Pasture
  - 5) Coppice
- Rural development opportunities can arise from pro-active management of the woodlands, including timber, farming, tourism and sporting interests.

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## **Executive summary**

The objective of this report is to provide a framework document for the management of the Loch Sunart Woodlands candidate Special Area for Conservation (cSAC) for nature conservation. The aims are to:

- a) describe the Sunart woodlands, their development and their present management;
- b) define 'favourable condition' as it applies in these woods, and evaluate the present condition in these terms;
- c) propose management that will maintain the woods within the favourable range; and
- d) report on the opportunities for utilising timber products and other service from the woods.

Information on the ecology, management and use of the woodlands was collated from a number of sources, including site visits and brief consultations with the main land use agencies and some of the woodland owners.

## **Ecology**

There was considerable variation among the woods in terms of tree composition. Whilst oak-birch woodland is widespread and most extensive, other woodland types are also present (ash, elm and alder dominated). Oak is a major component of the Sunart woods, but is not generally abundant. In fact, oak is infrequent in extensive parts of the woods on the south side of the loch. Both oak species are well-represented and both appear to be native to the district.

Woodland types for the whole of Sunart below 250m were predicted using the MLURI model. The predicted woodland types correspond reasonably well with reality on the ground, suggesting either that the current distribution of woodland types is relatively natural, or that assumptions underlying the MLURI model are based on woods such as those at Sunart. However not all woodland would naturally be oak-dominated. In fact, the current dominance of oak on some sites is artificial. Oak is unlikely to regenerate abundantly on most sites and may fail to colonise many suitable sites – many woodlands would revert to a generation of birch-dominated woodland. In the longer-term woods managed with minimum silvicultural intervention and minimum grazing intensity may undergo succession away from oak and other light-demanders.

The Sunart woods have a relatively low proportion of introduced tree and shrub species, and only limited invasions of naturalised introductions.

The woods are isolated, and although some isolation would be natural for Sunart, lack of landscape linkages has reinforced natural isolation. Wooded links from the western extremities to the south would be particularly beneficial.

## **History**

The majority of woodlands has been heavily managed in the past. Planting and management of oak coppice led to an expansion of native woodland cover, but has resulted in woodland with a highly artificial composition and structure. In the case of ancient wood pasture, traditional management has created an extremely important habitat.

The current age range of trees is highly artificial and there would be conservation benefits from diversifying the range of age classes. The traditional prevalence of oak and other light-demanding trees may be due to prolonged utilisation of the district as wood pasture.

## **Conservation status**

Although most of the Sunart woods fall within SAC citation woodland types, a significant minority do not (alder woods and the sub-montane birch, pine and willow woods). Nevertheless, these other woodland types are an integral part of the SAC, and contribute to its diversity and its connectivity.

The woodlands are important for conservation for a wide variety of woodland and associated species, particularly bryophytes and lichens.

A wide range of conditions should be regarded as 'favourable'. The basic formula suggested for W11 and W17 SAC woodlands is:

- Composition should be assessed as a whole-wood scale (say 10–100ha), not a stand scale. This assumes a dynamic patchwork model of natural oak-birch woodland.
- Oak should be within the range 5–95% of growing stock, measured in volume or basal area terms. Thus, only oak monocultures and near-absence of oak at a wood scale would be 'unfavourable'. Low values would be associated with regenerating stands.
- Site-native tree and shrub species should comprise at least 95% of the stand.

The main deficiencies of the existing woodland in relation to "favourable" criteria are: artificially high dominance of oak in some woodlands; absence of oak from other woods that have been assessed by MLURI as W11 and W17; lack of regeneration (ie a failure of succession) of native trees and shrubs; uniform structure and age class distribution; continuous use of woodland as pasture; quantities of dead wood are limited; and poor representation of ancient pasture woodland.

## **Management models**

Five management models are proposed, which together would act to keep the woodlands within favourable condition:

- 1) Minimum Intervention;
- 2) Long-Rotation High Forest;
- 3) Standard-Rotation High Forest;
- 4) Wood Pasture; and
- 5) Coppice.

Management criteria are given for each model and the types of woodland most suitable for the different models are outlined. Outline criteria for selecting Minimum Intervention areas in the field are provided. Exploratory calculations giving possible scenarios for adoption of the different models are given, with the

Minimum Intervention model comprising between 2 and 30% of the existing woodlands. Special guidance is given on management for bryophytes and conservation of epiphytic lichens.

It was not possible to give management models for individual woods, as this is a decision to be made in consultation with owners, with access to more site data and involving site visits.

## **Current management and use**

A large proportion of the cSAC is under private ownership, some of which are small owners. Current management includes woodland restoration, removal of *Rhododendron* and extensive regeneration schemes. Woodlands are currently used mainly for grazing, deer cover and to some extent as an aspect of the area's tourist value. There has hitherto been little attempt to diversify age structure of the former oak coppice woodlands or to manage broadleaved woodland for timber production.

The potential exists for modest timber production from the broadleaved woodlands, with utilisation facilities at an appropriate scale at Ardslynnish. There is currently an abundance of softwood timber arising from a Forest Enterprise programme of restoration of "Plantations on Ancient Woodland Sites" to native woodland.

## **Rural development issues**

Sunart is a classic example of a remote rural area where community development opportunities are relatively restricted and use of local natural resources is a key development opportunity. Virtually all the broadleaf woodland in the Loch Sunart catchment has been designated there are no significant non-designated broadleaved woodlands where productive management might take place. Many of the woods that have the greatest potential for productive management are in private ownership.

An account of stakeholder perceptions of management issues shows that: some owners would like to see active management of their woodlands for timber, whereas others prefer simply to restore and regenerate woodland; there is a need for constructive dialogue between those owners interested in timber management and SNH, in order to overcome past problems; there is a willingness on the part of stakeholders to look for mutually acceptable solutions to progress suitable management of the SAC.

**Timber:** There is potential for the Sunart Oakwoods to contribute to the local supply of oak timber for a mobile sawmilling business and possibly a firewood enterprise, through work restructuring the former coppice oak woodlands. The amount of timber cut might be no more than 20–70 tonnes annually for every 100ha of former oak coppice converted to high forest (both during the conversion period and thereafter). Well-designed timber production operations are potentially compatible with good conservation management of the cSAC. The scale of potential timber development that could be supported by the Sunart Oakwoods is small, but potentially significant at a local scale.

**Farming:** Some livestock farmers see benefits arising out of future use of woodlands for controlled grazing.

**Tourism:** The woodlands could be used in a number of ways to promote tourism in Sunart, with knock on effects to other service providers. Tourism does not usually benefit woodland owners except where they are involved with providing accommodation or activities.

**Shooting:** Shooting of roe deer is one option which could be developed and which could provide income to woodland owners.

## **Recommendations**

The next steps for determining management of the Sunart Oakwoods cSAC should centre on:

1. Developing a process of discussion and joint decision-making between the agencies (SNH and FC), woodland owners (including FE) and other community representatives.
2. Working towards pragmatic prescriptions for individual woodlands, based on the models described in this report, which achieve the overall conservation aims for the SAC.

Such a process could start with a number of agreed principles which might include:

- a) that the woodlands remain within the defined Favourable Condition;
- b) acceptance of the general concept of multiple objective management;
- c) individual woods within the district would have different objectives and management models; and
- d) individual owners and managers would have an important input into deciding the management models for their woods.

This would be followed by working towards agreement on how the woodland area should be assigned to the different management models. Detailed criteria for the selection of these areas need to be agreed based on the guidance provided in this report. An account is given of the structures and process needed develop this approach.

## 1 INTRODUCTION

The management of extensive woodland SAC's, comprising a number of protected woodlands spread across a substantial area, raises a number of important issues:

- How should the objectives and practice of conservation management be co-ordinated across the range of different woodlands?
- When most of the broadleaf woodland in a locality become incorporated into an SAC, how can options for timber production and other community benefits be fostered?
- How can the management of the SAC and the surrounding woodlands or other land be integrated to best effect?

In response to issues such as these, we were asked to "formulate a framework document for the management of the Loch Sunart Woodlands candidate Special Area for Conservation (cSAC) for nature conservation". As part of this we were asked to:

- consider the obligations of member states under the European Union's Habitats and Species Directive (92/43/EEC) for the condition and management of SACs and to set these in the context of Sunart.
- consider other woodland areas in Sunart where nature conservation may or may not be one of the main management objectives;
- identify the potential community benefits which could be developed utilising by-products from this management, and;

The Sunart oakwoods are commonly known as 'western oakwoods', and their importance as locations for rich assemblages of oceanic bryophytes and lichens has long been recognised. Ratcliffe (1977) noted (p.108) that 'this interest was spread over such a large area [that] there is a need here for a general policy of woodland conservation', ie that concentration on a limited number of clearly delimited 'sites' would be insufficient.

The sites which make up the SAC are sharply defined, but the woodland on the ground is diffuse and rarely exhibits sharp boundaries. Recognising both this and the need to integrate the nature conservation objectives with other values and potential uses, we were encouraged to adopt a landscape perspective, ie to consider the woodland resource as a whole, its relationship with other habitats and land uses, and its relationship with people. This develops an approach that is now well-established in the thinking of SNH and others (Peterken *et al.* 1995, Peterken 1999).

It is now widely accepted that nature conservation and rural development cannot be developed in isolation, especially in remote rural areas such as Sunart. Hence we considered both the historical use of the Sunart woods and their future potential to support rural development.

The aims of the report are to:

- describe the Sunart woodlands, their development and their present management;
- define 'favourable condition' as it applies in these woods, and evaluating the present condition in these terms;
- propose management that will maintain the woods within the favourable range; and
- report on the opportunities for products and services from the woods.

## **2 DESCRIPTION OF THE WOODLANDS AND THEIR CONTEXT**

### **2.1 General environment**

#### **2.1.1 Location**

The woods are ranged along both shores of Loch Sunart, and are predominately north or south facing (Map 1). One outlying wood is included, Uamha na Creadha, which is west of the mouth of the Loch on the lower slopes of Ben Hiant.

#### **2.1.2 Geology and soils**

The lithology of the area consists of:

- a substantial exposure of granite near Strontian;
- Moine era quartzose felspathic schistose flags, broken by north-south bands of Mica-Schist, into which basalt, dolerite has intruded; and
- Tertiary era basalt lavas at the seaward end.

The soils are relatively base-poor over most of the area. However, base rich soils occur overlying the basalt in the west and other intrusions in the central reaches of the loch eg at Ardslnish and at the western end of Glencripesdale. Soil fertility generally diminishes rapidly with elevation. Throughout the district, small-scale variation is imposed on the broad pattern, with frequent base-rich flushes, dry heathy knolls and mires.

*It is clear that the broad pattern of woodland composition is influenced by this variation in geology and soil conditions. These patterns are an integral part of the conservation value of the woodlands.*

#### **2.1.3 Climate**

The climate is strongly oceanic. In international terms, the woods are classified as part of the temperate rainforest biome, which is globally rare. The main influences of climate are:

- The high humidity supports the important bryophyte and lichen communities;
- High windspeeds mean that wind is probably the principle woodland disturbance agent;
- Wind and salt pruning occurs on woodland close to the loch shore which adds to the diversity and appeal of the woodlands;
- The upper limit of tree growth is lower than in many parts of Scotland (approximately 450–500m);
- High rainfall encourages the growth of deep peat soils on level or gently sloping ground, which restricts forest development.

## **2.2 Woodland composition**

### **2.2.1 Woodland types based on canopy dominance**

Dominance types (defined by the most abundant tree species, or the species with greatest biomass) are likely to be most relevant to any consideration of silviculture and utilisation. Four woodland types can usefully be distinguished on this basis:

1. **Oak-dominated woodland.** Stands in which oaks of either or both species predominate. In a few cases these are virtually oak monocultures, but generally they include some hazel, birch and/or rowan. Most stands occupy dry slopes at low altitude or rocky outcrops and they occur mainly on the north (south facing) side. They range from stands with a heathy ground vegetation (*Calluna vulgaris*, *Vaccinium myrtillus*, *Deschampsia flexuosa*) which conform to NVC W17 to stand with a grassy ground vegetation and/or bracken with a wider range of woodland herbs (eg *Endymion non-scriptus*, *Oxalis acetosella*), which conform to NVC W11.
2. **Birch woodland.** Stands in which birch is the most abundant tree, most of which have open canopies. Other species are usually found at low density, including aspen, which was seen only in this type. Like the oak-dominated stands, birchwoods range from heathy stands to grassy stands, which conformed respectively to NVC W17 and NVC W11. At high altitudes the birch extends onto acid mires with NVC W4 woodland.
3. **Alder-dominated woodland.** This occurs mainly on the lowest slopes, shoreline flats and streamsides, almost wholly on mineral soils that remain permanently moist from free-flowing water. On base-poor ground birch, sallow or even bog-myrtle are common associates, but on relatively base-rich ground hazel and ash are occasional. Most stands appeared to conform to NVC W7.
4. **Ash – wych elm woodland.** Such stands are very localised, but a fine example occurs on extremely steep slopes at Ardslnish (56/61). Insofar as it can be described from so few examples, this woodland type has few oaks and birch, but contains abundant hazel and some hawthorn. The best example conforms to NVC W9. On the basis of trees and shrubs in field boundaries, ash-elm and alder woodland types were the natural precursors of farmland, especially along the north shore.

As always, defined types represent no more than nodes in a continuum. Transitions are frequent, particularly between birch woodland and alder or oak woodland. In addition to the woodland communities listed above, hazel and blackthorn scrub also occurs.

### **2.2.2 National Vegetation Classification**

A detailed survey and description by Claire Cornish and Kate Proctor (Contract BAT/98/99/52) carried out in 1998–99 identified NVC types for the cSACs and adjacent areas. Six woodland communities were found, each with 1–3 sub-communities. The following table simplifies and summarises their findings for the cSAC woods by counting the most abundant sub-community in each community against the following quantitative scale: +++++ extensive; +++ frequent; ++ locally frequent; + occasional or rare.



**Table 1 Occurrence of different woodland NVC communities in the different woods (numbering of sites follows Cornish and Proctor)**

SITE	9	11	12	2a	3a	4a	7
W4, <i>Betula pubescens</i> – <i>Molinia caerulea</i>	++	+++	+	++++	++	++	++
W7, <i>Alnus glutinosa</i> – <i>Fraxinus excelsior</i> – <i>Lysimachia nemorum</i>	++	+++			+++	++	+
W9, <i>Fraxinus excelsior</i> – <i>Sorbus aucuparia</i> – <i>Mercurialis perennis</i>	++	++	+	+	+++	++	+
W11, <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Oxalis acetosella</i>	+++	+	+	+	+++	++	+
W17, <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i>	+++	++++	++++	+	++++	++++	++++
W18, <i>Pinus sylvestris</i> – <i>Hylocomium splendens</i>	++						

**Sites:**

9. Ben Hiant and Ardnamurchan Coast

11. Salen – Woodend

12. Ariundle

2a. Laudale

3a. Glencripesdale

4a. Rahoy

7. Poll Luachrain and Druimbuidhe

The NVC is ambiguous about tree species dominance, especially so in the oak-birch types, W11 and W17. A summary of the relative importance of the main tree species has been compiled from the tables and descriptions presented by Cornish and Proctor, supplemented by our own observations:

**Table 2 Relative importance of the main tree species in the different woodlands (numbering follows Cornish and Proctor)**

SITE	9	11	12	2a	3a	4a	7
<i>Alnus glutinosa</i>	++	++			+	+	+
<i>Betula pubescens</i>	+++	+	+	++++	++++	++++	++++
<i>Fraxinus excelsior</i>	++	+		+	++	+	+
<i>Quercus petraea</i>	?	++	+++	+	+		?
<i>Quercus robur</i>	++	++++	++++	++	+++	++	?

Key points to emerge from this are:

- No two woods are the same. Each one is a particular combination of woodland types and dominance patterns. The individuality of each site is reinforced by variation in the character of the rest of the SAC.
- Whilst oak-birch woodland (NVC W11, W17) is widespread and most extensive in some sites, it is not the only woodland community present

- Whilst oak is a major component of the Sunart woods, they are not generally abundant. In fact, they are infrequent in extensive parts of the woods on the south side of the loch (eg *Laudale*, *Rahoy*).
- Both oak species and intermediates are present, and in most sites the balance of characters inclines more to *Q. robur* than *Q. petraea*.

### **2.2.3 Potential woodland types**

An important question is whether current woodland types correspond closely with the woodland that might naturally be expected to occur on the site types encountered in Sunart, or whether they have been fundamentally changed by past woodland management or the influence of other land use practice. This can be investigated using maps produced by MLURI showing the “Predicted distribution of woodland and scrub communities”. However, we should remember that the NVC types were constructed on the basis of present-day semi-natural woodland, not original-natural or potential-natural woodland. Expressing ‘potential woodland types’ in terms of the NVC thus carries with it a theoretical risk, ie the tendency for the predicted patterns to be unduly influenced by current non-natural aspects of woodland composition.

Map 1 shows the predicted woodland types for the Sunart. These have been displayed as a spectrum of types ranging from base-rich, lowland types at the red end to base-poor, upland types at the blue end. The combinations recognised by MLURI on base-poor and upland sites have been simplified. The principal oakwood types, W11 and W17, appear in shades of green.

The map speaks for itself, but it may be helpful to point out some of the main features:

#### **W7: alder-ash**

Large patches at the western end of Sunart, on the north side west of Ardnastrang, Laga and east and west of Ardsignish. Smaller patches on the south side on Carna island, Glencripesdale and Liddesdale. Numerous small patches might be predicted throughout the lower ground, but would be too small to show on these maps.

Mosaics with W11 are common at the head of Loch Sunart, lower Liddesdale, Glen More and bay west of Glenborrodale, lower Laudale, and by Strontian river below Ariundle. A large area west of Ben Hiant has mosaics with both W11 and W9.

#### **W9: ash-elm**

Confined to western ends on both sides; Ardsignish and westwards on north side; west of Loch Teacuis on south side. Abundant on Poll Luachran.

Mosaics with W11 occur in the same districts. On Poll Luachran they form an upper zone grading into open birchwoods.

#### **W11: oak, birch, hazel**

Widespread at low altitude on both sides, though less frequent at the west ends. The main valley type in Poll Luachran, Rahoy, Glencripesdale. Monopolises the upper half of Ariundle NNR.

Mosaics with W17 are common around Glenborrodale and at low levels in Glencripesdale.

**W17: oak, birch**

Large patches associated with W11 areas on both sides, but not at west end on the north side, ie, mainly in central areas and eastern end. Common around Poll Luachrain and Rahoy.

**W4: birch**

Common at higher altitudes, ie remote from shoreline, on both sides. Generally occurs in association with mosaics combining W17, W18 and scrub woodland. These extend to shoreline west of Salen, east of Resipol and west of Laudale House.

**W18: pine-birch**

W18, W18/W4 mosaics: pine, birch. Localised: large patch on south side of Beinn Resipol with a tract of juniper; east end stretching up Glen Tarbert; head of Glen Laudale.

**Other combinations, NVC type not specified**

Basin bog woodland. Small patches west of Laudale House, head of Loch Sunart; towards head of Strontian river. Large patches on north side in a matrix of W4 and mosaics with W4.

Birch/willow. Patches at high altitude.

**2.2.4. Potential distribution of individual tree species**

This pattern described in Map 2 corresponds reasonably well with the character of existing semi-natural woodland, though inevitably the limitations on fine detail discriminate heavily against small and narrow patches of alder woodland. When the types are transformed into distributions of the principal species, the following patterns emerge:

**BIRCH.** The matrix species. Abundant at higher altitudes and common at low altitude. Restricted only in concentrations of alder and ash.

**OAK.** Common at low altitude on both sides of L. Sunart, but barely forms a continuous band of oak-dominated woodland. The weakest points in the band occur west of Salen Bay and the western side of Loch Teacuis (Map 3).

**PINE.** All-pervasive at low density away from shoreline, with concentrations in Glen Tarbert, head of Laudale and south side of Beinn Resipol. Extends at low density to shoreline at several points.

**ALDER.** Concentrations at low altitude west of Glenborrodale, Laga and west of Strontian on north side, and at Liddesdale and the mouths of Laudale and Glencripesdale on south side. Would be all-pervasive at low density on wet ground at low altitude, but the map cannot show this.

**HAZEL.** All-pervasive, but common only at low altitude on base-rich sites. Locally abundant with alder and ash.

**ASH.** All-pervasive at low density. Common in small patches associated with alder concentrations. Abundant only at low altitude at west end on both sides.

Key points to emerge from this are:

- The predicted woodland types correspond reasonably well with reality on the ground. This suggests that the current distribution of woodland types is relatively natural, though this conclusion may be influenced by circular reasoning (see above).
- However it also suggests that Sunart woods would not all be oakwoods and that the current dominance of oak on some sites is artificial.
- Scots pine may be regarded as a native of the district, but mainly as a small component of mixed woodland.

### 2.2.5. Potential for growing oak and ash

The MLURI maps provide an impressive basis for woodland restoration, but they are too complex to take in easily, and they deal in NVC woodland types, which are only loosely related to dominance patterns of individual tree species. They can, however, be transformed into maps of predicted distributions of the main tree species.

Maps 3 and 4 were prepared by Highland Birchwoods from the MLURI database. They show respectively the predicted frequency of oak at 50m scale in the predicted woodland types and the potential of all land within the study area for growing oak. They were constructed by assigning values to each of the units mapped by MLURI according to Table 3.

#### Natural distribution of oak

The values in Table 3 were derived from the tables in Rodwell (1991). The frequencies for W17, W4 and W7 have been scaled down, because Rodwell suggests that oak frequencies in the western Highlands are somewhat below the national average for the types. The resulting Map 3, which seems a realistic expression of the distribution of oak in natural woodland, concentrates oak along the lower slopes round both sides of Loch Sunart, with extensions up the main valleys. The oak component diminishes to the west, where the soil is relatively base-rich, and to the east, where birch on what is now moorland would prevail.

**Table 3 Values of frequency of oak in different NVC woodland types based on Rodwell (1991) and used to construct Maps 2–3.**

MLURI map unit	Frequency of <i>Q.pet</i> and <i>Q.rob</i> , Rodwell (1991)	Predicted oak frequency from natural regeneration	Suitability for oak silviculture
W11	II/I	II	IV
W11/W7 mosaic		I	III
W17	IV/I	III	V
W17/W11 mosaic		II	IV
W17/W18,W4 mosaic		I	II
W18/W4 wood/scrub		–	–
W4	I/I	–	–
W7	II/I	I	II
W7/W11 mosaic		I	III
W9	I/I	I	II
W9/W11 mosaic		I	III
W9/W7 mosaic		I	II

### **Potential for growing oak**

The values in table 3 are our assessment of the capacity of managed woodland on each MLURI map unit to yield utilisable oak. In accordance with the high nature conservation values of the district, oak silviculture is indicated only on types where oak would be a natural component, but the frequencies given are higher than the natural frequencies. Although other tree species would be mixed with the oaks, we assume that managers would aim to maximise the oak content. The resulting map (Map 4) shows the same overall pattern as the previous map, and indicates the areas where it might be worth managing woodland for oak. In practice, the small, remote patches would be ruled out by the costs of access and fencing.

### **Potential for growing ash**

The map of potential for growing ash (Map 5) was derived by a similar process. Ash is likely to grow reasonably well in W7 and W9 woodland, and to grow in base-rich pockets of W11 woodland, but is unlikely to grow to utilisable dimensions in W17 (Table 3). The map suggests that ash should be grown mainly at the western end of the study area, and with alder in particular areas towards the eastern end of Loch Sunart.

### **Potential for growing other native tree species**

Birch could be grown on almost any ground mapped as potentially wooded in Map 1, save perhaps for the alderwoods of W7. Admittedly, downy birch would grow on W7 ground, but the preferred species would be alder, ash or oak.

Key points to emerge from this are:

- Utilisable timber could be grown using site-native tree species on much of the lower ground around the shores of Loch Sunart and in the main valleys running into Loch Sunart.
- The preferred species would be oak or ash, according to site conditions.
- Where ground is too wet or too base-poor for oak or ash, alder and birch respectively may be used.

#### **2.2.6 Colonist trees**

The principal species currently colonising open ground vary between site types (minor species in brackets):

- Dry, base-poor sites: birch (oak, rowan, aspen, Scots pine)
- Dry, base-rich sites: birch, ash, hazel (hawthorn)
- Moist sites: birch, willow (ash, elm)
- Wet, base-rich sites: alder, birch, willow (ash, hazel)
- Wet, base-poor sites: birch, willow (alder)

Conspicuously, oak has colonised only locally, mainly on dry acid sites, especially where outcrops have both broken up the turf or bracken cover, and have provided refuges from grazing. It is possible that oak could grow on a wide range of sites at low altitude, and no doubt its ability to outlive birch and other

species would tend to increase its proportion in any stand, but on current evidence oakwoods may not be prevalent for decades or even centuries, even on suitable sites. Oakwoods have a better chance of developing rapidly by natural regeneration on open ground close to an existing oakwood.

Key points to emerge from this are:

- Native woodland is well able to regenerate naturally if seed sources are nearby, though on most sites an initial phase of birch dominance will tend to mask eventual differences related to site.
- Oak is unlikely to regenerate abundantly on most sites and may fail to colonise many suitable sites before the canopy of developing woodland closes.

### **2.2.7 Introduced trees and shrubs**

The native woodland has been diversified by introduced trees and shrubs. Ignoring for the time being the introduced conifers, none of which have thus far spread much beyond their point of planting, the main introductions fall into two main groups:

- i) naturalised species, notably sycamore, beech and rhododendron, and
- ii) broadleaves that have not spread, which around Sunart include species such as *Tilia vulgaris* and *Aesculus hippocastanum*.

The naturalised species are still very localised. Rhododendron is very abundant and spreading around Glenborrodale, but attempts are now being made to control it. Beech is present as mature trees in Ariundle. Sycamore is present on the richer soils west of Strontian and has established itself along some streams, but it does not appear to have spread far up the streams.

Sycamore does not determine the NVC woodland types, but beech does. If naturalised beech becomes abundant in the district, the resulting beechwoods would correspond with NVC types W14 and W15, though the descriptions of NVC beechwoods are ambiguous on whether such woods in Scotland would actually be classified as beechwoods.

Key points to emerge from this are:

The Sunart woods have a relatively low proportion of introduced tree and shrub species, and only limited invasions of naturalised introductions. This adds to the conservation value of the woodlands.

- Beech, sycamore and rhododendron have the capacity to spread, and may need to be controlled.
- Beech has the capacity to change the woodland types, as recognised in the NVC.

## **2.3 Woodland history and development**

It is important to understand the history of woodland around Loch Sunart as a basis for:

- understanding the ecological status of the woods; and
- proposing management that respects both historical development and current potential.

We are unaware of any detailed historical-ecological studies of these woods. We found very few cut stumps that could yield a meaningful count of tree age and growth history. What follows is therefore an extremely tentative interpretation, based mainly on easily available sources, cursory field examination, extrapolation from west Highland woods in general, and information from the Sunart Oakwood Research Group.

### **2.3.1 General history of oakwoods in the western Highlands**

The history of forest cover in the western Highlands was summarised in a recent report to SNH (Peterken 1999). The key points relating to native woodlands were:

- Most of the original woodland was destroyed in prehistory. By the time written records and maps became available, native woodland was reduced to discrete and named woods in a largely unwooded landscape.
- Remains of the original woods were used to supply timber, fuelwood and pasturage. Early exploitation was probably equivalent to treatment as wood pasture and wood-meadow.
- From at least the 17th century onwards the long-term loss of forest cover was increasingly reversed by establishing new woodlands on treeless ground. Some of these new woods were coppices of native trees, which now look little different from the remnants of the original cover. In addition, remnants of some original woods were allowed to expand.
- Many existing native woods are the relicts of a period of industrial coppicing from approximately the mid 18th century to the late 19th century. Woods were cut on rotations of 19–30 years, retaining standards of oak or ash, and were enclosed against cattle for 4–7 years after cutting. For the last century or so, many have been allowed to grow without silvicultural intervention.
- Originally, little woodland was pure oak, but the oak content was increased by destroying stools of less valuable species, restocking gaps with oak, and planting pure oak stands.
- Pasturage was an integral part of woodland use and management, principally for cattle, horses and goats. Pasturage was restricted during the period of intensive coppicing, but grazing by sheep and deer has increased latterly.
- Wood pasture relicts remain in the landscape. However, some facets of wood-pasturage have been largely lost, eg ancient hollies.

We understand from Richard Tipping of Stirling University that no pollen diagrams are available from within the Sunart woods. If they were available, we would expect them to show a marked increase in oak in the 19th century. A recent pollen analysis, that illustrates such a history, has kindly been made available by Philip Sansum, also of Stirling University (ANNEX 1). This comes from within oakwoods at Loch Awe and shows that oaks have been dominant only for the last 150 years. Similar findings from oceanic oakwoods elsewhere in the British Isles suggest that this is a general pattern.

### **2.3.2 Evidence of woodland development from written and cartographic sources**

Readily available historical material relating to the Sunart area (summarised in ANNEXES 2 and 3) suggests that the Sunart native woodlands have developed according to the pattern seen elsewhere in western Scotland. Earliest records combine with early maps to show that original-natural woodland survived as wood

pasture on the lower slopes and larger islands. It took the form of a broken ring round Loch Sunart, which was largely isolated from woodland in other districts. Within the wooded belt, the woodland appears to have been an irregular scatter of trees and patches of denser woodland, some of which were in irregular lines associated with outcrops, none being defined by hard edges or enclosure boundaries. This open woodland extended back up watercourses.

During the second half of the 18th century, substantial tracts of this woodland on the north side changed into dense stands with sharp edges running long distances at middle altitudes. Since these woods are oak-dominated today, this can only indicate that oak plantations were established, and then most – perhaps all – were treated as coppice. There is no sign on the maps that pre-existing trees survived in the plantations, but evidence on the ground shows that some did.

Outside the plantations, wood pasture survived. There were limited losses, but in general the patches of woodland present in the 18th and early 19th centuries correspond with surviving woodland. Enclosed farmland around settlements appears to have been generally unwooded, but west of Salen there were scattered groups of trees set in pasture or meadow.

Conclusions from old maps differ from the indications from records quoted by Anderson (1967) in that the latter gives no hint of planting. The records indicate the composition and condition of the unenclosed semi-natural woods. If the plantations took the form of oak-enrichment of existing woods, combined with intermittent grazing after coppice had grown for a few years, one can envisage that those who used the woods did not see the differences between plantation coppices and semi-natural wood pasture quite as sharply as we do today.

### **2.3.3 Generation structure of Sunart woods**

We were able to recognise three principal generations in the native woods as a whole.

#### **Ancient trees**

These are large maiden trees, stubs and pollards. The species involved are oak (both species), alder, ash, holly, rowan and willow. In the case of the oaks, many individuals could be more than 250 years, and some could be much older still. One oak stump in Ardery counted at 279 years (originated c. 1720). These oaks occur as:

- (i) conspicuously older trees in younger woods (eg, Ardery),
- (ii) wood pasture (eg, Liddesdale), and as large trees associated with enclosed farmland (eg, along the roadside west from Strontian). Several alder woods have extremely large stools which may have started as coppice which eventually developed into stubs by successively higher cutting (ANNEX 4). The remnant hollin (a group of holly bushes retained as a source of winter browse, for which they were regularly lopped) just to the east of Glencripesdale NNR boundary also comprises ancient trees.

These appear to be the relicts of traditional management, which took the form of an irregular combination of coppice and wood pasturage (see papers in Smout, 1997). Such management was probably general to the district until the 18th century, but it has largely been discontinued, save informally where ancient trees survive on land still used as pasture.



### **Mature generation**

These are trees dating from the late 18th century and much of the 19th century. Most oak-dominated stands appear to date from this period. McVean (1964) says that the oldest stands in Ariundle oakwood were 150 years old (originated c.1810). Other trees of a similar era are:

- (i) the policy woods, including the planted beech and Scots pine in Ariundle; and
- (ii) some of the older birch stands (eg the degenerating stands in Laudale SSSI).

These appear to be consistent with the general pattern of woodland change in western Scotland, during which there was widespread establishment of oak woods, policy woods of mixed conifers and broadleaves were planted in association with large houses, and some land evidently reverted naturally to mainly birch woodland. The oak woods may well have been planted, and some were coppiced. Coppicing, however, evidently ceased from the mid-19th century onwards. The youngest stands in Ariundle were said to be 40 years old in 1964 (originated c.1920).

### **Post-1940 generation**

These include conifer plantations, which appear to date from after 1945. Changes in land use brought about by the plantation fences have enabled substantial regeneration of native trees, especially between the forest fence and the loch shore though these are generally not within the SAC. Regeneration appears to have been prolific along much of the south side. Even ignoring the conifer plantations, perhaps most stands immediately adjacent to the loch have a majority of post-1940 trees, either as young stands dating entirely from this period, or as infill and fringes associated with older generations.

Restating this as periods in the development of Sunart woodlands:

- Until mid-18th century or possibly later. Traditional management as wood pasture and coppice with an irregular scatter of woodland. Pasturage by cattle, goats, etc. Estate records also suggest some felling in high forest.
- Late 18th century to mid-19th century. Progressive planting of (i) oak woods, (ii) policy woods. Coppicing of some oakwoods for charcoal and tanbark. Continued wood-pasturage and alder coppicing elsewhere, but steady breakdown of system leads to failure to regenerate. Non-native trees introduced mainly into policy woods.
- Mid-19th century to c.1940. Cessation of coppicing in oakwoods and alder wood pastures. All-pervasive pasturage by sheep. Localised reduction in grazing pressure allows birch regeneration. Policy woods maturing, but not intensively managed.
- c.1940 to 1980s. Steady expansion of conifer plantations onto both open ground and as replacements for oak woods and other native woodland. Disruption of sheep pasturage patterns allows substantial natural regeneration of native woodland. Limited and patchy spread of non-native trees and shrubs.
- Late 1980s onwards. Expansion of conifer plantations now limited. Mature plantations harvested, enabling native broadleaves to be planted and freed from competition. Continued but decreasing pasturage in most native woods.

If our interpretation of woodland development in the district is correct, the oak-dominated stands constitute the least-natural element in the semi-natural woodlands.

### **2.3.4 Status of oak species**

What does this imply for the status of the two species? Most descriptions, including those in Ratcliffe (1977), make no attempt to differentiate between the two species of oak, which is understandable, for many trees show intermediate characters or characters of both species.

The A-generation (ancient) oaks included both species. The sample seen was too small to make secure generalisations, but *Q. robur* seemed commoner in this generation on the south side, whereas *Q. petraea* was commoner on the north side. Likewise, both species were present in C-generation stands. On this basis, both species can be regarded as native to the Sunart district. One would expect *robur* to be characteristic of moist sites and *petraea* to be the oak of dry sites on outcrops and thin, well drained soils, especially on the northern (south-facing) side. Since *robur* sites have been preferentially cleared to farmland, we have a biased view of their relative importance.

The B-generation oaks may simply reflect seed sources and method of establishing oak dominance. Some may have been planted using distance seed sources. At the other end of the scale, some may be oak-enriched stands using local seed.

Key points to emerge from this are:

- The broad pattern of woodland has remained largely unchanged since at least the mid-18th century;
- The majority of woodlands have been heavily managed in the past;
- In the case of the ancient wood pasture, traditional management has created an extremely important habitat;
- The planting and management of coppice led to an expansion of native woodland cover, but has resulted in woodland with a highly artificial composition and structure;
- The general assumption that the Sunart woods are predominantly sessile oakwoods is not correct. Both oak species are native to the district;
- The genetic composition of oak in the B-generation has probably been altered by importation of acorns.

## **2.4 Structure of the woodlands**

Most woodland can be described in terms of conventional silvicultural systems. The mature oak stands take the form of mature high forest, most of which is even-aged or with a strong representation on one age class (section 2.3.3). Some have clearly been coppice, but they have grown out to high forest.

Mature stands of birch, ash or alder are also best described as high forest, though some ash and alder stands show signs of former coppicing. Where stands have been regenerating in the last 30 years or so, they are emerging to a high forest structure. A high proportion of birch stands are understocked, and many are so open that they could be classified as wood pasture in the broad sense, though they lack veteran trees that have been lopped or coppiced. The true wood pastures take the form of open woodland, with a wide range of age- and size-classes, including very large/old trees. They include small patches that would be classified as high forest if they were not intimately associated with wood pasture.

Some woodlands have relatively well developed shrub layers (eg ash-wych elm) but the bulk of the oak and birch woods lack a shrub understorey. This appears to be due to prolonged shade under an even-aged canopy combined with sustained grazing.

Key points to emerge from this:

- The current age range of trees is highly artificial;
- There will be conservation benefits to diversifying the range of age classes.

## **2.5 Natural processes**

It is important to consider how these woods would function naturally, and the implications for woodland composition and structure.

Several individual trees were seen that had been blown down, and most of these had regenerated new crowns from base sprouts or trunk sprouts. No evidence of large-scale windthrow was seen. Storms are known to devastate western woods – for example the 1968 storm that levelled woods at Loch Lomond and elsewhere – but perhaps Sunart is relatively protected. Certainly, there have been mature stands available to be windthrown for decades.

The only other form of natural disturbance seen was possible drought effects on oak on rocky knolls, where some individuals had very thin crowns. Even Dutch Elm Disease, a semi-natural disturbance, has not arrived.

If disturbances really are rare, then structure should trend towards widespread old-growth with small-scale regeneration patches in single-tree gaps, and much dead wood. Under these circumstances, shade-bearing trees will tend to become dominant, ie, elm in the base-rich sites, rowan and holly in the dry sites, and ash in groups on base-rich wet and dry sites. However, oak, birch and alder – all light-demanding trees - are regarded as the main woodland dominants.

Nevertheless, oak and other light-demanders have clearly been important components since prehistory. So, how could they be maintained as a dominant? Several factors may have contributed:

- Initial invasion after the last glaciation would have provided conditions in which light-demanders were at an advantage. The question is whether initial dominance could be perpetuated;
- Light demanders can regenerate slowly within small gaps and in degenerating, open stands. This would maintain dominance if shade-bearing competitors were absent;
- Oak may have been less light demanding. Warmer, sunnier summers would have helped. Possibly modern oaks are affected by new mildews;
- Oak and others may have been perpetuated by long-term wood-pasture and other utilisation. Wood pastures have often regenerated in pulses associated with some change or hiatus in grazing, and this would have allowed light-demanders to achieve patchy dominance. In the case of oak, which lives for 300–500 years in natural high forest, and probably longer in wood pasture, a very low rate of regeneration would maintain the population.

Key points to emerge from this are:

- The traditional prevalence of oak and other light-demanding trees may be due to prolonged utilisation of the district as wood pasture;
- Woods managed with minimum silvicultural intervention and minimum grazing intensity are likely to undergo succession away from oak and other light-demanders, but the long-term role and proportion of oak under these conditions is not known.

## **2.6 Network characteristics**

This section deals with the internal pattern of the Sunart woods and how they link to woodland outside the district.

### **2.6.1 Natural network**

Natural links within the Sunart woods are based on a 'bent comb' model of base-rich woods. Base rich and moist woodland rings the shoreline and extends up the burns. This unusual configuration of a dendroid network is broken in a few places where base-poor outcrops extend to the shoreline. The components take the form of corridors within other woodland, but the width of the corridor varies. Where the corridors are narrow, this woodland will be substantially influenced by the character of surrounding land. Isolation will be significant at headwaters. The dry, base-rich woodland patches will also be subject to isolation.

Oak-birch woodland takes the form of large patches between the 'teeth' of the comb. On base-poor rocks, headwaters may have so few base-rich pockets, that the oak-birch patches will effectively be linked in a complementary comb, that interdigitates with base-rich woodland. Even where patches are not joined, oak-birch stands are separated only by narrow base-rich corridors, so they would not be subject to isolation effects. Being large, they will not be much influenced by base-rich woodland.

Birch-willow-pine woodland forms the matrix, linked at sub-montane altitudes to woodland outside the district. Isolated patches of such woodland would exist within the oak-birch patches, and conversely small oak-birch patches could be expected within a matrix of sub-montane birch.

It seems unlikely that either base-rich woodland or oak-birch woodland would link to similar woodland outside the district from the head of Loch Sunart. Rather, such woodland would naturally link along the ocean shorelines to the west of the study area.

### **2.6.2 Influence of people on the network**

Records from the 18th century and earlier show that Loch Sunart was surrounded by a broken ring of woods, but that these woods were isolated from woods elsewhere by tracts of moorland. Despite the 20th century expansion of woodland, this larger isolation persists. Fragments of native woodland form links to the south towards Lochaline, and to the north-west at Doire Daraich by Loch Mudle, but these are thin birch fragments, and cannot link the oak, ash and alder types. New native woodland has been planted in Glen Tarbert, so external links from the head of Loch Sunart may improve marginally. Semi-natural woodland south of Rahoy forms better, but still broken, links towards Lochaline.

Traditional management broke up the ring of woods, especially west of Salen, around Glenborrodale, west of Strontian, and around the head of the loch. It also opened up the remaining woods. This may not have reduced connectivity as much as one might imagine, because:

- (i) trees, bushes and fragments of woodland remained along streams, mire fringes, on rock outcrops and around fields;
- (ii) the replacement grassland and mire vegetation contained some woodland species.

The 18th and 19th century planting phases restored connections to some extent by adding woodland in places which had little. On the other hand, the remaining diffuse matrix of trees in pasture outside the managed woods would probably have thinned out. Thus, woodland in the district was increasingly defined as discrete woods, rather than a matrix of semi-woodland and wooded pasture.

The post-1950 period filled in large gaps in the ring, but mainly with conifer plantations. This may well have favoured woodland generalist species, but could equally have isolated native woodland specialist species. On the other hand, the surge of secondary woodland growth, often associated with plantations, would have improved linkages. The net effect can only be guessed: by now there has probably been some improvement.

Today, it is difficult to believe that woodland generalists are limited by isolation, especially if they are edge species or capable of surviving in semi-woodland habitats. Populations of species dependent on close-canopy stands, and specialists dependent on oak or base-rich woods may well be isolated. Likewise streamside species must be isolated to some extent – but they would be isolated naturally. Dead wood volumes seem somewhat limited, so many saproxylics may also be isolated. However, epiphytes seem to have developed luxuriantly on mature trees, even in policy woods, which suggests that isolation is not a factor here.

An analysis of the distribution of individual species might throw light on the degree to which present-day populations are limited by isolation enhanced by past woodland loss and management. In its absence, the key assumptions are:

- That populations of many species, notably those depending on wet and base-rich sites, would naturally be subject to isolation effects;
- That populations of many species dependent on dead wood and large trees are likely to be suffering from artificially enhanced isolation;
- Isolation within the district would be reduced by limited additional woodland;
- Isolation between Loch Sunart district and woodland in other districts would naturally be severe, but that wooded links from the western extremities to the south would be beneficial.

## **2.7 Quantitative analysis of land use in the Sunart study area**

An attempt was made to estimate the areas of the main forest and land features in the Sunart study area by using intersections of the national grid as sample points (ANNEX 5). The results are inevitably approximate and subject to sampling errors, but they give a basis on which possible scenarios for forest development can be tested.

The total extent of the Sunart study area is approximately 25,100ha, of which:

Broadleaved woodland	2800ha
Plantations with some broadleaves	500ha
Conifer plantations without broadleaves	5000ha
Not forested, enclosed farmland	1100ha
Not forested, unenclosed, below 250m	9400ha
Not forested, unenclosed, above 250m	6300ha

On the basis of these figures, native, broadleaved woodland occupies 35% of the enclosed land and 13% of the unenclosed land below 250m. Forested land of all types occupies 35% of enclosed land and 43% of unenclosed land below 250m.

### 3 CURRENT NATURE CONSERVATION VALUE

Features of nature conservation value are itemised for clarity, though they overlap and are inter-dependent. The range of habitats is considered first, then woodland features, thereafter plants and animals. The details are derived principally from the citations relating to the SAC sites.

The basic value is that the concentration of ancient woods round Loch Sunart forms a large tract of semi-natural woodland, contiguous over long distances. Collectively, the woods constitute a Core Forest Area with good internal connections within the overall pattern of forested land in Scotland.

#### 3.1 Range of habitats

Uninterrupted zonations between marine habitats and woodland. This is rare in the UK. Marine habitats range from abundant brown algae, through saltmarsh, to transitional fen.

A wide variety of grassland and other open semi-natural habitats occur below the treeline. These include:

- (i) base-rich grassland (CG10a,b on Ben Hiant; herb-rich grassland on Poll Luachran, with *Thymus praecox*, *Linum catharticum*, etc.);
- (ii) base-rich crags and cliffs with *Galium boreale*, *Antennaria dioica* on Poll Luachran;
- (iii) base-rich glades with *Cirsium heterophyllum*, *Trollius europeus*, *Platanthera* spp. in Ariundle;
- (iv) base-rich areas in Salen-Woodend with *Eriophorum latifolium*, *Parnassia palustris*;
- (v) wet heath (M15), dry heath (H10), bracken (U20), grassland (U5a, U4) at Ben Hiant-Ardnamurchan coast and other sites;
- (vi) lowland mires in Salen-Woodend and Laudale with *Rhynchospora alba*, *Schoenus nigricans*, *Pinguicula lusitanica*, *Drosera intermedia*, *Hammarbya padosa*;
- (vii) *Sphagnum mires*; and
- (viii) wetlands, incl. bog pools and streams.

A wide variety of semi-natural woodland types. The pattern of the woodland types reflects the variations in site conditions (geology, soil, topography). The broad pattern of woodland composition appears to be fairly natural (ie as predicted by MLURI models).

#### 3.2 Structure and composition

Freedom from naturalised trees in most of woods. The only serious invasion appears to be the *Rhododendron* in Glenborrodale, and that is now being removed.

Stock of veteran trees, albeit now somewhat limited.

### 3.3 Biodiversity

The following notes summarise the biodiversity value of the cSAC.

Oceanic bryophyte diversity: the richest group of oceanic bryophyte-rich woods in the UK

Epiphytic and saxicolous lichen diversity, including well-developed Lobaria and many rarities. Listed for Ben Hiant. All 4 *Lobaria* spp in Glencripesdale.

Rich fern assemblage; including *Dryopteris aemula*, *Hymenophyllum tunbridgense*, *H. wilsonii*, *Gymnocarpium dryopteris*, *Phegopteris connectilis*

Nationally scarce vascular plants: *Arabis petraea*, *Hammarbya palludosa*, *Sorbus rupicola*.

Otters. Thriving populations benefiting from the juxtaposition of good feeding grounds at sea and suitable shelter on land.

Other mammals, including pine marten, wildcat, red squirrel, pipistrelle.

Birds: territories of buzzard, golden eagle, hen harrier range over the sites.

Reptiles and amphibians: 5 species, cat.2 importance.

Invertebrate species:

Moths and butterflies, including:

RDB1. *Zygaena viciae* ssp *argyllensis*, New Forest Burnet moth

RDB2. *Scropipalpa clintoni*, a micro-moth

Na *Cleora cinctaria bowesi*, Ringed carpet moth

Nb *Perizoma blandiata*, Pretty pinion moth

Nb *Boloria euphrosyne*, Pearl-bordered fritillary  
*Carterocephalus palaemon*, Chequered skipper (Ariundle)

Odonata, including

RDB3. *Somatochlora arctica*, Northern emerald



## **4 MANAGEMENT OF INDIVIDUAL WOODS**

Conservation management seeks to:

- (i) maintain existing habitats and biodiversity;
- (ii) restore former habitats and biodiversity; or
- (iii) allow natural processes to proceed and accept the habitats and biodiversity that they generate.

The obligations of Member States in relation to European sites (SACs) are set out in Article 6 of the Habitats Directive, which states that significant deterioration or disturbance should be avoided. This is defined and monitored by means of the concept of '**favourable conservation status**', which has been clarified by SNH as follows. It is the view of the UK Government that favourable conservation status (fcs) relates primarily to the overall extent and status of a habitat or species. At the site level, however, they accept that maintenance of fcs broadly equates with avoidance of deterioration or significant disturbance to features. This translates into the general principle that the obligation on Government is to maintain the status quo – if this is sustainable.

As part of the process of defining the condition of notified features, the UK Conservation Agencies have developed the concept of '**favourable condition**', which applies at the level of the individual site. This provides a framework within which managers can define their objectives and assess current condition and trends in relation to objectives.

### **4.1 What is Favourable Condition?**

The term "Favourable Condition" is used to describe a **range of states** within which a habitat should be kept in order to maintain high conservation value. These states can be described by means of **habitat** attributes, eg acceptable species composition or woodland structure. These relate directly to features of conservation value.

Favourable Condition can be described in terms of a range of values for each attribute. Limits of acceptable change should be set in order to maintain the habitat within the range of Favourable Condition. It is important that these attributes are **easily assessable** in the field.

Where a habitat has been degraded, the condition of the habitat, and the need for restorative management, can be assessed by comparing current and 'favourable' condition.

Defining Favourable Condition in woodlands raises a number of important issues:

- How important is naturalness as a determinant of conservation value?;
- Is the importance of naturalness less in areas which have a long history of management which has introduced elements of artificiality?;
- How important is diversity and should we intervene to promote it if natural processes are unlikely to deliver it in the foreseeable future?

These and other related issues are explored in the following sections, which describe favourable condition in terms of the composition, structure and dynamics of the Sunart woodlands.

## 4.2 Woodland composition

### 4.2.1 Does the woodland correspond with the SAC citation?

Seven sites within the Sunart woods are recognised as SACs which represent examples of “old oak woods with *Ilex* and *Blechnum* in the British Isles”. These are defined as “acidophilous *Quercus petraea* woods of the British Isles, with low-branched trees, with many ferns, mosses, lichens and evergreen bushes; the herb layer is formed by the group of *Deschampsia flexuosa*.”

Taken literally, this definition excludes *Quercus robur* woods, or at least those that lack *Q. petraea*. However, the type is generally interpreted to correspond with NVC W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* woodland and W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland, both of which types include *Quercus robur* and *Quercus* hybrids, and do not invariably include *Quercus petraea*. In fact, W11 and especially W17 stands in the western Highlands often lack oaks altogether.

Although most of the Sunart woods fall within these types, a significant minority do not. These are the alder woods, ash-elm-hazel woods, and the sub-montane birch, pine and willow woods. Nevertheless, these woodland are an integral part of the SAC, and contribute to its diversity and its connectivity. They cannot, however, be bound by the definition of Favourable Condition that applies to oak woods. Favourable condition not only relates to SAC features, but also to SSSI notified interests. For the purposes of this report, we are interested in how the existing SAC qualifying woods measure up to favourable condition.

SNH have indicated that Tilio-Acerion will shortly be notified as a SAC qualifying feature for Sunart. These are the ash-elm-hazel woodlands usually associated with ravines and other steep ground.

### 4.2.2 Natural changes in composition

Under natural conditions composition is unlikely to be stable. Composition would change in response to disturbances and interactions between species. Change is likely to be substantial at a small scale, but at larger scales it is believed that a net stability would be achieved under constant climatic and site conditions. The minimum area for this net stability is not known precisely, but is likely to be in the order of 50–100ha in the woodland types of the Sunart district.

If climate changes or site conditions are altered by, say, land movements or soil maturation, composition would change. This is clearly an issue at the present time, but for practical purposes we have assumed that climate and site will be constant.

More significantly, composition would change if new species arrive in the district and establish themselves. This would be acceptable if the arriviste arrived by natural means, but debatable if it spread naturally after introduction. It would be rational to accept introductions as components of future-natural conditions, but it may not be desirable (see 4.2.5).

### 4.2.3 The greater than expected incidence of *Q. robur* and intermediates?

Ecologists commonly assume that the oaks of oceanic oakwoods should be *Quercus petraea*, and this is manifested in the formal definition of the type represented in the Sunart SAC. In fact, there is good evidence that both oak species are locally native, and some indications that *Q. robur* would naturally be more

abundant than *Q. petraea* in parts of the district (section 2.3.4). Furthermore, intermediates are common, and 'good' *Q. petraea* individuals are in the minority. This is not an uncommon condition in the oak populations of the Western Highlands.

Since the natural balance between the two species cannot be determined, no criteria can reasonably be set in respect of this balance. References below to oak should therefore be taken to include both species.

#### **4.2.4 Dominance of oak**

A basis must be found for deciding the 'favourable' balance between oak and birch. Oak dominance in the Sunart area has probably been achieved by planting, oak-enrichment, or both, whereas birch dominance has clearly been achieved naturally by secondary succession. Historically, there are signs that oak was long a prominent species, though it is difficult to see how oak can be maintained as the dominant species by natural processes alone (section 2.3.5). Today, on the evidence of the Ariundle enclosure, mature oak stands in the absence of disturbance, acquire an understorey of rowan and downy birch, but no oak regeneration.

Under natural conditions, a mixture of oak, birch, rowan and hazel seems likely to prevail in W17 woodland, with birch predominating on disturbed ground, rowan regenerating in shade, and oak maintaining its prominence by great longevity, greater size, a capacity to regenerate vegetatively after disturbance, and irregular and rare episodes of regeneration from seed. At any given point, birch dominance or oak dominance seems possible, and neither condition would be more natural than the other. In W11 woodland, there would probably be more hazel and less oak and birch. In W9 woodland, ash, elm and hazel would probably reduce both oak and birch to small, scattered populations. In W7 woodland likewise, alder, ash and sallow would allow only small oak and birch populations to persist.

Under traditional management, the proportions of both oak and birch were evidently much larger in W7, W9 and W11 woodland than they would have been naturally. In general oaks were favoured far more than birch under both wood pasture and coppice.

#### **4.2.5 Occurrence of introduced, particularly naturalised species**

Introduced species can be judged on their merits in respect of biodiversity. There is little argument that *Rhododendron ponticum* is an unmitigated menace to biodiversity, and that the only favourable condition is absence. The other main naturalised species, beech and sycamore, are deciduous broadleaves that fit the prevailing physiognomy of the natural woods, and even add elements to inherited-natural biodiversity.

These species can also be judged on principle. By taking the view that original-natural and inherited-natural conditions are preferable to future-natural conditions, all introductions can be judged to be damaging. This rationale is appropriate to the best remnants of original-natural woodland, but is unduly purist in lesser woods.

A reasonable balance might take the form of;

- (i) minimising introduced species in the SAC woods; whilst
- (ii) allowing greater latitude in other woods.

Unfortunately, SAC woods are difficult to insulate from other woods. Nevertheless, this balance could be struck if silvicultural operations to control naturalised species in SAC woods were acceptable and practicable.

#### **4.2.6 Criteria for favourable condition relating to composition**

These considerations suggest that a wide range of conditions, or limits of acceptable change should be regarded as 'favourable'. The suggested formula for land mapped as W11 and W17 in SAC woods is:

- Composition should be assessed as a whole-wood scale (say 10–100ha), not a stand scale. This assumes the dynamic patchwork model of natural oak-birch woodland;
- Oak should be within the range 5–95% of growing stock, measured in volume or basal area terms. Thus, only oak monocultures and near-absence of oak at a wood scale would be 'unfavourable'. Low values would be associated with regenerating stands;
- Site-native tree and shrub species should comprise at least 95% of the stand. Where site-native species currently comprise more than 95%, this should be regarded as the lower limit of acceptable change. Thus introduced species should be kept below 5% or their present level, whichever is the smaller.

These criteria would be applied to all birch and oak ground below 250m, but not to alder or ash-elm ground. The term 'ground' implies the land on which these woodland types are present or would be present. The potential would be judged by site conditions, ie a refined, site scale judgement of the MLURI predicted woodland types.

On other ground the criteria must be different. In particular, on ground mapped as W4 the absence of oak will necessarily be acceptable. On ground mapped as W7 or W9, the acceptable limits for oak would depend on the chosen management or structure (section 4.3): absence would be acceptable under minimum intervention, whereas 5–50% would be acceptable under wood pasture or coppice. The upper limit recognises that other species would naturally be dominant, and should not be allowed to become a minority under managed conditions.

### **4.3 Structure and dynamics: Management models**

In this report we have developed several management models to address favourable condition in the Sunart woodlands. Management models have been couched in terms that are appropriate for oak woods, which are the focus of attention at Sunart. They would have to be modified for alder, ash and birch-dominated woods.

#### **4.3.1 The need for several management models**

There is rarely one best way to manage a particular wood. Usually, several options are available of more-or-less equal merit. Each option necessarily has its own favourable conditions.

The criteria proposed in the Tucker *et al.* (1997) were structured around four management models, near-natural, high forest, coppice and wood pasture, and these are adopted here with modifications. These models were seen as nodes in a continuum. Most stands in Sunart would conform to either high forest or wood pasture. The coppice model is not appropriate for oak-birch woods in Sunart, but could be appropriate for alder and ash-elm woods.

Two scales of favourable condition must be defined:

- Individual woods or parts of woods. A decision must be made on which management model is most appropriate, and a rationale should be devised to determine this. The decisions tend to be iterative: a management model must be determined before favourable conditions can be specified, but site management plans can only be devised after the limits of change relating to the attributes of the particular features of the site have been agreed. The models are discussed in 4.3.2–4.3.5;
- All woodland in the district. The balance and spatial relationships between the various management models must be defined. This is discussed in section 5.

Since a balance should be struck between the various management models at a whole-district scale, the management model chosen for any particular wood will depend on those selected for other woods, as well as the wood's particular characteristics. The approach to balancing the management models is discussed in section 8.2 and annex 6. Whilst recognising that much of the woodland oak/birch woodland might usefully be actively managed, rather than assigned to minimum intervention, a precautionary approach would be to limit intervention to at least the mature native stands until experience of the impacts of interventions has accumulated.

#### **4.3.2 Minimum intervention model**

This would apply to woods that are set aside as minimum intervention reserves (Peterken 2000). The acceptable composition can be either:

- (i) future-natural, in which any composition is acceptable, or
- (ii) original-natural or inherited-natural, where only the recognised site-native species would be acceptable. In both types, limits of acceptable direct and indirect human influence would be specified, but any structure would be acceptable. Favourable condition would therefore be maintained if:
  - No silvicultural operations take place. Exceptions are allowed for removing and excluding introduced species where inherited- or original-natural composition is the target;
  - Grazing is maintained at levels that allow regeneration in gaps;
  - Access tracks remain at low density and are well-maintained;
  - Introduced species are marginalised. If present, they are maintained in a non-reproductive state. This applies only to woods where the chosen objective is original- or inherited-natural composition.

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

### **4.3.3 Long-rotation high forest model**

This model would apply to woods where an existing mature structure is to be maintained, but from which a limited harvest of timber would be extracted. The basis would be rotations of 150–200 years, combined with small-scale felling and restocking by natural regeneration, planting, or both. Felling at this rate would allow 0.5–0.67% of the canopy to be renewed each year, but felling and restocking would in practice take place in episodes of, say, 10.0–13.4% restocking at intervals of 20 years. It would probably be practicable to use some of the ground in such woods as pasture. Favourable status would be maintained if:

- Mature and maturing stand structures to be maintained over at least 70% of the area. ‘Maturing’ in this instance would be 50 years growth or more, the age at which an oak plantation would be expected to develop an underwood, or the age at which a semi-natural oak-birch stand would start to appear mature and diverse. The criterion implies that up to 30% of an existing mature oak wood can be felled and restocked in the next 50 years;
- Rotation of canopy oaks to be at least 150 years. This allows much longer rotations, but ensures that the stand remains generally mature;
- Fell and restock patches to be a range of sizes up to 2ha. This mimics natural disturbance patterns and allows openings large enough to allow oak to grow into the canopy without permitting large clear-fell coupes. Most gaps would be no more than the spread of 2–3 mature trees;
- Thinning no more than 30% crown thin in any one operation. This leaves a mature stand that would rapidly fill most canopy gaps by crown expansion;
- At least 50% of the site to remain unthinned during the last 10 years. This avoids disturbing at least half the site until the rest of the wood has recovered from the last operation;
- Canopy trees retained indefinitely to be at least 5 per ha. These provide a minimum density of large old trees;
- Deadwood volume to be at least 40m<sup>3</sup>/ha. This is slightly above the values generally obtained in managed semi-natural stands;
- Shrub layer covers at least 10% of area in stands over 50 years old. It can hardly be higher if it is to apply to strongly acid oak-birch woods;
- Regeneration predominantly natural by seedling regeneration or vegetative regrowth. In the event of regeneration failure, planting confined to oak at low density on less than 50% of available ground;
- Grazing and browsing to be reduced to allow regeneration for at least one period of 15 years in every 100 years over 50–75% of site. This allows a pulse of regeneration over a majority in gaps and as advanced regeneration in shade within the life-span of canopy trees;
- Glades and other open space habitats (temporary and permanent) to occupy at least 10% of site. Gaps created by windthrow or silvicultural operations would count as open space habitats.

This model would maintain existing mature stands, and should be particularly suitable for mature oak woods. It perpetuates mature stands, but also diversifies the structure and helps to generate younger age-classes. It also enables timber to be utilised. The disadvantage is that stand structures and ground conditions that

have been undisturbed by felling within recent decades would be disturbed, and that some habitat trees for epiphytes would be removed. Care would therefore be required to ensure that extracted trees are not only utilisable, but do not currently support rare epiphytes.

ANNEX 6 suggests how stands might develop under this model with felling at the upper end of the range of rates proposed.

#### **4.3.4 Standard-rotation high forest model**

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

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

- Mature and maturing stand structures to be maintained over at least 50% of the area. ‘Maturing’ in this instance would be 50 years growth or more, the age at which an oak plantation would be expected to develop an underwood, or the age at which a semi-natural oak-birch stand would start to appear mature and diverse;
- Rotation of canopy oaks to be at least 100 years;
- Fell and restock patches to be a range of sizes up to 5ha. This mimics natural disturbance patterns and allows openings large enough to allow oak to grow into the canopy. Most gaps would be no more than the spread of 2-3 mature trees;
- Thinning no more than 50% crown thin in any one operation. This leaves a mature stand that would rapidly fill most canopy gaps by crown expansion;
- At least 50% of the site to remain unthinned during the last 5 years. This avoids disturbing at least half the site until the rest of the wood has recovered from the last operation;
- Canopy trees retained indefinitely to be at least 5 per ha. These provide a minimum density of large old trees;
- Deadwood volume to be at least 25m<sup>3</sup>/ha. These are the values generally obtained in managed semi-natural stands;
- Shrub layer covers at least 10% of area in stands over 50 years old. It can hardly be higher if it is to apply to strongly acid oak-birch woods;
- Regeneration predominantly natural by seedling regeneration or vegetative regrowth. In the event of regeneration failure, planting confined to oak at low density on less than 50% of available ground;

- Grazing and browsing held at levels that allow regeneration in gaps and advanced regeneration in shade;
- Glades and other open space habitats (temporary and permanent) to occupy at least 10% of site. Gaps created by windthrow or silvicultural operations would count as open space habitats.

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

#### **4.3.5 Wood pasture model**

This covers a wide range of conditions that may once have been generated by traditional management, and which still survive on a small scale. Wood-pastures can take the form of almost closed woodland permanently open to stock, but they may also be sparse parkland, ie a scatter of individual trees whose ground cover totals no more than 5–10%. Traditionally, wood pastures include large, old, open-grown trees: the trees range from large, ancient individuals to scrub. However, since any new wood pastures would lack large old trees for a considerable time, a broader definition is used here to include grazed and open woodland that may lack old trees. Note that the boundaries of these sites are generally undefined, ie the area specifications below depend on the notional boundaries of the wood pasture.

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

- Mature trees retained indefinitely covering at least 20% of the area;
- Existing mature trees all retained;
- Grazing and browsing reduced to allow regeneration for at least one period of 15 years in every 100 years over 50–75% of site;
- Age-class of trees under 50 years old present representing 10–50% of tree population;
- All tree species to be represented in under-50 year age class;
- Regeneration to be predominantly natural. Planting restricted to tree species that fail to regenerate.

Where wood pastures are extended by tree-planting into pasture, criteria should be based on the satisfactory establishment of enough trees to form wood pasture when they mature. At 10m canopy spread, this implies a density of 13 trees/ha for 10% cover. Allowing for losses, and the fact that some tree species do not grow that large, a planting density of at least 50 trees/ha seems appropriate, which would be reduced by 4 per ha for every mature tree already on the ground.

Wood pastures, when mature, provide excellent habitat for epiphytic lichens, and a structurally diverse habitat with large amounts of edge habitats. They allow continued grazing, afford some shelter to stock,



and help to diversify 'bleak' pastoral landscapes. Regeneration, however, usually requires fencing that is expensive for the number of trees established. Whilst there is no reason why branchwood should not be harvested, in practice most wood pastures would not yield timber.

#### **4.3.6 Coppice model**

Within the Sunart district this could apply only to W7 and W9 woods, and in practice is most likely to apply to limited areas of alder (W7). Coppice can be treated as a formal, highly organised system, or as a label to cover informal and irregular cutting, and there would be little to choose between them on nature conservation grounds.

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

These specifications allow considerable latitude in structure, but prevent any coppice from being clear-cut completely, and ensure that rotations are at least 20 years. Any glades would be retained by allowing grazing within 5 years of cutting.

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

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

#### **4.3.7 Variations in models for other woodland types**

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

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

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

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

## **4.4 Associated species**

Some of the species of conservation importance help to determine the limits of woodland management. Their requirements are set out here.

### **4.4.1 Management for the conservation of bryophytes**

Reports by Averis (1996) and Averis and Coppins (1998) provide both a general review and summarises the requirements of individual species.

Summarising the points made by Averis:

- Felling and thinning should be minimised. Large clearfells should be avoided. Particular trees known to be rich hosts should not be felled. Any felling on southerly aspects requires particular care, since such sites are more likely to dry out. Diversity of stand structure and composition should not be reduced, but equally homogeneous stands should not be selectively treated to increase diversity. If felling is necessary, locations rich in bryophytes and lichens should be avoided;
- Coppicing should be minimal, especially on southerly aspects. Any coppicing should be carried out in areas of low bryophyte and lichen interest;
- The volume of dead wood on the ground should be maximised, by leaving as much as possible after any felling, and by not removing that which is already present;
- Planting native trees in unwooded areas is desirable, but is rarely necessary in existing woods;
- Introduced trees should not be planted, and should be removed if present. The exceptions are existing mature sycamore, beech, lime and horse chestnut, which may be important locations for Lobaria communities;
- Rhododendron should be removed, particularly from stands that have not yet become densely infested.
- Light grazing by deer, cattle or sheep is generally preferable to heavy grazing. One reason is that this prevents holly growing abundant enough to shade out epiphytes. However, this is not a major concern in the Sunart woods;
- Spraying with herbicides to control bracken should be done with care by avoiding places rich in bryophytes and lichens.

A recurring theme is the need to be sensitive to the distribution of bryophytes and lichens. Averis (1996), table 1 summarises the habitats of scarce and vulnerable bryophyte species found in west Highland woods. Most habitats identified lie within 5m of a stream or loch shore, or within a ravine. The woodland habitats that fall outside these specifications are shaded woodland floor (M), shaded soil banks outside ravines (O) and logs and stumps outside ravines (Q). These are the 'most frequent habitats for 21 of the 147 species of mosses and liverworts listed. Of these 21, 18 also have 'most frequent habitats' in ravines, of close to streams and shores, and only 3 species mainly depend on shaded woodland floor, soil banks or stumps outside ravines, etc.

On this basis, there seems to be plenty of scope for judicious management without harming bryophytes, provided a buffer strip at least 5m wide is left around streams and shores.

#### **4.4.2 Management for the conservation of epiphytic lichens**

The above reports also provide guidance on the requirements for epiphytic lichens. These are species which generally thrive in high humidity and semi-shade. Many have a very limited capacity to colonise newly suitable substrates, and are thus found in relict locations along watercourses and on very old trees.

Management requirements can be summed up as:

- (i) minimising silvicultural operations, whilst
- (ii) maintaining moderate levels of grazing and resisting the development of dense underwoods, particularly *Rhododendron*.

Recognising that existing epiphyte assemblages have survived in woodland that was intensively managed in previous centuries, low-intensity silvicultural operations can be reconciled with maintaining resilient epiphytic lichen assemblages by:

- Maintaining a full range of tree sizes, ie by long rotations and retaining some trees to natural old-age.
- Small-scale working, to maintain humidity and variety of light climate.
- Achieving a variety of stocking, by irregular thinning in established woods, and creating new woodland as a mosaic of dense high forest and open wood pasture.
- Retaining a full range of native tree and shrub species.

#### **4.4.3 Chequered skipper**

This butterfly is now restricted to western Scotland. It occurs on the north side of Sunart, with an outlying population on the south side. Its requirements are summarised from the account by Ravenscoft (1996).

Chequered skippers are associated with the margins of damp oak-birch woodland. In particular, it inhabits bays at the edges of woods, large glades and strips of scrubby ground along wayleaves. Females lay eggs in tussocks of *Molinia* growing in semi-shade in light scrub, particularly where the grass is mixed with *Myrica* and scrub of birch, alder or willow. Adults take nectar from *Ajuga reptans*, *Cirsium palustre* and other herbs of moderately base-rich, wet ground. Populations are open in the sense that adults are particularly mobile: in any given location, they are evidently maintained as much by immigration as by individuals remaining on site.

Habitat management for chequered skippers requires:

- Maintaining irregular wood margins with bays, particularly on boundaries with marshy tracts;
- Maintaining moderate levels of grazing, that allow grassy tussocks to persist in open and irregular scrub. Heavy grazing would eliminate the scrub and tussocks, but absence of grazing would allow scrub to progress to closed woodland;
- Maintaining broad (20–30m) rides, wayleaves and large glades with herb-rich vegetation in full daylight;
- Ensuring that new suitable habitat is created within colonising distance of existing populations at a rate that matches or exceeds the rate at which suitable habitat is lost.

#### **4.4.4 Open ground species**

Since this report is focused on trees, woodland and plantations, it is necessary to record that the diversity of the Sunart district depends also on the open ground and the species associated with it. Thus, for example, forest expansion should avoid planting on the grasslands and mires of high conservation value, as described in SAC citations and summarised in section 3.1. There is also a need to keep enough open ground for raptors requiring large open spaces, notably golden eagle and hen harrier.

#### **4.5 How 'favourable' are the existing woodlands?**

How do existing native woods measure up to these standards? The principal deficiencies appear to be:

- 1) Poor representation of ancient pasture woodland, given its importance in the past and its conservation value, and failure of succession of oak;
- 2) Artificially high dominance of oak in some woodlands on the northern shore, including monocultures over substantial tracts. Oak is dominant on some sites that appear to be more suitable for other tree species, eg along the burn at Camas a'Choirce and on the lower slopes of Ben Laga;
- 3) Possible historic planting of stock raised from non-local acorns, raising further questions about status of the 2 oak species; (This is an assumption, which should be checked if records are available.)
- 4) Lack of regeneration (ie a failure of succession) of native trees and shrubs in SAC woodland areas. This is widespread, but actual degeneration of old stands without regeneration may be limited as yet to tracts of lower elevation birch on south shore;
- 5) Absence of oak from many woods that have been assessed by MLURI as W11 and W17. This includes failure of oak to colonise even when such ground is regenerating to native woodland;
- 6) Uniform structure and age class distribution, especially in oakwoods and birch woodlands;
- 7) Continuous use of woodland as pasture, which is the main reason for the failure of regeneration in gaps in many woods and wood pastures;
- 8) Localised presence of introduced trees and shrubs;
- 9) Quantities of dead wood are limited.

In general terms it seems improbable that current management will sustain the conservation values of these woods indefinitely. The woods are not being maintained in a net stable state, individually or collectively. The main elements at risk are the remnant wood pastures, the representation of oak in the younger age classes, and the exotics-free status of most woods. Clearly, there is no immediate threat, but if corrections are made early the eventual discontinuities in condition will be minimised. For example, the objective of maintaining indefinitely a strong representation of large, mature trees might be best achieved by an immediate programme of limited felling that would:

- (i) enable retained trees to grow larger faster; and
- (ii) allow regeneration to establish a succession.

## **4.6 Benefits and risks of management**

It may be worth summarising the benefits of silvicultural intervention, as opposed to minimum intervention, in most of the woods:

- **Sustainability:** allows a succession of trees to develop in currently even-aged and non-regenerating stands, thereby ensuring a long-term, dynamic stable-state;
- **Nature conservation:** increased side light to benefit epiphytes; greater structural diversity in some woods; greater small-scale diversity of trees and shrubs; invigorated open space habitats within woods; exclusion of herbivores relieves woodland ground flora;
- **Utilisation:** the timber and wood can contribute to social and economic goals;
- **Management stability:** long-term management plans incorporating several kinds of benefit are more likely to survive changes associated with short-term fashions in forestry and other policies.

On the other hand, the resumption of silvicultural operations in woods that have been untouched in this sense for decades carries risks:

- **Sustainability:** failure of regeneration may lead to requirement to plant;
- **Nature conservation:** loss of trees with valuable epiphyte communities; disturbance to ground vegetation by machinery; increased rate of colonisation by introduced tree and shrub species;
- **Landscape:** woods hitherto perceived as 'natural' become visibly managed.

## **5 FOREST MANAGEMENT AT THE WHOLE-DISTRICT SCALE**

Guidance on forest management is needed for the district as a whole, which deals with both the amount and spatial arrangement of all woodland, and the balance between the various management models (section 4.3). Defining favourable condition for the Sunart woodlands as a whole is tantamount to stating a woodland management strategy for the district.

### **5.1 Strategy**

The Sunart woodlands are already recognisable as a Core Forest Area, as defined by Peterken et al (1995), but they are isolated from woods in other districts, have significant gaps within the district, and their current management will not sustain their features indefinitely. We propose a strategy for the district with the following main components:

- 1) Generate external links by encouraging new native woodland north from Salen, south from Rahoy and Poll Luachran, and east up Glen Tarbet;
- 2) Improve internal links by (i) increasing the broadleaved elements in existing conifer plantations, and (ii) encouraging new native woodland between Ben Hiant and Ardsignish, and around the head of Loch Sunart;
- 3) Renew existing wood pastures by ensuring the succession of trees, especially where oak remains a component. Extend these to further improve internal links;
- 4) Identify a proportion of woodland to be retained as minimum intervention woods. These are likely to be concentrated along watercourses;
- 5) Restore management to a proportion of oak woods. This management should generally take the form of long-rotation high forest worked in small-scale operations and would be aimed at diversifying the age class distribution of oakwoods. This would provide a better basis for long-term conservation than the present narrow age-range of oak-dominated stands;
- 6) Establish a range of silvicultural treatments in the native woods as a whole. This might include limited oak-enrichment planting into some birch woods and revival of coppice in some alder woods;
- 7) Large and old trees should be retained in managed woods as habitats for saproxylic species;
- 8) Distribution and intensity of grazing should be more precisely controlled to achieve the optimum pattern for forest management and nature conservation.

This strategy would be implemented by measures relating to timber utilisation and pasturage, which are discussed in section 7.

These requirements do not preclude the utilisation of timber and wood. In fact, they are best achieved by interventionist management of varying intensity, well-distributed throughout the district. This management may be best achieved by defining an overall strategy for the district, within which decisions relating to individual land holdings can be taken.

SNH have responsibility for defining requirements in the SAC sites and share responsibility for the district as a whole. We consider that they should take into account:

- The artificial character of the oak-dominated woods, ie oak monocultures and even-aged stands;
- The failure of oak to regenerate strongly within woods, and in regeneration remote from oakwoods;
- Opportunities for expanding the area of oak woodland in conifer plantations, especially those retaining scattered remnants of former oak woods;
- The net benefits for nature conservation of oak age-diversification, oak expansion, better large-scale internal and external woodland links;
- The beneficial long-term management stability, based on a strategy incorporating public acceptance of multiple objectives.

## **5.2 Whole-district criteria**

These criteria relate to the pattern and turnover of woodland of all kinds. They assume that isolation should be minimised (or connectivity maximised), and that transfers between woodland and non-woodland (clearance or afforestation) should be minimised to maintain populations of slow-colonising and relict species associated with both woodland and other semi-natural habitats.

- Existing ancient woods to remain as woodland.
- Woodland should cover at least 30% of the ground below 250m. Simulations indicate that this will ensure that any new woodland will be close to existing woodland, and thus readily colonised by woodland species. This still allows substantial gaps in the ring of woods round Loch Sunart.
- The distance between stands with at least 5% oak in the growing stock (by volume or basal area) is less than 200m. This ensures that no oak wood (sens. lat.) is isolated.
- No net reduction in oak wood area.
- No more than 1% reduction (ie clearance to other land uses) in existing oakwoods in any one year, and no more than 10% reduction in 50 years. This minimises turnover in oak sites, without excluding it altogether. Loss of oak woodland to be defined as felling followed by management that prevents restocking or regeneration with oak.
- Age class distribution to be 'normal'. No 50-year age class, ie 0-50, 51-100, 101-150, 150+ years, to be below 15% of growing stock.
- A balance to be maintained between the range of management options.

These criteria provide for limited turnover in woodland pattern for secondary woods, limited turnover in the pattern of oak within the woods, a minimum overall pattern that minimises ecological isolation, and an approach to management that ensures a steady succession of stands. This ought to satisfy nature conservation, landscape and wood/timber supply requirement indefinitely, ie it would be sustainable.

### **5.3 Long-term scenarios for woodland development**

It is important for all stakeholders in the Sunart district that ideas for woodland expansion and restoration should be expressed in quantitative terms. This not only allows resources to be assessed against the plans, but enables interested parties to discuss the options with greater precision and fewer misunderstandings. Estimates of the current land use and areas of woodland types are given in section 2.7 and ANNEX 5.

Accordingly, ANNEX 7 provides an exploratory calculation, which could form the basis for such discussions. It is based on the aim of achieving 30% cover of all forms of native woodland on land below 250m, the presumed upper limit of utilisable tree growth. The measures by which this would be achieved would be some combination of:

- Creating new broadleaved woodlands by natural regeneration and planting;
- Extending woodpastures by planting native trees into enclosed farmland and open pastures;
- Converting some conifer plantations to broadleaved high forest;
- Adding an element of native broadleaves to other conifer plantations.

The calculation also covers changes in woodland management. Each category of existing and prospective woodland can be apportioned between the management models of section 4.3. ANNEX 7 shows three scenarios, but many other combinations are possible.

These figures should not be taken too literally. The calculations are very approximate, and they necessarily gloss over the individual characteristics and requirements of each wood. They are based on rough estimates of the woodland resource, and a number of assumptions. They highlight the need for a more accurate assessment of the stock of trees in existing woodlands.

### **5.4 Identifying minimum intervention woodland**

The first step in identifying suitable management for individual woods should be to select areas to be treated as minimum intervention woodland (section 4.3.2). The priority should be to protect species that require the undisturbed, moist conditions provided by a mature woodland canopy. Given the needs of oceanic bryophytes (section 4.4.1), minimum intervention woodland is best located in existing mature oak and ash/elm woodland close to watercourses. Most might take the form of belts along watercourses of irregular width. However there is also benefit in having minimum intervention woodland in a representative range of the woodland types in Sunart.

The total area for such treatment is best determined on the basis of existing information about bryophyte distributions. ANNEX 7 gives scenarios of 50ha, 200ha and 700ha. We consider that there is a case for allowing for a large area at the present time, but partly on the precautionary principle that any decision to intervene on a large scale should await satisfactory results from the initial interventions.

### **5.5 Selecting management options for individual woods**

Without detailed survey it is not possible to propose management options for individual woods. In any case, the assignment of individual woods to particular management regimes should be reasonably flexible, in order to allow individual owners and managers as many options as possible.



In order to facilitate discussion and decision, the following table has been drawn up to indicate the options that seem most appropriate for each existing woodland type. They recognise that continuity of treatment is usually best for nature conservation.

**Table 4 Suitability of each management model for different existing woodland types**

<b>Current stock</b>	<b>Long-rotation high forest</b>	<b>Standard rotation high forest</b>	<b>Wood pasture: parkland</b>	<b>Coppice</b>
Original wood pasture, oak, ash, alder	Acceptable, provided existing ancient trees are given space	Not appropriate	The preferred option for any remnants of wood pasture	Not appropriate
Oak	Preferred option for mature oak stands	Acceptable in some younger oak stands	Acceptable to allow some mature oak to develop towards wood pasture	Rarely appropriate, but possible on a small scale in younger stands
Birch	Rarely appropriate, due to shorter live span and small stature of birch	Appropriate as birch HF or, after planting oak, as oak-birch HF on areas mapped as W11 or W17	Current condition of most mature birch. **Continuation acceptable in short-term. Eventual treatment as HF	Acceptable, but rarely appropriate
Alder	Rarely appropriate	Acceptable: rotations would be shorter than oak; less need for replanting	Appropriate in association with existing parkland remnants	Acceptable, especially in younger stands
Ash-elm	Possible, not usually appropriate, since life-span of ash is shorter than oak	The preferred option for ash-elm outside minimum intervention and wood pasture stands	Appropriate in association with existing parkland remnants	Acceptable, especially in younger stands
Young growth	Usually inappropriate, but small patches might be included with existing mature woodland assigned to long-rotations	The preferred option	Appropriate in association with existing parkland remnants	The preferred type for developing into coppice
Conifer plantation	Acceptable, but rarely appropriate	The preferred option	Not appropriate	Not appropriate
Unwooded ground	Not appropriate	The preferred option for most native woodland planting	Extension of wood pasture will require scattered planting	Acceptable in well-stocked, naturally regenerated stands

## **6 DESCRIPTION OF OWNERSHIP AND CURRENT MANAGEMENT**

### **6.1 Ownership**

Ownership of the SAC woodlands area is split between private and public ownership. Private landowners account for the majority of the area and comprise large private estates mainly on the south side of the Loch (eg Laudale, Rahoy) and smaller landholdings on the north side (eg Ardery, Camuschoirk). Most private landholdings comprise a mixture of woodland and grazing, though a few of the smaller ownerships are predominately woodland. The following public agencies account for a substantial proportion of the area: Scottish Natural Heritage (at Glencripesdale, Ariundle), Forest Enterprise and Department of Agriculture/SERAD.

The key points relating to ownership are:

- A large proportion of the cSAC is under private ownership, some of which are small owners;
- Significant areas of the highest conservation value are under private ownership (eg Ardery, Ardsignish, Resipole, Laudale and Rahoy).

### **6.2 Management and use of woodland**

#### **6.2.1 Woodland management**

Woodland management approaches in the area can be categorised into:

- 1) Conservation management of:
  - woodland with grazing control. This includes areas of woodland restoration using fencing;
  - woodland without grazing control. Some areas are used for livestock grazing and some on the south shore are managed primarily for deer shelter;
  - remnant wood pasture (livestock grazing amongst scattered mature trees).
- 2) Restoration of plantations on ancient woodland sites to native woodland;
- 3) Multiple purpose management of plantations of introduced conifers and Scots pine, with an emphasis on timber production.

Much of the past management of the woodland SSSI's could be categorised as minimum intervention, and some aspects of management have not been favourable for conservation, especially the high levels of grazing. Many of the woodlands have been unenclosed and subject to grazing and browsing for most of this century. Others have been enclosed, some for several years (eg Ariundle) and others more recently. Plans are now in place to fence virtually all the SAC woods through the combined efforts of the FC, SNH, the Sunart project and private owners, some of the work being supported by LIFE funding. There are also substantial areas where Rhododendron is being removed.

There is considerable activity in restoration of plantations on ancient woodland sites, with the Forest Enterprise committed to restoring some 500ha and SNH a further substantial area at Glencripesdale.

### **6.2.2 Agricultural use**

There has been some pasturage of livestock in the cSAC woodland but this is not widespread.

### **6.2.3 Sporting**

Some of the woodlands are used as cover and wintering ground for deer especially on the south shore.

### **6.2.4 Tourism**

Efforts to promote the woodlands for tourism through leaflets, interpretation or walks/paths or other facilities have been hitherto relatively modest. However recent there have been increased activity to promote tourism in the area.

Key points relating to management and use are:

- 1) The standard of management of the woodland SSSI's has been variable. Where fencing and control of deer numbers has taken place, the management has been satisfactory. In other areas the continued high grazing pressure has led to a deterioration of woodland condition. Recently prospects for management have improved markedly with the restoration work carried out under the LIFE programme;
- 2) There has been little attempt to diversify age structure of the former oak coppice woodlands or to manage broadleaved woodland for timber productions. Reasons for this include the designation of the woods as SSSI's, coupled with SNH's view that a precautionary approach should be taken to felling proposals until a strategic overview of the whole resource was available. Also *until recently*, there was a lack of interest on the part of owners and agents in timber production; and a lack of obvious opportunities for utilising timber locally;
- 3) The lack of effort in developing the woodlands as a tourism resource is widely acknowledged as a missed opportunity.

## **6.3 The potential timber resource**

The main potential timber resource can be split into:

- Oak timber in the oakwoods on the north shore, in particular the coppice origin woods in Ariundle and the Woodend to Salen section;
- Other minor broadleaf species, particularly downy birch;
- Softwoods from the plantations on ancient woodland sites which are being restored;
- Softwood from plantations (on non-ancient woodland sites).

### **6.3.1 Former oak coppice**

There are several hundred hectares of typical former oak coppice woodland and some of the main areas are listed in Table 5. Estimates of the actual area do not currently exist – they cannot be distinguished either on aerial photos or NVC maps. Such woodland typically has about 100 stems per hectare, averaging about

30–40cm in breast height diameter and about 12–19m tall. A survey of oakwoods for the Sunart area suggested that the standing volume *sawlog dimension* timber averaged about 33m<sup>3</sup>/ha (Goucher 1999).

**Table 5 Area and standing volume per ha of potential sawlog material in a sample of the main oakwoods**

WOOD NAME	AREA (ha)	VOLUME OF OAK SAWLOG MATERIAL (m <sup>3</sup> /ha)
Ardery	78	25
Ardery FE	14	23
Ariundle	87	49
Bun Allt Eachain	2	13
Camus a' Chiorce	11	24
Camustorsa	2	30
Salen an Cnap	16	19
Salen Village	9	21
Camus Fearn	9	23
<b>TOTAL</b>	<b>228</b>	

The form of the oak is variable, with a only modest proportion (10–20%) of straight stems of sawlog length and quality). A major problem is dead branches at 3–6m height, that have acted to introduce rot into the stems. There is variable proportion of pippy stems, which presumably yield decorative timber (up to 15% in some stands). Careful conservation management should mean that a proportion of this timber could be made available for local use (see section 7.3 for more details).

### 6.3.2 Birch woodlands

There are modest areas of pole stage and mature birch woodland, which would be utilisable as firewood, charcoal and craft (turning) timber.

### 6.3.3 Conifers

The bulk of the conifer area is Sitka spruce which is of limited value for local use. About 10% of the woodland area of larch, which might be more marketable locally. The conifer area is currently diminishing rapidly as a result of the restoration of PAWS to native woodland, though substantial areas of conifer woodland will remain.

### 6.3.4 Harvesting

Harvesting opportunities are limited by terrain, though extraction distances to public roads tend to be quite short. Over half the area timber would be extractable by horse or small scale machinery; the rest would require use of a winch.

### 6.3.5 Local timber utilisation facilities

Timber utilisation facilities in Sunart at present comprise a mobile sawmill (set up as static), a kiln and wood

working workshop at Ardslnish, plus a few premises with basic circular saws. The Ardslnish sawmill saws small quantities of both hardwoods and softwood for joinery on a part time basis.

There is currently no local estate sawmill or firewood merchant.

## **6.4 Woodland initiatives**

Woodland development has been progressed recently by the “Sunart Oakwood Project” which is jointly funded and co-ordinated by FE, FC, SNH, Highland Council, Community Councils and Lochaber Ltd., and employs a project officer based in the Strontian FE office. This has concentrated on:

- 1) Joint woodland restoration projects based on enclosing existing woodlands to encouraging natural regeneration;
- 2) Removing threats to the native woodlands – conifer and rhododendron;
- 3) Restoration of Ancient Woodland to native woodland (mainly FE);
- 4) Community involvement;
- 5) Recreation;
- 6) Woodland inventory.

This is a successful project, which has attracted substantial funding from Millennium Forest for Scotland, LIFE funding and Transitional funds and is benefiting from partnership working.

Efforts are being made to enhance and diversify the skills of local woodland contractors, initially through direct training by FE and latterly supported by the Ardnamurchan Initiative at the Edge Training and Skills Project. Supported by the Training and Skills Project, local woodland contractors have formed a company to pool skills and resources to enable them to tender for work which individually would be too large.

Key points which arise from this:

- The potential exists for modest timber production from the broadleaved woodlands, with utilisation facilities at an appropriate scale at Ardslnish;
- Activity in restoring PAWS to native woodland means that there is currently an abundance of softwood timber available.

## **6.5 Local community**

### **6.5.1 Pattern of settlement**

The patterns of settlement is split between:

- **North shore:** This is, in Highland terms, reasonably extensively settled, comprising a string of small settlements centred on Strontian and Kilchoan, but closely connected also with Acharacle.

- **South shores:** This is more sparsely populated with a typical “large estate” pattern of a few big houses and associated dwellings, but no community centres.

The total population is approximately 1300.

### **6.5.2 Community organisation**

The community is organised under 3 parishes (Ardnamurchan, Morvern and Sunart). The main formal community organisations with potential relevance to woodland issues are:

- Community councils (West Ardnamurchan, Acharacle, Sunart, Morvern). These have hitherto not taken particular interest in woodland issues;
- Local tourist boards (Highlands of Scotland Tourist Board, and locally the Ardnamurchan Tourist Association). These have not sought to engage woodland owners in woodland related tourism development;
- Training initiative (Ardnamurchan Training and Skills Project). Training provision has included woodland skills.

### **6.5.3 Community based woodland organisation**

A nascent community woodland owners group has recently been formed comprising private woodland owners and agents participating in woodland restoration schemes. This includes the mobile sawmill operator and has input from the Sunart Project Officer.

Key points are:

- 1 On the north shore of the loch and adjoining areas, including Strontian, Kilchoan and Acharacle, there is a significant local population (in Highland terms). This has several members, including woodland owners, who have an interest in timber management and utilisation.

## **7 WOODLAND-BASED COMMUNITY DEVELOPMENT OPTIONS**

There are several aspects of the Loch Sunart area which suggest that the potential of the designated oakwoods for supporting community development could be strengthened:

- 1) Sunart is a classic example of a remote rural area where community development opportunities are relatively restricted. In such areas use of local natural resources is a key development opportunity and there are fewer alternatives than in more heavily populated areas;
- 2) Virtually all the broadleaf woodland in the Loch Sunart catchment has been designated as being of high conservation value. This simply means that there are no significant non-designated broadleaved woodlands where productive management might take place;
- 3) The history of many of the woodlands is one of management for several centuries. As a result of this, some of the SSSI woods have acquired a relatively high degree of artificiality. Whilst this is not a reason *per se* for re-instating productive management (restoration to a more natural state might be equally valid) – such woods make a better target for any management activity than woods of more natural composition and structure;
- 4) The total woodland area is large enough to accommodate both core non-intervention areas and areas which might be managed more actively;
- 5) Many of the woods that have the greatest potential for productive management are in private ownership and several are quite small units. Private owners often are less able to forego income opportunities than state agencies or charitable environmental organisations.

Thus the case for accommodating some productive management in designated woodlands in a region such as Sunart is far greater than in many other regions of Scotland.

### **7.1 Stakeholder perceptions of management issues**

The following points summarise the attitudes of the main stakeholders towards development in the woodlands.

#### **Private woodland owners**

- 1) The woodland owners value the woodlands in a general sense and express a sentiment of not wishing to damage them.
- 2) Several owners have engaged in positive management over recent years aimed at restoring and extending the woodlands. Some of these owners (mainly on the north shore Woodend to Salen) feel that this should have engendered in SNH a more positive attitude to requests to carry out timber management or other development in the woods. They perceive no such response on SNH's part and this has led to some resentment. In contrast, other owners have limited their management to woodland restoration, removal of Rhododendron and regeneration schemes and have not encountered significant difficulties with SNH over these management arrangements.

- 3) Some owners consider that there should be mechanisms for deriving income out of the woods in general, and in particular those parts which they are actively restoring. Whilst this may have been forthcoming during the restoration works (as grants), there is a uncertainty as to how further income can be generated. The concept and scope of "utilising the by-products of conservation management" as a means of generating income is not understood and needs clarifying.
- 4) Some owners wish to carry out positive management and to explore all avenues which may generate income from the woods, either in terms of saleable products or grants. Opportunities suggested include timber, livestock, sporting, housing/chalet sites and tourism. Some see potential in using the Sunart Oakwoods as a label to attract tourists, whilst others see little benefit in this.
- 5) The grounds given by SNH for refusing or moderating recent requests from some owners to carry out management operations (eg thinning woods, felling small numbers of trees or bracken control) are not deemed sufficient. This has led to a degree of disillusionment on the part of some owners with the concept of conservation management and with the management arrangements for the woodland SSSI's.
- 6) There is a perceived lack of effective communication between SNH and some woodland owners and aspects of the system (eg written consent) are seen as overly bureaucratic.

### **Scottish Natural Heritage**

- 1) SNH's concerns centre on the fact that the woods are acknowledged as being of international and national significant, as well as being locally important. SNH has a duty to wider society protect them.
- 2) SNH accepts that there is a good case for productive management of parts of the woodlands, and is in favour of this provided that the effects of such proposals are demonstrably "neutral or better" for the conservation interest. The management of SAC's is more complex than for SSSI's because of a legal obligation to demonstrate that management operations/developments are favourable to the conservation status. (SNH had to accept the management styles which were in place when the SSSI's were designated, even those might not be favourable for the conservation interest (eg overgrazing)).
- 3) Despite the special circumstances in areas such as Sunart, SNH consider that they cannot be seen to apply a more "permissive" interpretation of the SSSI legislation in an area like Sunart than in other parts of the country.
- 4) Previous refusals on the part of SNH to sanction management operations have been partly because they need to adopt a precautionary approach until an overall management strategy could be drawn up.
- 5) Too much emphasis has been placed on timber value of broadleaved woodlands, on the part of those promoting community development, sometimes generating unrealistic expectations. Insufficient consideration has been given to the potential contribution of woodlands to tourism.
- 6) SNH would view positively mechanisms which would improve mutual understanding of management issues and would improve communication among parties.



## **Forest Enterprise**

- 1) Forest Enterprise recognise the conservation importance of the woodlands and believe that in the long term positive management of the woods, which generates some income is the best guarantee of their future.
- 2) FE's programme of conifer felling is generating considerable local activity and employment in the short term, but in the long term the expanded area of broadleaf woodland will potentially contribute to timber-related activity.
- 3) There is a convergence of interests between management for conservation and small-scale timber utilisation. Diversification of age structure and thinning of woods will benefit nature conservation as well as providing timber for sale to the local small sawmill. The arrival in Sunart of the sawmill at Ardsignish is an ideal opportunity to demonstrate rural development fully integrated with conservation.
- 4) SNH's precautionary approach to sanctioning felling operations has currently lead to an impasse.
- 5) FE is willing to continue to support the local sawmill by providing both hardwood and softwood timber (the hardwood is currently sourced outwith Sunart).

## **Forestry Commission**

- 1) Forestry Commission has been a major funder of woodland restoration and regeneration schemes in the area (second only to LIFE).
- 2) FC's input has led to significant woodland expansion in the area and the majority of schemes have been uncontroversial.
- 3) Only one felling licence for oak has been applied for (from the FE), and this is awaiting the outcome of the present report before a final decision can be made.

### **Key issues:**

- SNH's viewpoint is based on the national scarcity of Atlantic Oak woodlands, whereas the community start from the view that they are locally abundant. This particular mismatch of perspective is usual with most local conflicts over conservation;
- A moderate degree of conflict over management and use of the woods has been generated over recent years. This needs to be overcome as it has the potential to undermine longer progress in both conservation and rural development;
- A process is needed whereby proposals for diversification of the age structure and thinning in *some of* the woods, which would lead to modest and sustainable levels of timber production, can be developed in a way, which is demonstrably neutral or favourable for the conservation status of the woodlands;
- There is a willingness on the part of stakeholders to look for mutually acceptable solutions and to improve future communication.

## **7.2 Development potential of Sunart Woodlands**

Discussion with local stakeholders highlighted the following short to medium term, local rural development options of the Sunart woodlands (including conifer plantations):

- 1) **Timber production and utilisation:** small scale local processing of both hardwoods and softwoods, yielding products either for local use or sale;<sup>1</sup>
- 2) **Other (“non-timber”) products:** such as charcoal and woodland mushrooms;
- 3) **Livestock production:** the use of woodlands for grazing and shelter;
- 4) **Recreation and tourism:**
  - the potential to market the Sunart Oakwoods as a regional identity to attract and retain visitors;
  - development of tourist facilities such as paths and holiday accommodation.
- 5) **Sporting:** shooting of deer;
- 6) **Development sites.**

The following sections give an outline analysis of these options (except development sites, which is beyond the scope of this report) in the context of management, which would be broadly compatible with retaining favourable conservation status in the cSAC.

## **7.3 Hardwood timber production and utilisation**

There are clearly some opportunities for small scale hardwood timber production based around thinning and group felling in broadleaf woodlands. Although activity will be small scale, this can still be valuable in the context of the Sunart Community, particularly if the focus is mainly on high value end products. The opportunities and constraints can be characterised as follows:

### **Opportunities**

- A significant proportion of the woodlands on the north shore is oak which is the single most versatile and valuable hardwood;
- The oakwoods are generally mature with a relatively high proportion of trees capable of yielding sawlog dimension material. Thinning and felling to diversify the age structure of oakwoods would yield trees of suitable dimensions for milling;
- The form of the trees, whilst not of high quality in conventional terms, is adequate for a mobile sawmill operator able to select trees and logs;
- The areas of birch, together with the poorer quality oak, would constitute a resource for local scale fuel wood production and other minor forest products (eg turning timber, charcoal, shitake mushroom).

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<sup>1</sup> It is clear that production of softwoods for sale to conventional external markets, as is currently carried out, also has local community benefits in terms of employment etc.

## **Constraints**

- The resource is relatively small in area terms and production of quality logs would be only ever be sufficient to support small scale use. It should be noted that even the hardwood resource of the whole of Argyll is considered too small to support a conventional scale hardwood sawmill (Davis *et al.* in prep.).
- Of the broadleaved species in Sunart, which potentially produce sawlog material (oak, ash, elm, birch, sycamore, beech), only oak is present in sufficient quantity to constitute a workable resource. The relatively large areas of birch generally appear to be of too poor form to consider for sawlogs.
- The quality of oak logs is moderate and assortments are likely to conform to the quality categorisation for oakwoods in the rest of Argyll (Davis *et al.* in prep.), ie:
  - 20% sawlog grade;
  - 35% fencing grade;
  - 45% chockwood grade.
- The community is a relatively small market. However this is offset to some extent by the potential to tap into the tourist trade, and the fact that high value articles can be marketed well beyond Sunart (as is currently the case with boats);
- Designation of the broadleaf woodland resource will mean that only a modest proportion of the total timber production would be available for felling and extraction;
- Firewood consumption for domestic heating is currently not widespread.

These constraints suggest that the only realistic opportunity for encouraging local timber processing is based on small scale sawmilling – of which native hardwood timber would constitute part of a mix of timber types utilised.

### **7.3.1 Supply and demand issues**

Any proposals to encourage timber production in Sunart should be based on the following logic:

- A modest amount of timber is potentially available in the short – medium term from restructuring of a proportion of the mature oak woodland (of coppice origin);
- The restructuring process would last for a finite period (100–150 years). When it is complete, timber production at a similar level would be available on a long term sustained basis from oak woodlands within the SAC, managed as high forest of normal age structure (see below);
- In the longer term timber production from the converted FE “plantations on ancient woodland sites” (PAWS) will become increasingly important.

### **7.3.2 Timber production during diversification of former oak coppice**

On the basis of figures derived from a survey of semi-natural woodlands in Lochaber, Goucher (1999) estimates that, for the Sunart woodlands, supply of 100 tonnes of oak sawlogs annual would entail the felling of an average of 2–7ha (average 3ha) of woodland, (or the thinning of larger areas, depending on

the thinning intensity) comprising 90–300 trees. This area could be reduced (ie production could be increased) by utilising smaller trees (Goucher assumed a minimum of 38cm DBH) and smaller logs, especially if a double slabber was used.

Conversion to high forest would produce a substantial quality of small round wood and other types of firewood grade material (say roughly 150–200 tonnes for every 100 tonnes of sawlog material).

The timber output from a programme of conversion of oak coppice to high forest management could be estimated from the following parameters: area of oak woodland; the rotation length and length of the conversion period given in the “high forest management models”; Goucher’s values for standing timber volumes; various assumptions about harvesting volumes and growth rates (see Table 6).

It should be noted that conversion still only produces relatively modest quantities of sawlog timber; 20–80 tonnes/yr for every 100ha which is converted to high forest management. However this would still represent a significant contribution to the hardwood timber supply for a small sawmill.

**Table 6 Potential sawlog timber production for 100ha of oak woodland during conversion to high forest models**

	MANAGEMENT MODEL		
	Standard rotation	Long rotation	
Rotation length	100 years	150 years	200 years
Area felled during conversion per year	1 ha	0.67ha	0.5ha
Total volume of felled during group fellings	200 tonnes/year	134 tonnes/year	100 tonnes/year
Volume of sawlog grade material (15–30% of total)	30–60 tonnes/year	20–40 tonnes/year	15–30 tonnes/year
Average area available for thinning per year (75+ yr old trees)	62ha	70ha	81ha
Volume removed in thinnings per ha/year	1 tonnes/ha/year	0.75 tonnes/ha/year	0.5 tonnes/ha/year
Average volume thinned per year	62 tonnes/year	52 tonnes/year	40 tonnes/year
Volume of sawlogs in thinnings	9–18 tonnes/year	8–16 tonnes/year	6–12 tonnes/year
<b>TOTAL TIMBER VOLUME PER YEAR</b>	<b>262 tonnes/year</b>	<b>186 tonnes/year</b>	<b>140 tonnes/year</b>
<b>TOTAL VOLUME OF SAWLOGS</b>	<b>39–78 tonnes/year</b>	<b>28–56 tonnes/year</b>	<b>21–42 tonnes</b>

### **7.3.3 Sustained timber production following conversion**

Davis *et al.* (*in prep.*), working from Forestry Commission yield tables, estimated that between 150 and 800ha of woodland was necessary for the sustainable production of 100 tonnes of sawlogs annually under traditional high forest management, depending on the assumed rotation, length, growth rate and log quality specifications. Goucher (1999), estimated a value 500ha based on a survey of woods in Lochaber. Table 7 gives estimates of the long term timber production under the 2 high forest management models for a 100ha area of oak woodland given various assumptions about the composition of the stands, tree growth rates and timber quality.

This suggests production of 20–70 tonnes/ha/year for every 100ha managed under these models. The values are similar to those given in Table 6 for the conversion period. This is because the following factors tend to balance each other out: the thinning area (higher *during* conversion); the thinning volume per hectare (higher *after* conversion); the felling volumes (higher *during* conversion as the woods are currently pure oak, but would include other species after conversion).

### **7.3.4 Consumption by mobile sawmills**

Consumption of timber by a mobile sawmill using 1–2 operators is typically in the range 200–500 tonnes (m<sup>3</sup>) per year, depending on the type of saw, how many days in the year it was operational, and what types of timber are being used; though a saw operated continuously is capable of processing over 1000 tonnes per year (Davis *et al.* *in prep.*)

This suggests that:

- 1) Hardwood from the Sunart Oakwoods would be a significant proportion of timber utilised by any small sawmill business but production from Sunart could not wholly supply a mill;
- 2) Hardwood would need to be sought from sources more widely in Argyll and Lochaber;
- 3) The majority of timber used from the local area is likely to be softwood if the mill was to operate continuously;
- 4) Any such business would be strengthened if it could be developed in conjunction with a firewood business utilising the smaller and poorer grade material.

### **7.3.5 Potential markets for hardwood timber**

The main utilisation opportunities accord with those identified by Davis *et al.* (*in prep.*) for hardwoods in Argyll, ie:

- A mobile sawmill producing small amounts of sawn hardwoods for local markets. Oak and ash timber in particular could be used for interior joinery, cladding, decking and crafts and outdoor landscaping products such as bollards and signs made from poor quality oak sawlogs;
- A fuelwood business using both hardwoods and introduced conifers. This has potential if developed at an appropriate scale;
- A “non timber” business using oak or birch small roundwood for charcoal or shitake mushrooms.

**Table 7 Potential long term sawlog timber production for 100ha of oak woodland managed under high forest models**

	MANAGEMENT MODEL		
	Standard rotation	Long rotation	
Rotation length	100 years	150 years	200 years
Area felled during conversion per year	1 ha	0.67ha	0.5ha
Total volume of felled during group fellings (75% timber species)	150 tonnes/year	100 tonnes/year	75 tonnes/year
Volume of sawlog grade material (20–340% of total)	30–60 tonnes/year	20–40 tonnes/year	15–30 tonnes/year
Average area available for thinning per year 40–75 year old trees (75+ year old trees)	35ha 25ha	23ha 50ha	17ha 62ha
Volume removed in thinnings per ha/year	1.5 tonnes/ha/year	1.1 tonnes/ha/year	0.75 tonnes/ha/year
Average volume thinned per year 40–75 year trees (no sawlogs) 75+ year trees (some sawlogs)	52 tonnes/year 37 tonnes/year	25 tonnes/year 55 tonnes/year	13 tonnes/year 46 tonnes/year
Volume of sawlogs in thinnings (15–30%)	6–11 tonnes/year	8–16 tonnes/year	7–14 tonnes/year
<b>TOTAL TIMBER VOLUME PER YEAR</b>	<b>239 tonnes/year</b>	<b>180 tonnes/year</b>	<b>134 tonnes/year</b>
<b>TOTAL VOLUME OF SAWLOGS</b>	<b>36–71 tonnes/year</b>	<b>28–56 tonnes/year</b>	<b>22–44 tonnes</b>

## **7.4 Softwood timber production**

There are clearly considerable opportunities for small scale softwood timber utilisation in Sunart. The opportunities and constraints can be characterised as follows:

### **Opportunities**

- There are no immediate timber supply problems, provided satisfactory communication between mobile sawmill operator(s) and the FE (and other woodland owners) can be maintained.
- The low price of softwood logs and the current difficulties faced by woodland owners selling profitably into conventional markets.
- The potential to sell timber of non standard species (eg larch) and non standard dimensions to local residents and businesses.
- FE's recent commitments to support local community enterprises.

### **Constraints**

- The sawmill at Fort William supplies sawn softwood timber at competitive prices, and so limits the market for locally sawn softwood of standard timber types and dimension.
- The relatively low proportion of the most suitable softwood species for local use (larch, pine).
- The supply of softwood timber from Sunart woods will diminish when the restoration of the PAWS is completed.

However experience in other parts of Scotland has demonstrated that mobile sawmills have been able to operate successfully under similar conditions. The likelihood of mobile sawmills being successful is enhanced if their operators also promote their products and services, stressing the importance of local processing of local timber.

## **7.5 Longer term timber production potential**

The timber production potential could be increased in the long term firstly by appropriate management of native broadleaved woodlands on "plantations on ancient woodland sites" (PAWS) with timber production as an important objective of management. Over time these could become the focus for timber production, taking the pressure off the semi-natural woodlands. A further option is to diversify the tree species composition of the remaining plantations at clearfell by including hardwoods (oak, ash) and a proportion of European and hybrid larch.

## **7.6 Other ("non-timber") woodland products**

Broadleaved woodland can provide some saleable products other than timber, the most widely exploited ones being charcoal and woodland mushrooms.

## **Charcoal**

Charcoal can be made out of most hardwood timbers and oak and birch are both ideal. This is in theory a suitable outlet for smaller dimension oak timber, but requires considerable effort in marketing the product in competition with supplies from conventional outlets. Economic margins are similar to that associated with other woodland products, ie they are not particularly high.

## **Woodland mushrooms**

Woodland mushrooms are increasingly being collected and sold to commercial outlets. Such activity is usually carried out without the knowledge of owners and owners derive no benefit from it. Done in an uncontrolled way mushroom collection can have damaging ecological consequences.

There is some potential for local owners to organise a limited and controlled collection of woodland mushrooms, ideally sold to local restaurants and hotels. Indeed this might be better than the status quo, where uncontrolled picking may be taking place unbeknown to owners and agencies.

## **7.7 Livestock farming**

Woods have been traditionally used in Scotland for grazing and winter shelter for livestock. Opinions vary as to the demand for grazing ground in Sunart. On the north shore some owners report that there is little need for grazing of cattle or sheep in the woodland, whereas the FC report several applications for permission to allow livestock into areas of restored woodland and recent regeneration.

Some owners could see benefits in allowing some summer grazing by cattle in particular in regenerated woodland in order to help control the spread of bracken.

Livestock is generally wintered on the lower hill ground. Opening parts of woods to controlled overwintering of cattle may be an option for some owners.

## **7.8 Recreation and tourism**

Economic studies have shown that tourism is the single largest sector in terms of income/expenditure and employment in rural Scotland.

### **7.8.1 Sunart Oakwoods as a regional identity to attract visitors**

The Sunart Oakwoods is one of the few regional woodland labels recognised in Scotland, though its use beyond Sunart is currently largely restricted to foresters and ecologists. The juxtaposition of extensive broadleaved woodland (along the main thoroughfare) and the sea (Loch Sunart) is unusual. Such a combination is both relatively unexpected and attractive for many visitors.

The development and promotion of a label for Sunart, based partly or wholly on the woodlands, could be used to attract and retain visitors to the area. This could mirror attempts by tourist agencies elsewhere to use woodlands to this effect (eg the Perthshire Tourist Board "Autumn Gold" initiative, and the Deeside Forest). Even simply making sure that the woodlands featured in promotional tourist literature would be a useful step.



Such initiatives, if successful, would benefit the local tourist industry with knock on effects to other service providers. It would however not benefit woodland owners, unless they were involved with the tourist industry.

### **7.8.2 Development of woodland tourist facilities**

Options for woodland owners to be involved in provision of tourist facilities can be characterised as follows:

**Tourist activities:** Guided walks could be developed as part of an enterprise providing activities for tourists in the area. Operators do not usually pay forest owners for access of this type, but instances of this happening do occur.

**Paths and interpretation:** Grant aided provision of paths and interpretation would add to the tourist experience in the area. This does not usually benefit woodland owners.

## **7.9 Shooting**

Open hill red deer stalking is currently a source of income and the woods provide winter shelter for red deer. Roe deer use the woodlands but currently there is no let roe shooting within the cSAC woodlands.

Organised woodland roe shooting was identified as an option which could usefully complement open hill shooting.

## **7.10 Development sites**

Development sites for housing and tourist accommodation is clearly an important issue. However this is beyond the scope of this report and requires an overview at Highland or national level.

## **7.11 Conclusions: potential development options**

**Timber:** There is potential for the Sunart Oakwoods to contribute to the local supply of oak timber for a mobile sawmilling business(es) and possibly a firewood enterprise, through work restructuring the former coppice oak woodlands. The amount of timber cut might be no more than 20–70 tonnes annually for every 100ha of former coppice oak converted to, and managed under a high forest system. The majority of the wood cut by such a business would need to be softwood if the saw was to operate continuously.

**Farming:** Some livestock farmers do see benefits arising out of future use of woodlands for controlled grazing.

**Tourism:** The woodlands could be used in a number of ways to promote tourism in Sunart, with knock on effects to other service providers. Tourism does not usually benefit woodland owners except where they are involved with providing accommodation or activities.

**Shooting:** Shooting of roe deer is one option which could be developed and which could provide income to woodland owners.

Key issues:

- There is only a limited number of options for local rural development that could provide economic returns to woodland owners (timber, roe shooting, development of tourist facilities). Of these timber is currently the option of greatest apparent interest to most owners. Well-designed timber production operations are potentially compatible with good conservation management of the cSAC;
- The scale of potential timber development, that could be supported by the Sunart Oakwoods is small, but potentially significant at a local scale;
- Tourism is an important option for bringing benefits for service providers in the local community. Tourist initiatives, which include woodland aspects would contribute to the wider local economy and could be usefully supported by both the owners and SNH;
- SNH, FE, FC and the local stakeholders should seek to develop a better mutual understanding of the potential and limitations of hardwood timber utilisation and some of the other development options.

## **8 RECOMMENDATIONS: THE WAY FORWARD**

We recommend the following main elements to guide the next steps for determining management of the Sunart Oakwoods cSAC:

- 1) Developing a process of discussion and joint decision-making between the agencies (SNH and FC), woodland owners (including FE) and other community representatives;
- 2) Working towards pragmatic prescriptions for individual woodlands, based on the models described in this report, which attempt to achieve the overall conservation aims for the SAC whilst ensuring an appropriate balance between the woodland models;
- 3) Developing working structures to facilitate this process as efficiently as possible.

Such a process could start with a number of agreed principles outlined in this report, which might include:

- An overriding aim would be that the management of the woodlands must comply with government obligations under the Habitats Directive;
- Acceptance of the general concept of multiple-objective management for the woodlands and wider land-uses;
- Individual woods within the district would have different objectives and management models including both minimum intervention and high forest models. Individual owners and managers would have an important input into deciding the range management styles for their woods according to:
  - (i) their own objectives;
  - (ii) the current condition of the ground and its history; and
  - (iii) the contribution of their woods to the objectives for the district as a whole.
- Acceptance that there is a genuine local need to use a proportion of the SAC woodlands productively and that sustainable management opportunities exist;
- There is a potential convergence of conservation and community interests in instituting high forest management, especially management to diversify the age structure of some of the former coppice oak woodlands. It is possible to do this in a way which enhances their conservation value and provides modest amounts of timber for local use.

A process of this type, based on consensus and joint working, would provide security for the interests both of those safeguarding the nature conservation interest, and those wishing to utilise the timber and other resources.

## 8.1 Key decisions

The following key issues need to be progressed in order to advance the process outlined above:

- 1) **Minimum-intervention areas:** Agreement on how much of the total woodland area should be earmarked as minimum intervention stands and which are the most appropriate stands for this management model (see section 4.3.2). Detailed criteria for selection of these areas need to be agreed based on the guidance provided in this report. This needs to be followed by identification of candidate areas in a joint process by owners and the agencies;
- 2) **Wood pasture areas:** Identification of all remaining areas of ancient wood-pasture needs to be carried out. There then needs to be agreement with owners that these should be maintained as such and management plans drawn up to ensure their restoration and regeneration (see section 4.3.4). These should include areas beyond the current boundaries of the cSAC;
- 3) **Managed high forest areas:** Agreement on which woodlands are potentially suitable for high forest management with the primary aim of diversifying the age class distribution in the short to medium term. (see section 4.3.3). Detailed criteria for selection of these areas need to be agreed based on the guidance provided in this report. This needs to be followed by identification of candidate areas in a joint process by owners and the agencies;
- 4) **Increasing the area of oak woodland:** Agreement on which areas of land are most suitable for increasing the area of oak dominated native woodland. This could include plantations on ancient woodland sites, other conifer plantations and open ground, but should be sensitive to the need to retain the mosaic of woodland and open habitats;
- 5) **Habitat links:** Agreement on preferred options for improving large-scale internal and external woodland links;
- 6) **Grazing/deer browsing:** Review of the distribution and intensity of grazing and agree an approach for introducing better control;
- 7) **Timber production:** Formulation of an agreed statement on the likely timber production in the short-medium term from restructuring of the oak woodlands managed under the high forest model. This would detail output under a small number of realistic scenarios of:
  - a) area to be restructured;
  - b) time period of restructuring and
  - c) timber specifications.

## 8.2 The balance between management models

We are reluctant to advocate a particular balance between the five management models described in section 4.3, though we recognise the need for stakeholders to reach a common understanding of the target proportions. On the precautionary principle, we recommend that proportions approximating to scenario 3 of Annex 6 (ie 30% minimum intervention) should be sought in the first instance, but reviewed in the light of experience after an agreed period, say after 10 years. These would still allow a good deal of silvicultural

intervention in existing native woodland, a substantial programme of introducing native broadleaved to conifer plantations, and would provide for substantial new native woodland, but they would also safeguard the critical mature native woodland resource from intervention until after experience of the effects of silvicultural interventions has been accumulated in a minority of such woods.

The proposed review of targets would take into account not only experience of the effects of management, but also any changes in the aspirations and policies of stakeholders.

### **8.3 The process**

To implement the decisions outlined above, the structures and process outlined below need developing.

#### **Structures**

- Owners need to form a coherent group with which government agencies can communicate effectively.
- A forum needs to be developed, which includes SNH, owners' including FE and some wider community interests.

#### **Process**

A "consensus building" process needs to be developed comprising the following steps:

- 1) SNH needs to promote discussion of the various management models potentially available to owners within the context of achieving favourable conservation status for Sunart. Production of a "field guide" covering these issues would be useful.
- 2) Owners and managers on individual land holdings need to consider which models they prefer individually based on:
  - their own objectives;
  - the current type and condition of their woodland and its history;
  - the contribution of their woods to the objectives for the district as a whole.
- 3) Owners and SNH then need to agree management models for the woods which best achieve the overall objectives of all parties and ensure these fit the desired balance of woodland models across the SAC.
- 4) All parties need to agree an approach to other development opportunities, drawing in other expertise and partners (eg tourist boards, tourist operators).
- 5) Forest Enterprise should develop timber marketing links with local (Sunart and Wider Lochaber) timber users and should seek to encourage people interested in developing local timber utilisation by training and advice.

Sunart is in a good position to advance this process given the co-operation, which is beginning to emerge as the result of the Sunart Project and other developments. There could be advantages to employing an independent professional facilitator to guide the process.

## **8.4 Information requirements**

The main information requirements for underpinning the process outlined above are:

- A concise overview of information on woodland type, condition and current management for all the individual woods/ownerships in the cSAC, including area statements;
- Production of a “field guide” describing the management models and the types of woodland most suitable for each model;
- A document describing in detail the process of restructuring former coppice oakwoods for conservation benefit, and the timber outputs which are achievable;

In the longer term a clearer understanding of historical woodland development around Loch Sunart would be useful. There are clearly good potential sites for small-hollow pollen studies to elucidate long-term woodland changes. In addition collating material from historical sources, combined with archaeological survey and analysis of woodland structure and pattern, would be productive. The aim would be to determine how the present condition was reached and to understand the various changes that woodlands and their associated species have undergone.

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## SUNART PHOTOGRAPHS



*Plate 1 – A wood pasture landscape with sessile oaks within a matrix of younger woodland and pasture at Resipol, near Salen. Limited amounts of hazel and birch grow with the oaks, but the main oak patches were fairly pure. In and around the Resipol Burn, the modern distribution of oaks corresponds closely with the distribution mapped in 1750 and 1806, perhaps the relics of coppicing for charcoal.*





*Plate 2 – Highland cattle maintaining the wood pasture tradition amongst open mature oak woodland infilled by secondary birch growth. Resipol, near Salen.*





*Plate 3 – Windthrown oak, alive and healthy, at Resipol, near Salen. An example of the main natural disturbance factor in west Highland woods.*



*Plate 4 – Mature oak at Ariundle, near Strontian, within a conifer plantation forest. Although the conifers can damage oaks by killing the lower crown branches, and no doubt many oaks were felled when the conifers went in, the plantation environment does provide some protection from grazing, which in turn allows oak to regenerate.*



*Plate 5 – Oak saplings rooted by the trackside ditch in Ariundle. This was the main location for oak regeneration, facilitated presumably by the high light intensity combined with some ground disturbance. Despite browsing, this sapling is breaking free of check.*



*Plate 6 – Even aged oakwood in Ariundle. The tree in the foreground has more space than those in the background, which has encouraged it to develop a wider crown, and enabled a copious epiflora to develop.*





*Plate 7 – View across the Strontian river to Ariundle NNR. The acid mire with Myrica gale grades into the riparian alder scrub. The oak wood on the slopes is confined by lodgepole pine planted on the valley mire and spruce planted above the oak.*



*Plate 8 – Ash-elm-hazel-oak woodland on steep east-facing slopes above Camas Ban at Ardsignish, west of Glenborrodale. The oaks were once coppiced. The base-rich soils have allowed a fairly rich ground flora to develop, despite former grazing. In the background, the woodland on the lower slopes of Beinn Bhuidhe is a typical irregular mosaic of woodland and open ground with few sharply-defined edges.*





*Plate 9 – Rhododendron ponticum has spread far and wide around Glenborrodale, extinguishing ground vegetation and tree regeneration alike. Initial cutting merely generates Rhododendron coppice, which has to be herbicided if the shrub is to be controlled.*



*Plate 10 – Old oak coppice near Laga. This stool has grown for more than a century since it was last cut, and was already large at that time, so it probably originated before 1800. The trunk spreading into an adjacent gap supports a healthy crop of Lobaria.*





*Plate 11 – Another oak coppice stool, long uncut, that toppled over leaving a pit where it once grew, and then regenerated a new crown from a colonnade of new branches originating from the prone trunk. Despite the steep terrain and apparently exposed position of many woods, the proportion of trees that have fallen over in this way is remarkably small. Nevertheless, this tree indicates natural processes that allow oak rejuvenation in unmanaged woods.*



*Plate 12 – Ancient stub-pollard pedunculate oak on the track to Ardery. Originally about 2m dbh, only about 35% of the shell remains. This relic of the traditional woodland pasturage has suffered from lack of cutting and shading from younger oaks. Nearby, the stump of a large and once vigorous oak that had recently been felled had 279 annual rings on a diameter of 79cm (c248cm diameter at 50cm): this was presumably another relic of that era.*





*Plate 13 – Tall shred oak near the track to Ardery. This had recently died, having survived perhaps 200 years of competition with planted (?) oaks by growing on the edge of a gully. This was the only tree of this form seen in the district.*



*Plate 14 – Large pedunculate oak at Camas Sallach, Glencripesdale, 221cm dbh. This had probably once been a single stub tree, but with neglect and growth it has split into three trunks around a hollow*



*Plate 15 – The same oak, showing its position on the edge of a clearing. This was one of several ancient stub and coppice trees near this remote former settlement, pedunculate oak, sessile oak, ash, alder and grey willow, now severely restricted by planted trees and younger native growth. The adjacent clearing contained the windthrown remains of a large spreading wych elm, which had probably once been pollarded. Branches cut several metres from the roots had 145 and 165 annual growth rings.*



*Plate 16 – View of Camasinas, east of Laga, from Glencripesdale. Typically, woodland is restricted to the lower slopes of Ben Laga, and only scattered trees grow on the farmed flats by the shore. The woodland forms an irregular mosaic with open pasture, but is concentrated in corridors along burns.*





*Plate 17 – Ash-elm woodland mixed with heather and bracken in Glencripesdale, extending from shore to the main break of slope onto moorland. Birch stands form a patchwork of various ages.*



*Plate 18 – Open birch woodland in a narrow valley running down through Glencripesdale NNR. This heterogeneous mixture of bracken, heather, acid mire, open birch and dense clumps of birch is typical of self-sown birchwoods.*



*Plate 19 – Birch regeneration in heather at Glencripesdale, with limited growth in the foreground mire, but stronger growth on the dry slopes. Oak is present, but typically in a small proportion.*



*Plate 20 – Relict old oaks on a crag above an inlet in Glencripesdale. In the background, birch has regenerated copiously during the last 30–40 years.*





*Plate 21 – A group of aspen, probably a clone, in the predominantly birch regeneration in Glencripesdale.*



*Plate 22 – Remains of a hollin just east of the boundary of Glencripesdale NNR. These ancient trees had been coppiced or lopped for fodder as part of the traditional woodland pasture, but in recent decades they were overplanted with spruce (recently removed), many have died, and the survivors have been severely weakened. The hollies probably date from the 17th and 18th centuries.*





*Plate 23 – The birch-dominated slopes of Laudale SSSI, with scattered ash in gullies, and a thin scatter of old oaks. Most of the birch appears to be from 20th century regeneration, but the open mature woodland just right of centre may be older growth, now degenerating with age. Typically, open ground occupies perhaps 25–30% of the ground.*



*Plate 24 – Farmland within the scattered settlement of Ariundle village, showing the scatter of hawthorn, rowan, sycamore, willow and alder in a matrix of semi-natural grassland treated as pasture. The background shows part of the plantations and wood pasture remnants in Liddesdale.*





*Plate 25 – Open oak woodland in Ariundle NNR, with a few hazel, and limited regeneration of rowan and birch. Ground vegetation of mossy boulders in a matrix of bracken, Anthoxanthum, Festuca and Molinia.*



*Plate 26 – Old sessile oak in Ariundle NNR. The branching pattern shows that some parts of this wood have always had a low density of trees.*





*Plate 27 – Pure oak woodland in Ariundle NNR, probably even-aged of early 20th century origin, all with single stems. It is difficult to believe that this is not a plantation.*



*Plate 28 – Lichens on a large roadside oak near Woodend, an example of one of the key nature conservation features of the Sunart woods.*



*Plate 29 – View from near Woodend to Laudale. The foreground oak looks like an even-aged plantation. The background shows the concentration of open birch woodland on the slopes, with few trees on the lower slopes and upper moorland.*



*Plate 30 – Ash and hazel growing by a stream near Ardery. Typically, these species were absent from the surrounding acid oak-birch woodland.*





*Plate 31 – View from near Woodend to Liddesdale. Below the large block of plantations is a belt of relict woodland pasture with ancient oak, ash and alder.*



*Plate 32 – Infill of naturally regenerated broadleaf woodland between the forestry fence and the shore.  
On the south shore of Loch Sunart, immediately south of Strontian.*





*Plate 33 – Typical former oak coppice at Ariundle and Salen to Woodend sections*

## ANNEX 1 – Tree pollen diagram from oakwoods by Loch Awe

Unpublished data from Philip Sansum, Centre for Environmental History and Policy, Department of Environmental Science, Stirling University, quoted with permission.

This summary of tree pollen data comes from Lower Fernoch, Loch Awe, Argyll. It suggests that oak became dominant only in the last 150 years (in bold). For a few hundred years before that, the woods appears to have been more open, and alder and hazel were prominent. Until about 1000 AD, the woods appear to have been mixed. A sequence from (i) mixed, closed woodland through (ii) wood pasture with limited oak and birch, to (iii) the present oak-birch closed woodland seems to be indicated.

Depth /cm	age estimate. cal. years B.P. (see below)	% tree pollen of terrestrial pollen	% <i>Alnus</i> of tree pollen sum	% <i>Betula</i> of tree pollen sum	% ' <i>Corylus</i> – type' of tree pollen sum	% <i>Quercus</i> of tree pollen sum	% <i>Salix</i> of tree pollen sum	% ' <i>Sorbus</i> – type' of tree pollen sum
4	<b>65</b>	90	5	21	6	<b>66</b>	0	0
8	<b>130</b>	86	6	52	9	<b>31</b>	1	0
12	<b>195</b>	85	8	69	12	<b>7</b>	0	0
16	<b>260</b>	59	10	45	26	<b>13</b>	1	1
20	<b>325</b>	64	7	37	46	<b>6</b>	1	1
24	<b>390</b>	71	40	4	43	<b>12</b>	0	1
28	<b>455</b>							
32	<b>520</b>	69	20	8	60	<b>11</b>	0	0
36	<b>585</b>							
40	<b>650</b>	80	81	5	10	<b>3</b>	1	0
44	<b>715</b>	41	22	12	48	<b>4</b>	7	5
48	<b>780</b>							
52	<b>845</b>	57	22	17	24	<b>31</b>	4	0
56	<b>910</b>	81	17	36	20	<b>26</b>	1	0
60	<b>975</b>	87	15	50	20	<b>14</b>	0	0
64	<b>1043</b>							

### Notes

- The pollen taxon, *Corylus* – type, includes *Myrica*; *Corylus* is present on and *Myrica* near the site at the moment.
- *Sorbus* – type could include *Malus*, *Prunus* and *Crataegus* as well as *Sorbus*;
- Other tree taxa that occur below 5% of the tree pollen sum are: *Fraxinus*, *Pinus*, *Populus*, *Larix* and *Ulmus*;
- Philip Sansum stresses that the age estimates are very crude; since he has only one Carbon date so far. He has had to assume a constant rate of peat accumulation. Even if that assumption is true, because 14C uses 1950 as a proxy for the present time, the true ages of the pollen spectra will be slightly younger than the estimates;
- Philip Sansum suggests that the size of the increase in oak seen in the pollen spectra may be exaggerated by the suppression of flowering of oak while it was being coppiced regularly and the 'sudden' development of high forest after coppice abandonment.

## **ANNEX 2 – Evidence of woodland change from old maps**

T. Pont surveyors drawings and notes.

1750 maps

1860 OS 6" maps

Old and New Statistical Accounts

**A Plan of Loch Sunart surveyed by Alexander Bruce, 1733**, concentrates on improvements and mining, but it shows woodland along much of the north and south side.

There was no woodland at Ariundle, Glenborrodale, around Laga, and around Strontian (save for some by the lower reaches of the Strontian river), but Salen, Resipole, Ardery, Camasinas, Glencripesdale, Laudale, Liddesdale were well-wooded. The pattern of woodland along the loch shore seems real enough, but woods at some distance might have been missed (though they were found in the L. Sheil catchment). We do not know if the woodland information was surveyed or plagiarised. Nevertheless, it confirms that woodland was abundant and patchy 270 years ago and suggests that Ariundle oakwood is secondary. It also implies that some oak-dominated stands were formed in pre-existing woods, a process of which there is still proof on the ground in Ardery.

**General Roy's map of c.1750** was available as a photocopy for all but the head of the loch on the south side. In copy, the colouring which indicates relief obscured some of the tree symbols, particularly on rugged and higher ground, but on lower ground around the shoreline tree symbols were clear. Although the scale is not large, the form of woodland and the distribution of individual trees appears to be real. Tree symbols are shown in various concentrations as irregular scatters which appear wholly realistic.

Ariundle is shown as wooded on the slopes, but not on the gentle ground close to the Strontian river, and the scatter of woodland on the south side corresponds well with existing woodland. This suggests that the lack of woodland in 1733 was an omission. Working west, there was no woodland until Woodend, save for a line of trees along the stream down to Ardnastang: cultivated patches are shown. From Woodend an irregular scatter of woodland runs almost continuously to Resipole, with slight concentrations along streams, lower slopes and Eilean Mor, and this pattern continues to Salen. West of Salen there appear to be few trees until Camasinas, but substantial scatters around Camasinas and Glenborrodale. Laga has woodland only along the lowest reaches of the stream. Trees peter out west of Glenborrodale, and are absent around Ardslynnish. A restricted scatter appears at Ben Hiant where there is still woodland.

On the south side, there was a continuous scatter of fairly dense trees on lower slopes from Liddesdale through Laudale, Glencripesdale, and into Rahoy, but none on the flats around Laudale, where patches of cultivation are shown. The Poll Luachran area seems less wooded, though the islands of Oronsay and Carna were well-wooded. The upper margin of woodland appears to be the main break of slope, as it remains today.

**The Balds Estate map of 1806–7** (Scottish Record Office RHP 72) was available in photocopy. It covers the north shore and hinterland from about 3km west of Salen to about 1km east of Woodend. It is at large scale, clearly drawn and shows much detail. Two kinds of woodland are shown:

(i) dense woodland with no internal detail, save for the accurate depiction of watercourses, and

- (ii) irregular scatters of trees and small woods. The dense woodland is shown with hard edges, and has every appearance of being plantations. The irregular scatter has no boundaries, and appears to be wood pasture. There are many places where the irregular scatter corresponds very closely to the present-day distribution of unenclosed semi-natural woodland, eg, in the valleys running north from Cruach Bhreac, NW of Salen.

Comparison with the Roy map shows that the dense woodland is the innovation, ie substantial plantations were established between 1750 and 1806 (and probably nearer 1750, to judge from the 'mature woodland' appearance on the map). They occupied almost all the ground between Woodend and Ledaig, ie through Camusine, and the tract that is now conifer plantations west of Salen. Where they were not established, the woodland remains very much as it had been in 1750, though there is unambiguous indications of loss of irregular woodland east of Salen near Lochan na Brocha and on Eilean Mor. Planting exclosed a scatter of trees on higher ground, particularly along headwaters. The close correspondence of the open woodland shown along the Resipole Burn with existing woodland.

Enclosed land around settlements is shown as a mosaic of cultivated and what must be pasture and/or meadow. Between Salen and Tarbert numerous trees are shown in the enclosures, but at Resipole, Camusinas and east of Woodend there were none. Taken literally, this shows that wood-meadow and wood pasture on fertile ground were restricted.

## **Conclusions**

Whilst it is risky to draw too many detailed conclusions from maps without independent evidence of their purpose and accuracy, internal evidence and comparisons with modern conditions indicates that the 1750 and 1806 maps are accurate, but that the 1733 map is less so. They combine to show a substantial replacement of wood pasture with planted oak, and a gradual attrition of the wood pasture remnants left unenclosed.

## **ANNEX 3 – Woodland records from Anderson (1967)**

A general picture of forest condition and development for the western Highlands can be built up. The only Sunart-specific references I noticed were:

1.419. Walker (1808) measured a decayed tree upon the road between Inversanda and Strontian on 27 October 1764. One foot from the ground it was 17 feet 3 inches in girth. 'The remains of many other great Oak, approaching the same size, were observed in this Valley of Morbern; yet they were all situated among rank heather, in deep peat earth, lying above banks of mountain gravel.' This was on the road dividing Ardgour from Morvern.

1.421. Knox (1785) observes that the glory of Loch Sunart was its woody banks, occupying a surface of 10,000 acres, and affording a never-failing source of wealth to its proprietors. The road from Loch Gilp to East Tarbat was bordered by an 'ascent sprinkled with young wood of oak, ash, birch and hazel which is cut down every 20 years for bark and charcoal. Many of these trees grow out of the crevices of the rocks.'

2.30. Watson (1816) wrote: 'In various places of this part of the country (Argyll) there are stands of natural wood, chiefly birch, interspersed with some valuable spots of oak and ash, but, in general, the appearance of it is naked. Some patches of wood of this description in the south-east of Morvern. On both sides of Loch Alin and on both sides of Loch Sunart, there are woods of the same kind, which bring very considerable returns to the proprietors; indeed, over the whole district here and there, such woods grow; but as there are few or no enclosures, and no care is taken to preserve them, the cattle being allowed free access, they cannot thrive. ... Ardnamurchan, and other parts to the north of (Argyll) are almost naked ... oak, fir, ash, mountain ash, holly, elm and the Scotch poplar grow naturally everywhere.'

2.34. In Morvern parish in 1792 there was valuable coppice of natural woods in many places, but especially along the whole of Loch Sunart, consisting chiefly of birch, but with some patches of oak and ash, ...

2.67–68. In September 1794, oak, ash, birch and black woods in Arisaig and Moidart were on offer and some thousands of acres, mostly oak, on the banks of Loch Sunart, much of the oak being of a size for ship-building.

2.72. In Argyllshire the local name for natural woods of birch, alder and hazel, with absence of oak and ash, was 'black wood'. ... In January 1796, useful black wood or oak for bark and charcoal was offered by sir James Riddell on Cammulyeen, Loch Sunart. In October 1799, what was perhaps the same lot was advertised for sale in Ardnamurchan with the remark 'if not inclined to boat the black wood, it can be sold in the neighbouring islands.'

2.176. Early 19th century. At Strontian in Ardnamurchan parish there were flourishing plantations forming a striking feature of the landscape.

2.193. Writing generally of the period 1790–1854: Natural [oak] coppice could not survive repeated cuttings unimpaired, especially on the poorer sites. Attempts were made to renew them artificially ... the general tendency was to use imported acorn from both England and the Continent. Preference was given by the nurserymen and some foresters to the pedunculate oak, and the native strains of sessile oak ... were deliberately neglected.

2.606. 1845 New Statistical Account. Morvern said to have 1500 acres of plantation and 1569 acres of natural woods.

2.631. Records of tree remains in peat, from Old and New Statistical Accounts. In all the mosses [of Morvern] the remains of trees are dug up. On the mountain sides, huge trunks of oak yet remain, some of which ... still measure upwards of ten feet in circumference.

## ANNEX 4 – Peter Quelch notes

These are extracts from notes made by Peter Quelch on visits in 2000.

Visit: 27.6.2000

Visit area: Resipole – oakwood in lower gorge at NM724646

Features seen:

- 1) **Pollard type oak** – large open grown trees just inside the new deer fence gate, on a bouldery slope. Two old **dykes** cross the area, one separating old inbye arable below the old oaks, one seemingly crossing the old oaks diagonally (*not sure what it was – PQ would like to see 6" or bigger maps with the dyke arrangement on to try to make sense of them here*).
- 2) The lower dyke had some excellent **pollard birch** right on the dyke, the best being beside the (now widened) gateway. Classic tree (comparable with the best ex-pollard birch PQ saw in Aland Isles, Finland). That dyke also had several old birch coppice stems right on the dyke, and an old alder and hazel on or adjacent.
- 3) The **inbye field** below that dyke, itself had an interesting structure and features, (*yet to be surveyed*), with what look like clearance cairns, a platform base etc. In tree terms, that area also has a very **large multistem oak** growing on a stone mound (*natural outcrop perhaps added to with field clearance stones*), and on the western fringe a lot of secondary birch in rock scree, but within them some much older birch parents. It is a feature of how I imagine the 18thC landscape, that some character trees continued within otherwise cultivated or arable areas. However they were usually pollarded, pruned or coppiced to keep them from casting too much shade, as well as to give wood products (*cf the ash in rassal ashwood on clearance cairns between cultivated terraces*).
- 4) Classic **edge pollards** (mainly birch, also oak), on the one-sided wood bank separating the inbye field from the wet flush adjacent, which itself runs up to and merges with the old oaks. The wet flush contains mainly secondary birch and alder, so was probably bare less than 50 years ago?
- 5) The old pollard type oaks above show varying **degrees of pollarding**, some being convincingly cut at head height in the past, others less so. This was true of all oaks seen right up the glen as far as we went this time. (*PQ means to write a separate short guide to **pollard features** in these upland situations and needs the help of an artist to illustrate it. First though he needs to use photos and simple sketches in a first draft. Such a guide would amplify what we saw today, and PQ needs it anyway to complement his oakwood structural guide- also in draft, in a project with Jo Lenthall*).
- 6) Further up the glen (around NM730650) is a small area with **veteran hazels**, one with a pronounced **rowan 'air tree'** with the rowan roots growing through the old hollow hazel pollard, and which are now acting as the main supporting 'stem' of the rowan. The other hazel, (as are several others down near the deer gate), is of the '**Glenfinglas Grazed-Pollard Hazel**' form. This may well be due to man's fodder-cutting at low head height in the past, but could also be explained just through centuries of stock and deer grazing (*no consensus on this yet*).
- 7) Old **birch pollards** were also seen at this point, on the edge of the wood. Different growth stages of birch patches were pointed out – it is normal for pasture woodlands to regenerate in **small patches** like

this, despite the presence of some grazing. Scattered **hawthorn** are another feature of pasture woodlands, simply because they can stand extreme grazing levels and still eventually get away to form a large bush.

- 8) Also higher up the glen area some excellent **oak pollards**, smaller than those down below but not necessarily younger? They are close to the old track, and often in strategic situations. Only some ring boring would help determine true ages of such trees, plus cross sectioning any fallen trees.
- 9) Another 'old-growth woodland' feature was an old birch beside a tributary burn, (*seen only with Jean*), which had a massive **ivy** growth. Only two stems of ivy but they contained almost as much wood as the birch tree itself!
- 10) In conclusion we had been looking at a classic, upland, **historic wood pasture**. Resipole old oakwood has probably been in this form for centuries, and has not been through the simple industrial oak coppicing past use, as have so many other of the Sunart oakwoods. One can picture here a woodland say at the end of the 19thC with actually very few trees (although no doubt many old birch have disappeared since then) in a scattered wood pasture structure, grazed by and sheltering stock. Other trees within or on the boundaries of the arable patches are also noticeably heavily pruned and dwarfed. The wood is in fact inextricably linked to those old crofting arable areas (*a feature seen in most other woods of this type – they are primarily an agricultural type of woodland in a way hard to imagine today*). Shepherding techniques were no doubt very different then, and the wood pasture may have been empty of beasts all winter and early spring, and also contained probably few, if any, red deer at that time (? – *documentary and other evidence needed here. Discussed the study of landscape paintings of the period as contemporary evidence*).
- 11) Even at the end of the 19thC, the wood was presumably still a relict of a bygone age of pastoral use of woodlands by the crofters. One can only guess at when the pollarding was last carried out (*my guess is in the period 1800–1850*). **Ageing/coring studies** on the trees could help determine this with some accuracy.
- 12) Interestingly, the **Scottish Ancient Woodland Inventory** shows the Resipol gorge in a series of patches either Ancient or Roy\*. This could be explained by the fact that large parts of the wood would have been in a very open wood pasture structure in the first ed OS maps of 1860, and so would not be classed as woodland, even though they had all been shown on the Roy map of 1750. *\*(Can the team's map studies throw any light on this aspect?)*
- 13) Another fascinating aspect of the above analysis of this site, is that the old wood pasture, which is unfenced to the hill above, then merges imperceptibly with the **old gorge woodland** above. The latter is presumably a remnant of the once more extensive **natural origin mixed broadleaved woodland**, out of which were created the working wood pastures, coppice woods and plantations the remains of which now dominate the landscape. It is therefore no coincidence, that these gorge woodland remnants contain some of the **rarest old-growth lichens**, and no doubt other organisms, as they are **true refugia** of the once natural woodlands. Interestingly though, the **continuity and the natural origin of the wood pastures also makes them of high nature conservation value**, probably very much more so than the ex-coppiced stands (but depending on which species group is studied). I would like to see some real studies comparing nature conservation value of these different woodland stand types within Sunart oakwoods to help decide woodland management priorities (*though I realise that I am now well outside the scope of the Sunart woodland archaeology MFST project!!*).



Visit 25.2 2000

Stands at Ardery and Bunalteachan. Discussion points:

### **Restoration Felling, Regeneration, and Deer control**

Large areas of the FE owned Sunart oakwoods have now been felled of commercial spruce and are beginning to recover. Indeed felling continues in other stands. The joint deer fence has stopped incursion of hill deer, but each owner within the enclosure now has to tackle deer control. Deer control at Bunalteachan was discussed and also with Mrs Henderson, one of the private owners.

The main discussion centred on **Monitoring**, both of deer numbers, seedling damage levels, and vegetation recovery in general. Whereas each form of monitoring might need a slightly different approach, P. Risby was very keen to combine them into one scheme if possible, to prevent duplication and extra cost. My only advice is to ensure that only a minimum amount of data be collected to answer the management need for the monitoring. Complex datasets will probably never be fully used or analysed. Unlike some NNR or research monitoring it is not being done for long term archive value. It is vital that the results of monitoring answers the manager's questions directly so he can make decisions on future action.

Deer numbers are important, eg as assessed through dung counts, but the site will never be completely deer free, and deer will probably build up again as the fence deteriorates after 12 years or so. The main aim is to get a new cohort of tree regen safely away in that window of opportunity.

So the key monitoring is of the native trees themselves: not so much the young seedlings which may come and go, but the recruitment of young sapling trees which will steadily move into the canopy if not damaged by deer or farmstock (*some sheep were in evidence*). NVC is of interest and may change with exclusion of grazing but is not a priority for monitoring.

Monitoring was to be:

- by fixed point photography;
- by quadrats permanently sited in each 'site type' – ie a stratified random plot method.

### **Grazing**

Reinstating some controlled and seasonal cattle grazing may be beneficial in helping keep some glade systems from wooding over with wet birchwoods, especially to help conserve populations of woodland glade butterflies. There is little experience on how to do that without causing damage to recent regen.

### **Thinning**

FE are under some pressure to help out a local small hardwood sawmill by making oak sawlogs available for purchase locally. Currently the miller is bringing timber in from other parts of UK. However, SNH are understandably reluctant to agree to timber thinning from SAC oakwoods, and there is something of an impasse. FE do not want to be seen to be pushing oak timber production too hard, and lose conservation credibility with SNH, especially as there is no real financial gain to them from such work. The main aim is mainly social ie: sustainable local use of local resources.

A proposed thinning at Bunalteachan which had been marked by blue spraypaint, may be something of a test case, and SNH views are awaited. While there was nothing wrong with the thinning *per se* (except PQ pointed out that forked trees with rot-holes etc were better left standing as wildlife habitat niches), there is a fundamental difference of view between the conservationist and the forester when looking at the same stand of trees. In a top level conservation designated woodland (SSSI/SAC) it is unlikely that SNH will give way easily on this one. Basically they do not see the need for thinnings, and would rather let trees fall and rot, which in itself provides further wildlife niches.

This approach denies the potential of the oakwoods for local socio-economic use. That is something I believe the community itself needs to take up with SNH. I suspect that a long drawn out debate and negotiation will be needed to establish ground rules for thinning in the Sunart (and similar) oakwoods, which I also suspect FE will be reluctant to take the lead over. This could be something the Sunart Oakwoods Project manager could explore over time, along with FC Research. It seems more likely that SNH would agree to carefully planned and monitored research trials in thinning and group felling, and I note correspondence with FCRA and FC towards this.

The case for felling oak trees in an SSSI needs to be carefully made on the grounds of:

- Purely structural modifications to the stand – for whatever benefits...;
- To favour certain tree and shrub species;
- To promote particular BAP species;
- Opening out canopies to favour big crowned trees as future seed bearers;
- Promoting wind stable trees to go on to old age;
- Letting in more light which might benefit ground flora, also epiphytic lichens (however light/air might be deleterious to bryophytes);
- Better visual amenity and more open for walking through (not likely to count for much in an SSSI);
- Open oakwoods perhaps better for some characteristic birds and mammals?;
- Allow understorey development eg of hazel.

### ***Structural Stand Types in the Oakwoods***

One problem in dealing with “the Sunart Oakwoods” is an in-built assumption that all those oakwoods are similar, and that indeed all the ground is covered in oak. Both things are obviously untrue. It would be useful for all concerned if we started to recognise the variation in structural stand types within the oakwoods and their associated habitats. Ideally use a classification or nomenclature for the obviously different.

During the visit we walked through many distinct oakwood structures eg:

- Low, scrubby, open multistem coppice and windswept trees near the coast;
- Tall single stem apparently planted oak higher up (above the green van);

- Tall unsingled coppice with very large holly, and the occasional veteran oak, (on the craggy slopes above the planted oak);
- Pollarded/pruned trees on boundary banks surrounding old arable areas;
- The heavily thinned and underplanted oak, now without conifers again;
- An amazing patch of widely spaced veteran oaks surrounded by ruins of old settlements and an ancient track, in a sort of lowland wood pasture structure;
- Widely spaced medium aged oak stools with hazel understorey; etc.

Each of these structures has a quite different set of values, either for conservation, history/archaeology, recreation, epiphytes, birds, fungi, timber, etc. The only thing they share in common is oak trees!

I suggest that if you want to progress the idea of thinning for timber, [and why hide the fact that a regular supply of timber for local use is a legitimate aim of any woodland owner], then the arguments should be pointed towards particular structural stand types. The management plan then becomes a sort of negotiation, ie leave such an area or certain stand types wherever they occur as non-intervention reserves. In some other accessible stand types, especially those with a strong history of intervention and planting, agree a presumption of gradual thinning.

One of the problems at Sunart is that the whole oakwood resource tends to be long neglected old-growth with high conservation values, ie a historic resource on designated sites. It is much easier to be interventionist with timber stocks that are younger (eg the Glengarry birch regen), or if of planted origin.

It would help in any negotiations over management at the stand level, which this approach implies, to do surveys at the stand scale, and know the values of the main features of each stand type. This will mean specialist survey, not as lists of species for whole woodlands, but targeted lists for certain stands. These surveys would soon show that for example some stands, eg the ancient wood pasture stand are of much higher value for epiphytic lichens than the ex-planted stands, etc etc. Not all stands are equally 'natural' or equally valuable as wildlife niches.

Of course one also has to look at the whole woodland scale or level as well. It is built up of a mosaic of different structural and ecological stand types, together with non-wooded habitat patches (and perhaps patches of plantation conifers as at Glengarry). As well as being a wildlife habitat the same woodlands may also be ancient cultural landscapes, and the MFST Awards team archaeology survey will help show this.

Once the manager has this sort of knowledge, then decisions on thinning regimes would become relatively straightforward. This may sound a lot of preparatory work, but if conflict with the statutory conservation bodies is to be avoided, I see no alternative.

There is after all only one set of woodlands in the world called the 'Sunart Oakwoods' and it will surely be worth collating the expert knowledge of some key specialists, to help with their future management. This is perhaps something the project manager could work towards, perhaps storing the data in a GIS, including the results of the archaeology survey.

## **ANNEX 5 – Analysis of land use in Sunart study area**

In the absence of figures from other sources, we estimated the areas of various components of the Sunart study area by taking the 1 km square grid intersections as sample points.

### **Method**

For each intersection falling on land within the study area (excluding shores below high water) I recorded:

- Altitude, above or below 250m, as read from OS maps;
- Location, within enclosed farmland, or not. This was judged by boundaries marked on OS maps, combined with limited knowledge of the ground. Low hill land was excluded;
- Current cover: native woodland, plantation, plantation with broadleaved admixture. This was taken from OS 1:25,000 maps and maps supplied by Highland Birchwoods;
- Woodland history, ancient or not, as taken from maps supplied by Highland Birchwoods, based on the Ancient Woodland Inventory;
- Potential forest type, as shown on the MLURI map.

Care was taken to record precisely on the intersection, even though it was tempting to assign an intersection to a rare combination that was just missed. Where the exact location fell on a line, the intersection was scored for the land to the NW.

This approach gives estimates, not precise measurements, and can only give areas to the nearest 1 km<sup>2</sup> or 100ha. Like the underlying sources, it probably underestimates rare types. It is, however, an objective assessment; it brings out relationships between characteristics, and it allows distribution of combinations to be examined.

### **Results**

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

Some 83 intersections were forested, ie the study area is 33.1% forested. Most forested land is under plantations (55 intersections, of which 5 had a broadleaved admixture), but 28 intersections had broadleaved woodland (11.2% of study area; 33.7% of all forested land). Not surprisingly, forested land was mainly below 250m, and broadleaved (mainly semi-natural) was proportionately more abundant on the low, enclosed ground (Table A5.1).

**Table A5.1 Forested land in relation to land zones. The number of 1km<sup>2</sup> intersections for each combination is given**

	Land above 250m	Below 250m, not enclosed	Enclosed farmland	TOTAL
Broadleaved	0	22	6	28
Plantation	6	49	0	55
Not forested	63	94	11	168
TOTAL	69	165	17	251
Forest as % of land type	8.7%	43.0%	35.3%	
Broadleaved as % of land type	0	13.3%	35.3%	

**Map 1.** gives the potential woodland types for the study area. After modification by Highland Birchwoods to our specifications, the types have been arranged in an approximate order from base-rich types on moist soil to base-poor types (Table A5.2).

This shows clearly that the study area is dominated by the birch types (9–11), which would occupy 69.7% of the land, leaving the oak types (6–8) on 19.9% and the base-rich types (1–5) on 9.2%. It also shows that the land above 250m is almost wholly occupied by the birch types, and that the oak and base-rich types are restricted to land below 250m. This must be a consequence of the assumptions behind the MLURI map, but it surely expresses the potential correctly.

Ancient woodland sites total 43 intersections (17% of area; 23.6% of land below 250m). Of these, 26 have broadleaved woodland (60% of ancient woodland sites), 2 have plantations with a broadleaved admixture, and 15 have plantations. None is above 250m, but 6 fall within enclosed farmland. Some 28 fall within the oak types, 5 within the base-rich types, and 10 within the birch types. These figures will be subject to the uncertainties surrounding the Inventory definitions and methodology, but they correctly reflect the understanding that woodland continuity is limited to less than one-quarter of the land below 250m, and is most strongly associated with the oak types.

**Table A5.2 The range of potential woodland types in relation to land type, woodland history and current forest cover. The number of 1km<sup>2</sup> intersections is given for each combination**

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

## **ANNEX 6 – Long-rotation high forest: illustration**

**Starting point:** a mature oak-dominated woodland with the main canopy of 150 year old trees.

**Management:** according to section 4.3.3., taking the top end of the range of silvicultural intervention rates.

Could fell 10.0–13.4% in 20 years or 25.0–33.5% in 50 years, leaving 5 mature trees per ha. Ground to be restocked with oak, preferably by natural regeneration, but probably supplemented by planting.

Could thin up to 30% crown cover. This would exclude possibility of oak regeneration.

### **By 50th year:**

Could have felled up to 33.5%, leaving 5 oak/ha of 200 year in matrix of young growth of 0–50 year containing oak;

Could have thinned 66.5%, leaving a stand of 200 year.

### **By 100th year:**

Could have felled 67%, leaving 5 oaks/ha of 250 year in a matrix of young and maturing growth of 0–100 year containing oak. The older restocked stand would themselves have been thinned;

Remaining 33% of 250 year oaks, large due to thinning.

### **By 150th year:**

Age range of stands generally 0–150 year;

All stands contain older oaks of 300 year, ie 2-storey high forest;

Older stands would be thinned, allowing oaks to grow large;

NB: These would be associated with minimum intervention stands that have not been felled.

Advantages:

- Full succession of oaks;
- Maintained scatter of large oaks, well-lit but sheltered;
- Closed canopy stands never less than 20% of area (assuming 30 year to canopy closure);
- Increased representation of shrub layer;
- Large-scale structural diversity reflecting felling patches;
- CWD volumes enhanced by leaving crown branches on site, stumps, ancient trees.

Disadvantages:

- Immediate decrease in total maturity of stand;
- Visible management reduces 'wilderness' impression;
- Some oak planting needed;
- Stock control required.

Character:

- Sustained resource;
- Multiple benefits from resource, including some timber utilisation.

## **ANNEX 7 – Future management options: an exploratory calculation**

This is an attempt to state the future management possibilities in quantitative terms, based on the calculations summarised in ANNEX 5. Essentially, these are ‘what if’ calculations relating to woodland expansion and changes in woodland stocking.

### **Forest habitat network**

The minimum requirement for a forest habitat network is about 30% forest cover, reasonably well distributed through the area under consideration (Peterken *et al.* 1995; Peterken 2000). If we accept this as the threshold or target, the current deficiencies in the Sunart area are:

- that the broadleaved proportion below 250m is too low; or
- that forest habitat quality is too low, ie, conifers predominate.

### **Broadleaved expansion**

One measure, which is already agreed, is to convert those parts of the conifer plantations that still contain a proportion of broadleaves to native broadleaves. The estimated area is 500ha, or 9% of the plantation area.

Further new broadleaved woodland is needed to bring the total proportion up to 30%. For practical purposes, including growing utilisable timber, this would be confined to land below 250m. This totals 16500 + 1700ha, so 30% comes to  $0.3 \times 18200\text{ha}$  or 5460ha.

Since 2800ha is already occupied by broadleaved woodland and a further 500ha will be generated by conversion of conifer plantations, the amount of broadleaved afforestation required would be 2160ha.

The land ‘available’ for this is 3400ha. This is the ground below 250m that is (i) mapped as potential oak or ash woodland (types 1–8 of ANNEX 4), and (ii) not already forested by either broadleaves or plantations. The intersections that meet these criteria are (see also the MAP):

North side, from the west: 51/64; 52/64; 53/62; 54/62; 55/62,63; 56/63; 58/62; 67/66; 68/63,65; 74/63; 82/62; 83/63; 85/61

South side, from the west: 55/57; 56/56,57; 57/55; 58/58; 60/55,59; 61/55,56; 63/58; 64/57; 65/56; 72/61; 77/58; 80/60; 81/60; 82/60; 83/60; 85/60.

Taking these together, the opportunities appear to be concentrated on the north side west of Glenborrodale, but with scattered locations along to Strontian, and on the south side east of Laudale and west of Glencripesdale. Opportunities are limited in the central parts on both sides for the very good reason that broadleaved woodland and plantations are already abundant there.

If these conversions and expansions are achieved, forested land of all kinds would occupy 54% of the Sunart study area below 250m, which would have substantial implications for grazing and landscape. This may well be judged to be too much woodland and plantations, in which case two responses are available that would still enable the forest habitat network threshold to be achieved:

- Broadleaves can be introduced into the 4400ha of conifer plantations, eg, on ride margins, rock outcrops, as a measure for improving habitat quality within plantations;
- The broadleaved expansion could be achieved as wood pasture, ie by planting oak and ash into pasture, say, along margins, rock outcrops, watercourses, and continuing to use the land as pasture. This should be suitable for many woodland species, and may in the long term be particularly suitable for epiphytic lichens.

Thus, the 30% threshold for a forest habitat network could be achieved by reducing the area of broadleaved afforestation below 2160ha in proportion to the area of new wood pasture and conifer plantations with a broadleaved admixture.

## **Broadleaved woodland management**

Without further ground survey it is impossible to give precise figures about how the existing broadleaved woodland might be managed. However, some estimates of the state of the broadleaved woodland resource were obtained from 1988 air photographs. At the 28 intersections with broadleaved woodland recorded on the OS 1:25,000 map, we classified the woodland into four categories. Unfortunately, the available prints did not cover the northern fringes of the study area, so 5 of the 28 intersections could not be assessed. Results:

- 5: no information;
- 5: closed canopy, generally large crowns;
- 6: closed canopy, with generally small crowns (mostly young birch);
- 9: open canopy, all crown sizes;
- 3: sparse scatter of trees.

Assuming that the unassessed intersections were representative of the rest, then:

- 600ha well-stocked, mature trees predominate;
- 750ha well-stocked, small-crowned trees predominate;
- 1100ha poorly stocked;
- 350ha sparsely treed.

Against this background, it is now possible to set out quantitative scenarios for broadleaved woodland management in terms of the models described in section 4.3. Scenario 1 allows a substantial proportion of minimum intervention in the existing mature woodland, and for all the new woodland to be treated as timber-growing broadleaved plantations. Scenario 2 allows less minimum intervention, but allows for 1000ha of conifer plantations to be enriched by native broadleaves, and a commensurate reduction in the area of new broadleaved afforestation. Scenario 3 repeats scenario 2, but allows for a much larger proportion of minimum intervention in existing woodland.

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



### Scenario 1.

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

	Total area of type	Minimum intervention	Long-rotation high forest	Short-rotation high forest	Wood pasture	Coppice	Conifer HF
Existing pure conifer plantations	4400						4400
Converted from conifer plantation	500			500			
Existing well-stocked, mature	600	200	400				
Existing well-stocked, small crowns	750		100	400	200	50	
Existing poorly stocked	1100			800	300		
Existing sparse woodland	350				350		
New broadleaved afforestation	2160			2160			
<b>TOTALS</b>	<b>9860</b>	<b>200</b>	<b>500</b>	<b>3860</b>	<b>850</b>	<b>50</b>	<b>4400</b>

### Scenario 2.

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

	Total area of type	Minimum intervention	Long-rotation high forest	Short-rotation high forest	Wood pasture	Coppice	Conifer HF
Existing pure conifer plantations	4400				1000		3400
Converted from conifer plantation	500			500			
Existing well-stocked, mature	600	50	500	50			
Existing well-stocked, small crowns	750		100	400	200	50	
Existing poorly stocked	1100			800	300		
Existing sparse woodland	350				350		
New broadleaved afforestation	1160			1160			
<b>TOTALS</b>	<b>8860</b>	<b>50</b>	<b>600</b>	<b>2860</b>	<b>1850</b>	<b>50</b>	<b>3400</b>

**Scenario 3.**

As 2, but much large minimum intervention in existing BL woodland.

	Total area of type	Minimum intervention	Longrotation high forest	Shortrotation high forest	Wood pasture	Coppice	Conifer HF
Existing pure conifer plantations	4400					1000	3400
Converted from conifer plantation	500			500			
Existing well-stocked, mature	600	400	200				
Existing well-stocked, small crowns	750	200	100	300	100	50	
Existing poorly stocked	1100	50			750	300	
Existing sparse woodland	350	50			300		
New broadleaved afforestation	1160		1160				
<b>TOTALS</b>	<b>8860</b>	<b>700</b>	<b>300</b>	<b>2710</b>	<b>1700</b>	<b>50</b>	<b>3400</b>

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

**Comment**

The numbers in this analysis should not be taken too literally. They provide a semi-quantitative basis for presenting possibilities in a way that can be debated with minimal misunderstanding. Without them, discussion would be based on vague phrases (such as 'balance between this and that'). The scenarios can be modified and adjusted as necessary in debate. If a particular scenario were agreed, it would still be no more than an indication of what the people currently think is desirable.