

Prospects for Native Timber Utilisations in the Scottish Highlands: a discussion document



Còille Beithe na Gàidhealtachd
**HIGHLAND
BIRCHWOODS**



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Published by Highland Birchwoods. Any enquiries should be addressed to Highland Birchwoods at Littleburn, Munloch, Ross-shire, IV8 8NN, Scotland.

ISBN: 0 9536447 3 1

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This report should be cited as follows:

Davies, I., Burns, B., & Nelson, D., (2001) *The Production and Marketing of Scottish Hardwood Flooring*, Highland Birchwoods, Munloch.

Prospects for Native Timber Utilisation in the Scottish Highlands: a discussion document

by

Ivor Davies, James Pendlebury, and Richard Worrell

Edited for publication by Diana Gilbert



Highland Birchwoods is a charitable company (SC021146) limited by guarantee and registered in Scotland (no 142892).
Registered office: Redwood, 19 Culduthel Road, Inverness, IV2 4AA

Acknowledgements

This booklet is published through Highland Birchwoods' Native Woodland Demonstration Programme, a Millennium Forest for Scotland project, part funded by the Millennium Commission

The authors are grateful to the following for their support:

Scottish Natural Heritage who originally commissioned this report and subsequently agreed to its publication by Highland Birchwoods.

Duncan Stone, Pat Snowdon, Bob Dunsmore, Derek Nelson, Denis Torley, and several staff at Highland Birchwoods who provided valuable comments upon the text at various stages. Further thanks are extended to Bob Black, Doug Lamont, Gavin Munro, Kenny Sinclair, Bob Stubbs, and David Sulman who provided invaluable information based on their considerable experience.

Photographs:

Cover: Downy Birch Woodland (*Highland Birchwoods*).

Insets: Detail of an oak window (*Forest of Spey*); I beam factory (*Highland Birchwoods*); Laggan Chairs (*Forest of Spey*); stack of birch, 50mm² blanks (*Highland Birchwoods*).

Page 8 Clockwise from top left: Large-scale processing of medium quality timber in a modern sawmill (*Highland Birchwoods*); hardwood flooring produced in a small-scale mill (*Highland Birchwoods*); a small-scale static sawmill (*Forest of Spey*); small-scale use of very low grade logs for firewood (*Richard Worrell*); sawlogs and small roundwood produced in a typical estate forestry operation (*Highland Birchwoods*); a small mobile sawmill (*Highland Birchwoods*); Scots pine timber cladding made on a medium sized sawmill (*Forest Enterprise*).

Page 11: Argyll Oak Woodland (*Richard Worrell*); Sutherland Downy Birch (*Highland Birchwoods*); Strathspey Pine Woodland (*Forest of Spey*)

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SUMMARY

This report aims to stimulate discussion regarding the future of native woodlands by reviewing the current and future timber utilisation potential of these woods in the Scottish Highlands.

Much of the native woodland resource in northern Scotland is in a relatively fragile and fragmented state. With the exception of Scots pine, the current capacity for native woodlands to sustain anything beyond small-scale timber utilisation is extremely variable and often quite poor. That said, a number of possibilities for enhancing the timber utilisation of these woodlands do exist, and the report analyses these opportunities against the background of current management, resource and geographic constraints. Information on the timber quality and quantity needed in the future for specific industries to be viable is given, and the productive capacity of the woodlands is assessed in the light of this.

The report concentrates on three areas, Argyll, north west Sutherland and Badenoch and Strathspey. These areas were selected because they illustrate both the main native woodland types found in the Scottish Highlands, as well as the range of economic factors to determine the viability of wood processing businesses in the region. The key findings for each of the three areas are as follows:

Argyll

For the foreseeable future the main native timber manufacturing options will be limited to small-scale processing of low to mid grade logs for a variety of end uses. A small amount of good quality oak could be produced over the next few years, but given the maturity of much of the standing crop, continuity of supply will become an issue in the medium term. For the immediate future, the principal local utilisation opportunities are probably restricted to:

- Small-scale harvesting with the better quality timber sold to markets outwith Argyll (as at present).
- Use of mobile sawmills to produce modest amounts of sawn hardwood for craft use and occasional use in buildings.

- Production of outdoor landscaping products such as bollards and signs made from poor quality oak sawlogs.
- A small-scale manufacturing business using both locally sourced native timber and timber imported into the region.
- Fuel wood businesses using both native timber and non-native conifers.
- Small round wood, used chipped, for smokery wood, as a substrate for shiitake cultivation and for charcoal production.

It is clear that a substantial and sustained woodland management commitment is required if the utilisation of native woodlands in Argyll is ever to move beyond the limited scale outlined above. Major issues include:

- The need to address currently diffuse management objectives and undertake active woodland management to enhance timber production, beginning with removal of grazing pressures.
- The need for resource owners to develop sensitive multiple-benefit management, especially for sites with landscape and conservation designations.
- The need to improve the standard of broadleaf silviculture to increase future timber utilisation prospects. In particular the current predominance of older age classes needs to be altered by a long-term programme of woodland regeneration, restructuring and new planting.

North west Sutherland

In north west Sutherland poor quality downy birch is the principal native woodland resource. Utilisation options can only be described as severely constrained and, for the foreseeable future are limited to the small-scale use of very low-grade logs. The main limiting factors are:

- low growth rates;
- poor resource quality;
- unsympathetic management objectives;
- lack of incentive to improve management;

- the poor infrastructure and remoteness of the area.

Consequently the current utilisation for firewood and craft manufacture probably represents best practice. Without major shifts in woodland ownership patterns or management objectives, utilisation is unlikely to grow. Some potential does exist to improve fuelwood utilisation through better management of the existing supplies and increased development of the local markets. Further inventory information on the resource would be needed before any wider native timber utilisation proposal could be implemented.

Badenoch and Strathspey

The area can continue to support a medium to large-scale wood processing industry utilising large volumes of mid-quality Scots pine in combination with other conifer species. However, the potential for developing a pine specific industry may be limited by a number of factors such as season dependent harvesting, the biased age structure of the standing crop, and management constraints associated with resource ownership. Similarly, the utilisation of the available birch resource from grazed areas is limited due to its biased age structure and poor quality. That said, there is an as yet unquantified volume of birch in mixture with conifer crops and on restock sites throughout the area and this may be of sufficient quality and volume to support the development of local birch wood processing in the future. These factors provide the wood processing industry with a range of manufacturing opportunities including:

- Continuation and possibly growth of the existing mix of large softwood sawmills and panel product manufacture utilising both native and non-native conifers.
- Market profiling of Scots pine in order to differentiate it from the run of the mill spruce timber. Products might include a premium brand decking product or a range of laminated furniture products.
- Establishment of a small-scale hardwood flooring factory to add value to small volumes of medium grade birch sawlogs along with other hardwoods imported into the area.
- Firewood or small-scale bio-energy markets would also appear to present development potential, particularly given the proximity of population centres.

Three woodland management issues influence the future prospects for Scots pine utilisation in Badenoch and Strathspey:

- In the short term the continuing decline in capercaillie populations mean that pine harvesting practices may have to adapt to systems that take account of breeding requirements.
- The establishment in recent decades of plantations and new native pinewoods at wide spacings with corresponding reductions in future timber quality with a negative impact on the available volumes of timber in the medium term.
- A growing interest in management of pine for timber quality and also an increase in long term retentions provide the prospect of larger dimension higher quality timber becoming available in the future.

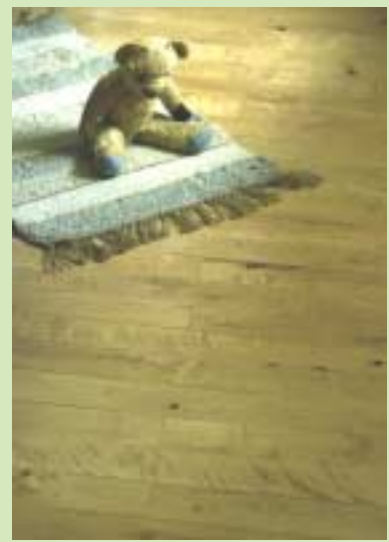
Proposals

From the findings of this study the following eight proposals have been made :

- With some urgency, public agencies should define what rural development benefits they wish to achieve from a future healthy, sustainable native woodland based timber resource and how these are to be achieved, for example through integrated incentive schemes and regulations.
- Silvicultural systems should be adopted which best fit the local market requirements for regular timber production at an appropriate scale.
- Support should be provided for timber utilisation ventures which are developed to cope with wide variations in quality and quantity of raw material supply. In practise this may mean supplementing the local native supply with non-native and imported timber.
- Detailed woodland resource and timber quality assessments should be undertaken of the main commercial native woodland species in semi-natural woodland and within non-native plantations.
- Public agencies should take the lead in developing strategic area plans for the sustainable harvest of timber from native woodland, including designated sites. Such management should be implemented

on agency owned designated sites and promoted as best practise exemplars to private woodland owners.

- The current designs for new and existing woodlands should be reviewed to ensure that appropriate priority is given to native timber production on suitable sites.
- Support should be made available for rural communities wishing to develop small-scale utilisation of local native and exotic conifer timber resources, through demonstration, advice and funding.
- Well targeted promotion of fuelwood, through demonstration, advice and funding, should be undertaken.



Examples of the range of timber utilisation discussed in this report. Clockwise from top left:

Large-scale processing of medium quality timber in a modern sawmill;

Hardwood flooring produced in a small-scale mill;

A small-scale static sawmill;

Small-scale use of very low grade logs for firewood;

Sawlogs and small roundwood produced in a typical estate forestry operation;

A small mobile sawmill;

Scots pine timber cladding made on a medium sized sawmill.



BACKGROUND TO THE STUDY

Context

In Scotland, timber is, at best, only one product of native woodland management. It is typically produced in small quantities, often as a by-product of other management and there tend to be large disparities between the woodland manager's perceptions of the value of the timber and downstream market requirements. If native woodland utilisation is to have an important role in the future economic development of rural Scotland, the debate needs to move beyond a purely resource based discussion to consider what the market wants and how this might be provided from an expanded native woodland resource. In other words, 'market pull' needs to influence native woodland management so that 'resource push' better matches the anticipated market requirements, as well as other benefits.

Native woodlands can clearly contribute many tangible benefits to rural communities including, for example, eco-tourism, stock and game shelter, higher values for neighbouring properties, improved fisheries management, and much more besides. It is however much less clear how much timber utilisation these woodlands could support on a sustainable basis. There is little information available on this subject in Scotland or indeed anywhere else in the UK. Numerous studies have identified the range of products that have been, are, or might potentially be, manufactured from this resource. However there has been little attempt to relate such information to the underlying economic and environmental factors which determine the viability of a particular timber utilisation option in a specific location.

Objective

The objective of this report is to assess the current and future prospects for native timber utilisation in the highlands of Scotland. In particular the study looks at how economic and environmental factors combine to determine the sustainability, or otherwise, of different

types and scales of woodland utilisation. The report is intended as a discussion document to stimulate debate as to the future of native woodlands in this area.

Scope

This report examines native woodlands in the highlands of Scotland, equivalent to the area covered by Highlands & Islands Enterprise. For the purposes of this report these are taken to include both semi-natural woodland and plantations of native species. They are only a tiny part of the total forest resource, which includes a much larger component of non-native species as shown in table 1.

Table 1. Woodland statistics for the whole of Scotland

Type of woodland	Area (000 Ha)	% of land area	% of total woodland
All woodland	602	12	100
All conifers	502	10	83
All broadleaves	100	2	17
Native conifers (Scots pine)	126	2.5	21
Non-native conifers	376	7.5	62
Native broadleaves	85	1.7	14
Non-native broadleaves	16	0.3	3

Source: MacKenzie and Callander 1995

The report records and analyses information on both hardwood and softwood logs. There are different conventions on log grades for different timbers and for this reason and for clarity the terms large sawlogs and small roundwood have, unless otherwise stated, been used in summary tables and text according to the table overleaf.

“Large Sawlogs (> 24 cm top)” includes the following grades all over 24 cm top diameter:

- Oak: sawlogs; fencing and beam logs; and chockwood.
- Birch: sawlogs.
- Pine: sawlogs, pallet wood.

“Small roundwood (7 – 24 cm top)” includes the following grades all between 7 and 24 cm top diameter:

- Oak: sawlogs between 15 and 24 cm top; other roundwood, including fuelwood, below 15 cm top.
- Birch: sawlogs and pulp wood between 15 and 24 cm top; other roundwood including fuelwood below 15 cm top.
- Pine: sawlogs and pallet wood between 17 and 24 cm top; pulp wood between 15 and 17 cm top; other roundwood, including fuelwood, below 15 cm.

Future utilisation prospects for the mainstream, commercial conifer species have recently been considered in a major report commissioned by the Forestry Commission and other agencies (Jaakko Poyry 1998). While this present review draws upon some of these findings it does not

attempt to address any of the challenges facing the wider industry except insofar as these may impact upon native woodland utilisation. Scots pine is, of course, included in both studies.

This report assesses the volumes of native timber currently available and in the context of ecological and economic sustainability sets out to answer the following questions:

- *What quantity and quality of native timber is needed for specific industries to be viable?*
- *What do these timber needs mean in terms of productive native woodland?*

In attempting to answer these questions three contrasting areas were used as case studies: Argyll, north-west Sutherland and Badenoch and Strathspey, (Map 1). They were selected because they illustrate the main native woodland types found in the highlands and the range of economic factors that determine the viability of wood processing businesses in the region.

Map 1. Location of the three case study areas



CURRENT STATUS OF NATIVE WOODLANDS IN THE HIGHLANDS

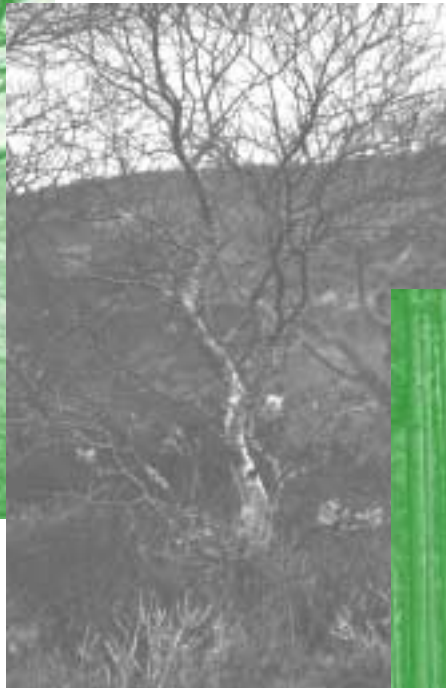
Introduction

This chapter reviews the woodland information that is available for the three case study areas and then draws some tentative conclusions regarding future timber production potential. Arriving at these conclusions is necessarily a fairly technical process and, for the purposes of clarity, the findings are summarised in this chapter with details in Appendix 1.

It must be emphasised that the resource analyses that follow are limited in their reliability and scope of application due to the variable quality of the data available on age structure, condition, area, quality etc. Indeed, the lack of data on native woodlands in north-west Sutherland has rendered it impossible to perform any analysis on that area's potential production. Even where analysis has been possible the long term timber production figures are very uncertain.



Argyll Oak Woodland
(Rick Worrell)



Sutherland Downy Birch
(Highland Birchwoods)



Strathspey Pine Woodland
(Forest of Spey)

Argyll

Extent & Condition of the Resource

The management history of native woodlands in Argyll has been dominated in recent centuries by wood pasture followed, from the mid 18th to late 19th centuries, by coppice. Neither of these management systems were for timber but rather for non-timber products such as tan bark and charcoal. In order to supply these markets, the woodland management tended to favour oak at the expense of other species. The local coppice markets ceased with the collapse of the iron smelting industry in the late 19th century and there has been little active management of the native woodland resource in Argyll since that time. The relatively mature, uniform aged, oak dominated resource we see today is thus to a large extent an historical artefact. Currently available data on timber quantity and quality are very limited.

The Caledonian Partnership under its Argyll Pilot Project (in prep) recently surveyed over 216 randomly selected, semi-natural woodlands throughout Argyll, equivalent to 5% of the semi-natural woods in the region, or 21% of their area. The survey provided detailed information on a number of species, including sessile and pedunculate oak, downy birch, and ash, as shown in Figure 1. Mixed, semi-natural/plantation, woods were not sampled and so the quantity and perhaps the quality of the total native resource is under estimated (Caledonian Partnership, in press).

The inventory created from this project provides the best available baseline from which to assess the condition of the current resource and it shows that the majority of the oak and ash woodland is mature with little recruitment. This hugely skewed age distribution has implications for any potential sustainable yield over future years. Indeed, in the case of oak the data clearly indicates that large diameter oak logs will be an even scarcer commodity in the future than at present, unless action is taken now to secure the next generation. Downy birch, the most widespread species surveyed, has a much less biased age distribution, but it is still skewed to medium diameter classes with smaller trees considerably under-represented. In production terms downy birch may present the best opportunity but this



Map 2. Native woodland distribution in Argyll (Caledonian Partnership, in prep.).

is dependent on the instigation of improved silviculture for timber. Although the lack of a large and healthy younger crop waiting for release does raise questions over the level of any future sustainable yield.

It should be noted that the available inventory data does not record the impact of recent woodland grant schemes aimed at restructuring parts of the oakwood resource. Nor, as noted above, is there data on the additional native timber located in mixtures, although it is likely that it would certainly include good quality stems.

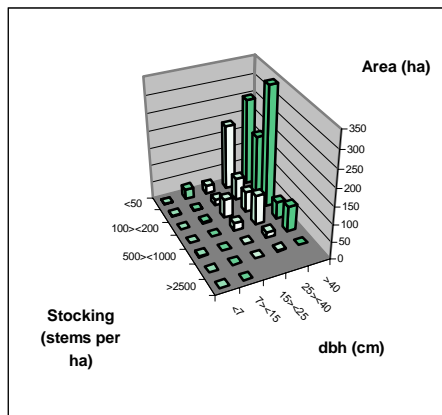
Constraints & Opportunities

Management

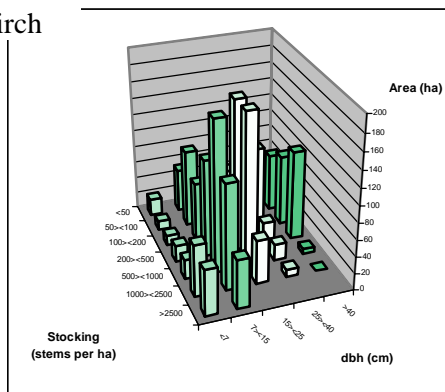
With the possible exception of downy birch, the hardwood resource in Argyll is largely stagnant with most woodlands comprising mature trees. It is doubtful if there is much potential for sustainable native timber production in the medium term without considerable invest-

Figure 1. Field gathered data on the distribution of age class, diameter at breast height, and stand density for selected species.

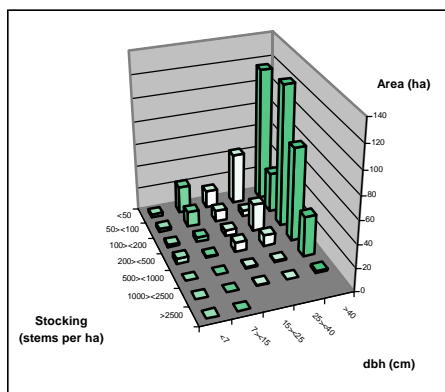
Oak



Downy Birch



Ash



ment in management. Although there are moves in this direction it will be many years before widespread improvements are seen in the resource. Thus, in the foreseeable future the inventory does not present an encouraging situation for investment in added value processing.

Ownership & Designation

Where owners' objectives focus on deer stalking or livestock husbandry and stock numbers within woodland are high there is little hope for healthy woodland. Likewise, designations

(such as National Nature Reserve, Site of Special Scientific Interest or Special Area of Conservation) tend to focus management on nature conservation. In some cases timber is harvested as a by product of stand restructuring but it is short term and the timber is of variable quality.

Single objective management precludes opportunities for achieving multiple benefits. In the above cases the development of even small-scale, long term sustainable supplies of timber is not possible. But the designation framework provides the necessary safeguards for the future development of best practise in integrated management. It could allow for some timber production to support small local wood using industries, while ensuring nature conservation remains a high priority.

Resource quality

Information on resource quality, which could help to support investment decisions is limited. However, the following sources provide the most authoritative and up to date information available.

A very experienced hardwood merchant, who buys around 70 m³ per annum of oak from Argyll, estimates the quality of the current oak resource as:

- 10 –15 % all grades of sawlog;
- 30 - 40 % fencing and beam logs;
- 40 - 50 % chockwood, small roundwood and firewood.

Although this indicates a poor quality resource, the merchant believes that the potential is there for some woods to produce good quality timber if they were managed with timber production as an objective (G Munro, pers. comm.).

More detailed, but limited, information is provided by a small timber quality study carried out in 1995 for Argyll Broadleaves (McConnell, 1995). In this study five trees were felled on each of ten sites throughout Argyll and the logs were assessed for their sawmilling and manufacturing qualities (see table 2). The sites were selected for timber quality and were relatively fertile and freely draining compared to most oakwoods in Argyll. While this is a small sample and not by itself statistically meaningful it is notable that the percentages of the different grades broadly agree with the timber buyers assessment quoted above.

Table 2. Oak quality grades from McConnell (1995).

Timber grade	Percentage of oak volume at the grade
Good sawlog with only very minor defects, few market limitations	2
Poor sawlog with considerable defects, limited markets	10
Fencing & beam logs	14
Chockwood	20
Small roundwood & firewood	54

Following grading the 50 logs selected for the trial were sawn, kiln dried to a moisture content of 10% and then manufactured into office desks, laminated window frames and flooring. The key factors that arose from the test were:

- recovery of merchantable sawn timber was only 39%, compared with an industry average of 50% or better;
- only 2 to 4% of the sample was of a quality suitable for regular cabinet making;
- the kilning degrade was considerably higher than industry standards, although no firm conclusions could be drawn as to the cause;
- the machining characteristics were below standard with high wastage being a particular problem.

The McConnell study concluded that the market value of Argyll oak is considerably below the French or American oak most commonly available to the trade.

The public road network in the region is not capable of handling large volumes of timber. Thus harvesting and haulage economics are a further restraint on commercial viability. An associated problem is the distance any manufactured products would have to travel from Argyll to potential markets in Scotland's central belt or southern England, with low value added products being unable to carry the haulage costs.

Consequently, much of the resource would be unmerchantable into mainstream markets due to the combination of its poor quality and high transport costs.

Current Utilisation

The current harvest of oak sawlogs in Argyll is limited to c. 70 m³ per annum being bought by one timber buyer. Much of this timber leaves Argyll for processing. Most local craft workers, for example the Argyll Green Woodworkers Association buy their timber from this one buyer. The main wood sourced, processed and used locally is a small, but unquantified amount of firewood (G Munro pers comm.).

Argyll oak is however potentially suitable for the manufacture of short length products such as parquet flooring or even for external cladding if suitable designs utilising very short lengths were to be developed. Local, low technology use is perhaps the best market prospect for the chockwood grade material. This could include various low volume markets such as exterior benches and bollards along with small-scale non-timber products such as smokery wood, charcoal and Shiitake mushrooms.

North West Sutherland

Extent & condition of the Resource

In relation to the other two study areas there is relatively little published, quantitative information on the extent, or condition of the native woodland resource in north west Sutherland. However, the remotely surveyed Scottish Semi-natural Woodland Inventory (Caledonian Partnership, 2000) indicates that there are approximately 35,500 ha of woodland in the area of which over 80% are plantation conifers and only 4,700 ha are semi-natural broadleaves. Interestingly, 95% of the non-plantation conifer resource is also classified as degraded, or fragmented, in terms of canopy cover and thus is likely to be mature given the predominant land use patterns. Overall, the native woods are dominated by poor form downy birch, although Scots pine and oak woodland are also present, and there are some important areas of alder. Assessments of native timber are mostly qualitative but emphasise the extremely poor quality of most of the resource, with the main uses being firewood or very low volume specialised crafts where timber appearance and 'character' are determining factors.

Map 3. Native woodland distribution in north west Sutherland (Caledonian Partnership, 2000).



Constraints & Opportunities

On a few of the more sheltered and fertile sites there is the potential to grow timber of better form although current management objectives such as sporting shooting, tend to preclude this. That said, the Tongue policy woodlands are a fine example of the quality of silver birch that could be produced on the right sites with appropriate and sympathetic management. Unfortunately, from a timber perspective, recently established new native woodlands tend to have been planted at wide spacings which will limit the quality of the timber they ultimately produce. Like Argyll, the current resource is relatively small scale and, even with recent plantings, offers little prospect of the kind of continuity of supply needed by any but the smallest prospective manufacturer. Most of the existing and significant native woodland remnants are under conservation designations and timber production is not a management priority.

The transport infrastructure in the area is extremely poor and presents a severe constraint on both harvesting timber and distributing finished products. The problems of local access to woodlands is further exacerbated by the terrain and would preclude larger scale harvesting operations even where the volume and quality available was in itself not a constraint. That said, it is worth noting that the small pockets of timber typically

available are well suited to small-scale harvesting operations by locally based contractors.

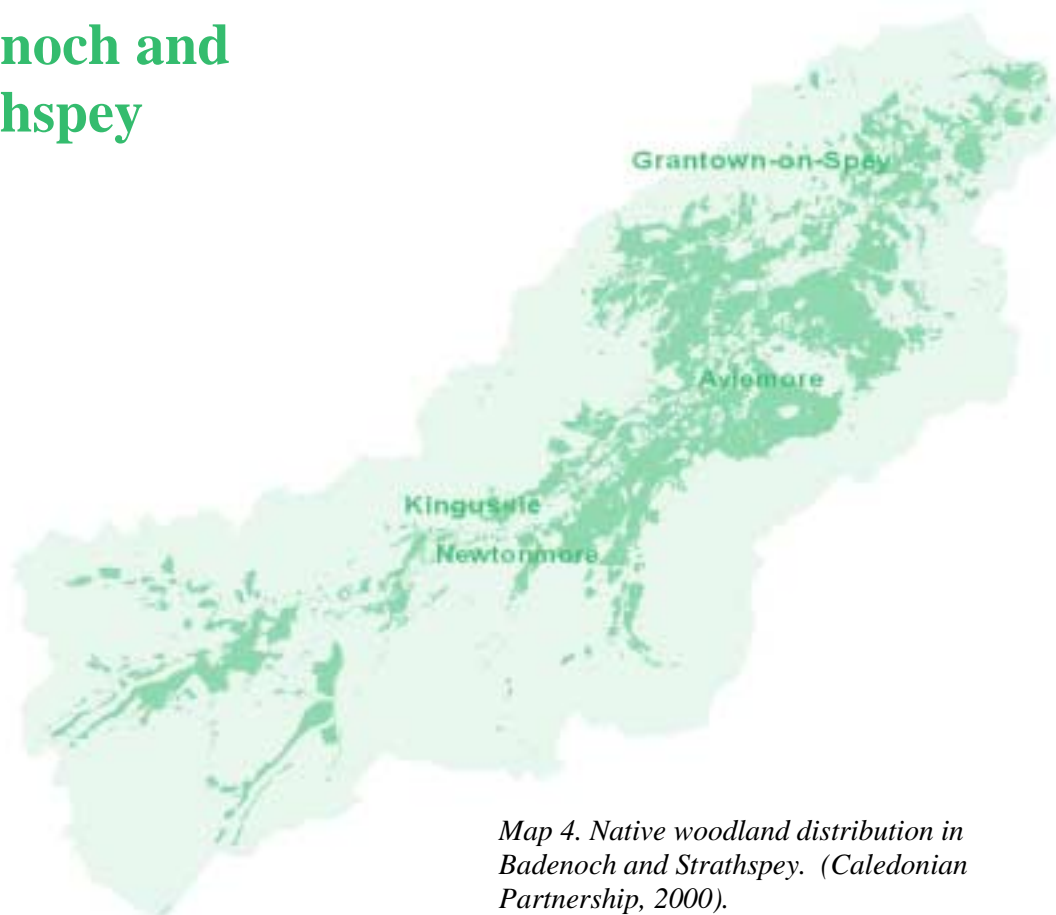
In order to improve the utilisation of native woodlands in the area the quantity and quality of the timber available to the market has to be increased. Wood quality is dependent upon site conditions and appropriate silviculture. Downy birch, although the most common native species in the area, would appear to face severe utilisation constraints due to its poor form. The total quantity of native timber available may, even under current conditions, be slightly larger than is realised.

Alder in particular may represent a potentially utilisable resource, albeit one only available in small parcels across multiple ownership. The feasibility of harvesting such timber from predominately wet woodlands is a major issue and improved information on the distribution and quality would be required before effort to realise this potential could be justified. Indeed such an inventory would be needed before any significant growth in local native timber utilisation could be realistically considered.

Current Utilisation

Current utilisation of the resource is somewhat ad hoc in practice but tends to be limited to small scale harvesting for firewood and crafts.

Badenoch and Strathspey



Map 4. Native woodland distribution in Badenoch and Strathspey. (Caledonian Partnership, 2000).

Extent & condition of the resource

As inland transport slowly improved in the 18th and 19th Centuries, forests in the remote highland glens were increasingly, and often unsustainably, exploited. This continued until timber prices collapsed in 1866. Most of the mature Caledonian pinewoods seen in Badenoch and Strathspey today date from self seeded regeneration from this period.

Information supplied by the Cairngorm Partnership (Worrell & Ross, 2001) shows that there are approximately 40,000 ha of all woodlands in the strath, of which around 20% are owned by the Forestry Commission, with the rest being in private or other ownership such as the Royal Society for the Protection of Birds (RSPB) or Scottish Natural Heritage (SNH). Around 27,000 ha (67%) of the total area is coniferous, with the rest being broadleaved or mixed. Encouragingly 4,500 ha of natural regeneration Woodland Grant Schemes have been approved since 1993 of which 1,700 ha is Scots pine and 2,500 ha is birch. Most recently recruited birch is naturally regenerated in the absence of grazing and the quality may be significantly better than much of the mature resource in the

area, if managed appropriately, or if support to continue management is forthcoming (D. Torley, pers comm.).

Scots pine comprises the principal conifer species accounting for around 20,500 ha of the total forest area with birch being the predominant broadleaved species covering 6,700 ha. Most private owners are willing to market timber if the price is right, although it should be noted that 5,500 ha (13.5% of the total resource) is managed primarily for nature conservation, where timber production is not an objective.

The Scottish Semi-Natural Woodland Inventory (Caledonian Partnership web site) indicates that 17,948 ha of the Scots Pine is high forest Category 1 (that is stands which are or could be capable of producing wood of a size and quality for sawlog or small roundwood). Of these 14,100 ha are over 30 years old, with only 3,800 ha having been established within the last 20 years. Birch also exhibits a strongly skewed age structure with almost 80% of the trees over 30 years old. Despite this 950 ha are potentially capable of producing timber.

Inshriach pinewood, established in the 1950s, is

believed to be broadly representative of the timber quality of post war Scots pine plantations in the area. This wood produces 10,000 m³ of timber yearly and the timber quality recorded in current Forest Enterprise sales records is shown in table 3 (K Sinclair, pers. comm.).

Table 3. Typical Scots pine timber grades currently produced at Inshriach

% for thinnings		% for final clearfells	
5-7	Fencing stobs	43	Sawlogs (of which 25% red logs, 75% green logs)
		15	Pallet logs
93-95	Small roundwood	42	Small roundwood

Note: "red logs" are low quality sawlogs and "green logs" are good quality sawlogs

Post war plantations such as Inshriach were established at over 3,000 stems per hectare. However changes in silviculture since the 1970's have tended to decrease initial planting densities to between 2000-2500 trees per hectare. The quality of timber resulting from these stands will be significantly poorer, raising considerable question over its future marketability.

The timber quality of birch in the area is more difficult to assess as virtually none is being harvested at present. In the drier more easterly part of the Strath silver birch predominates and it is likely that the potential quality is similar to silver birch harvested from other relatively dry and low lying areas of the Highlands, such as Black Isle. However, since the war there have been much greater grazing pressures in Strathspey than on Black Isle and this will have reduced the respective birch quality considerably. Highland Birchwoods experience is that about 25% of the mature birch being harvested on good sites on Black Isle would produce small sawlogs suitable for flooring and the remainder would only be suitable for chipwood or firewood. Consequently, it is possible to speculate that on better sites, in the drier eastern parts of Strathspey, the sawlog yield will probably be around 10-15%. In the wetter western parts of Strathspey, the recovery of sawlog quality timber will tend to be lower. There is a considerable, although unquantified amount of birch within conifer stands and some of this may be of reasonable quality and potentially harvestable as part of normal forestry operations.

Constraints & Opportunities

It is clear there is a reasonable quantity of medium quality, relatively mature Scots pine in Badenoch and Strathspey. However, as already noted, the quality of more recently established plantations will not be as good, and current thinning practices aimed at reducing the costs of management have reinforced the problem (Worrell & Ross, 2001). These management practices raise serious questions regarding the quality of the pine resource which will reach the market in the coming decades. It is encouraging in this context to note the increased interest in growing quality pine and the trend towards longer term retentions. There could be up to 6,000 ha of pine restock sites appearing in the area in the next 25 years (D. Torley pers comm.) which represents a substantial opportunity to improve the quality of the resource in long term.

The status of Scots pine as a marketable timber is largely tied to the fortunes of the mainstream Scottish softwood processing industry. Modern sawmilling techniques are geared to high production output utilising very uniform logs. While Scots pine can produce very high quality timber, its form in many pinewoods is currently very variable making it difficult to process as profitably as spruce. Additional constraints are that Scots pine:

- has larger diameter knots than spruce, which limits its use in high grade end uses;
- commonly suffers from a sap stain attack which, during the summer months, severely limits the amount of timber that can be sawn (although this is less of a constraint for panel product manufacturers).

This seasonality has important implications for any future sawmill processing development which aimed to specialise in Scots pine. The wood processors preference would be for continuous timber supply throughout the year. This could potentially be assured by a local sawmill investing in specialised and expensive control measures, such as spraying debarked logs with anti-sap stain chemicals. However, in some woods, summer felling may be precluded on conservation grounds as it would be incompatible with the high ornithological value of these woods due to their breeding bird populations.

It is reasonable to predict that any specialised processor in the area expecting to use locally

grown Scots pine would face serious problems due to the seasonality of supply.

There are good prospects for growing birch timber in the eastern end of the area due to the quality of the growing sites. Currently, timber production is not a high priority and most stands are adversely affected by browsing.

Current utilisation

Scots pine is mainly used as an undifferentiated mainstream feedstock for large-scale softwood sawmills or board manufacturers in the region. The volume products from Scots pine will continue to be small roundwood for use in panel product manufacture and winter felled sawlogs for construction timber. A very limited volume is also used for furniture and crafts.

Current birch utilisation for anything other than firewood is virtually unknown.

Potential Timber Production in Native Woodlands in The Highlands

Current production estimates for native species plantations

Oak, silver birch and Scots pine are the main native species with timber production potential in the highlands. The predicted annual production of these three species is shown in figure 2, along with the estimated area required to produce 100 m³ of the main product types listed in the McConnell study (for details see Appendix 1, table 6). These estimates are based on plantations which comply with both the Forestry Commission Yield Tables and with modern forest standards.

The variations in area required to produce 100 m³ of all grades of sawlogs between the three species (as shown in figure 2) reflects the range of growth rates. It is clear that fairly large woodland areas are required in order to produce substantial quantities of good quality oak sawlogs (up to 769 ha).

The figures for oak and birch give a reasonable reflection of those sites which are fully stocked and well managed, but over estimate the output of sawlogs from both under and over stocked woods. Those for pine give a reasonably realistic picture of current output in pine stands in Strathspey, the majority of which are managed for timber production. The figures over estimate timber production for semi-natural pinewoods and new native woodland (see below).

Future production of oak and birch in Argyll

Estimates of the long term annual production of timber from oak and birch in Argyll are shown in figure 3. Oak is clearly the species with greatest potential in the shorter term on account of the greater standing volume. In the longer term however, the potential sustainable volume production of the two species is similar. About 50% of the woodland area for both species is under some type of designation and this will inevitably restrict harvesting possibilities.

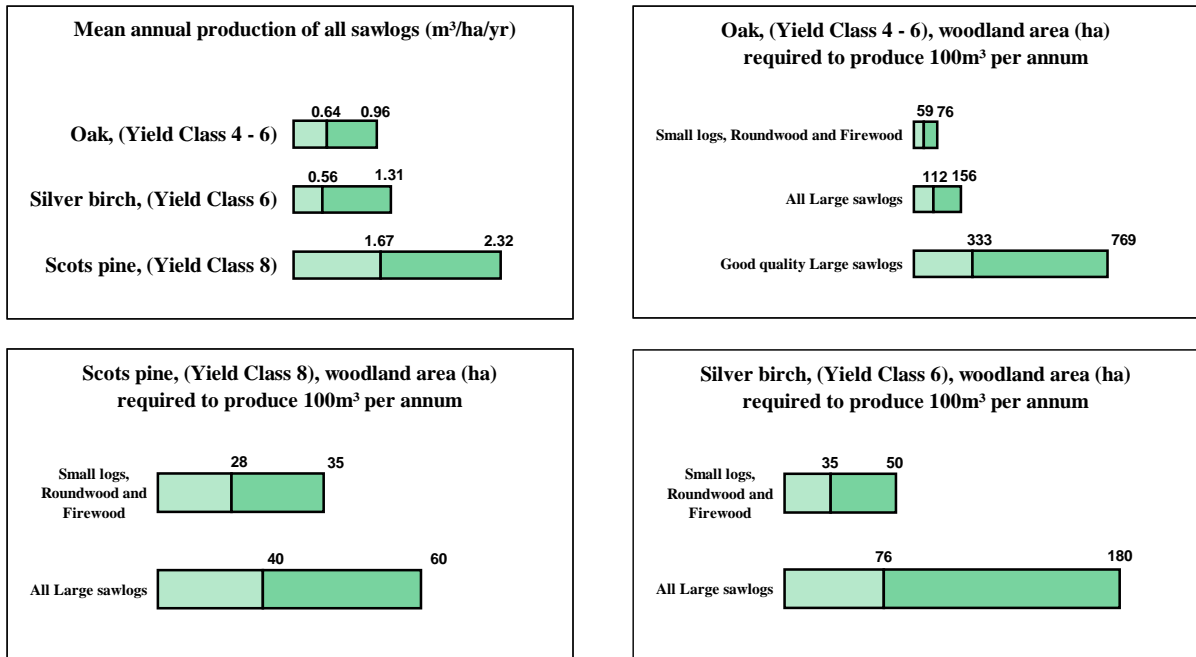


Figure 2. Annual production related to area for oak, pine and birch in the highlands

It should be noted that the production of sawlog material from existing semi-natural woodlands, may have been compromised by earlier management for different objectives and will be lower than for native species plantations. The most significant effects of past management being any of:

- overstocking of trees due to lack of thinning, leading to low diameters;
- multi-stemmed trees due to coppice management, or earlier browsing damage;
- under-stocking, leading to increased side-branching and low volumes.

Future timber production of Birch and Scots Pine in Badenoch and Strathspey

In response to growing public interest the incentives to establish new native woodlands primarily for nature conservation benefit now outweigh those for timber production. This has seen a move away from timber plantation to new native woodland establishment, using design criteria which do not favour timber production. The most significant impacts are:

Reduced timber volumes due to:

- Increased initial spacing;
- intimate mixes of several species, including those not normally associated with timber production;

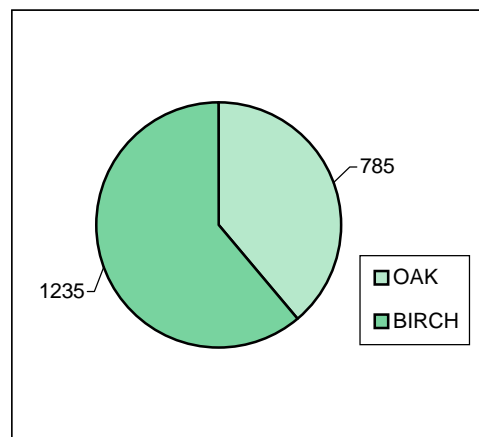


Figure 3. Possible long term outturn (m³ per annum) of all grades of sawlogs from the accessible areas of woodland shown in Appendix 1.

- Use of local origin, native planting stock of unknown timber producing performance;
- Greater proportions of woodland as open space.

Reductions in timber quality due to:

- Wider initial spacing leads to more branchy trees and therefore timber with more defects. The trees develop mutual shelter much later increasing, particularly in the highlands, the proportion of juvenile core, (that is the knotty, movement prone, timber laid down in the centre of trees in the period before canopy closure)

and the risk of environmental damage from wind or snow. Increased tree taper and spiral grain may further limit the value of the timber to a sawmill.

- Lack of thinning reduces the diameters of final crop trees. It also means poorer trees are retained resulting in an overall reduction in quality across the crop.

Despite this it is possible to establish a woodland for a number of objectives within the forest design criteria. They permit variable spacing of stems, allowing for close planting at a maximum of 2m in areas where there is good potential for timber production. Where such areas are subsequently managed to produce timber they can be expected to conform at least to the quality grades provided in tables 2 & 3. The remainder of the site could serve nature conservation or recreational objectives, where harvestable timber may develop but on an unpredictable basis.

A worst case scenario might be woodlands established at 3m spacings which receive no further silvicultural care. In which case the safest assumption would be that the timber was only suitable for fuelwood and pulpwood.

Future native timber production in north west Sutherland

From the data available it is impossible to give any meaningful predictions of the long term annual production in the native woodlands of north west Sutherland. As already outlined the total resource area is restricted and is dominated by poorly managed downy birch, with some alder, Scots pine and oak. In general the timber volumes and log quality are very low due the effects of overstocking, browsing, understocking and other factors listed above, and it is likely that the quality of any timber will correspond to the worst case scenarios outlined above.

In such circumstances it is fair to assume that securing the future of the resource is the overriding management priority and that timber production is, in most cases, a small and incidental by-product yielding mostly firewood and pulpwood. Small areas of better quality timber do exist but, as already outlined, more survey data is needed before any meaningful output predictions could be made.

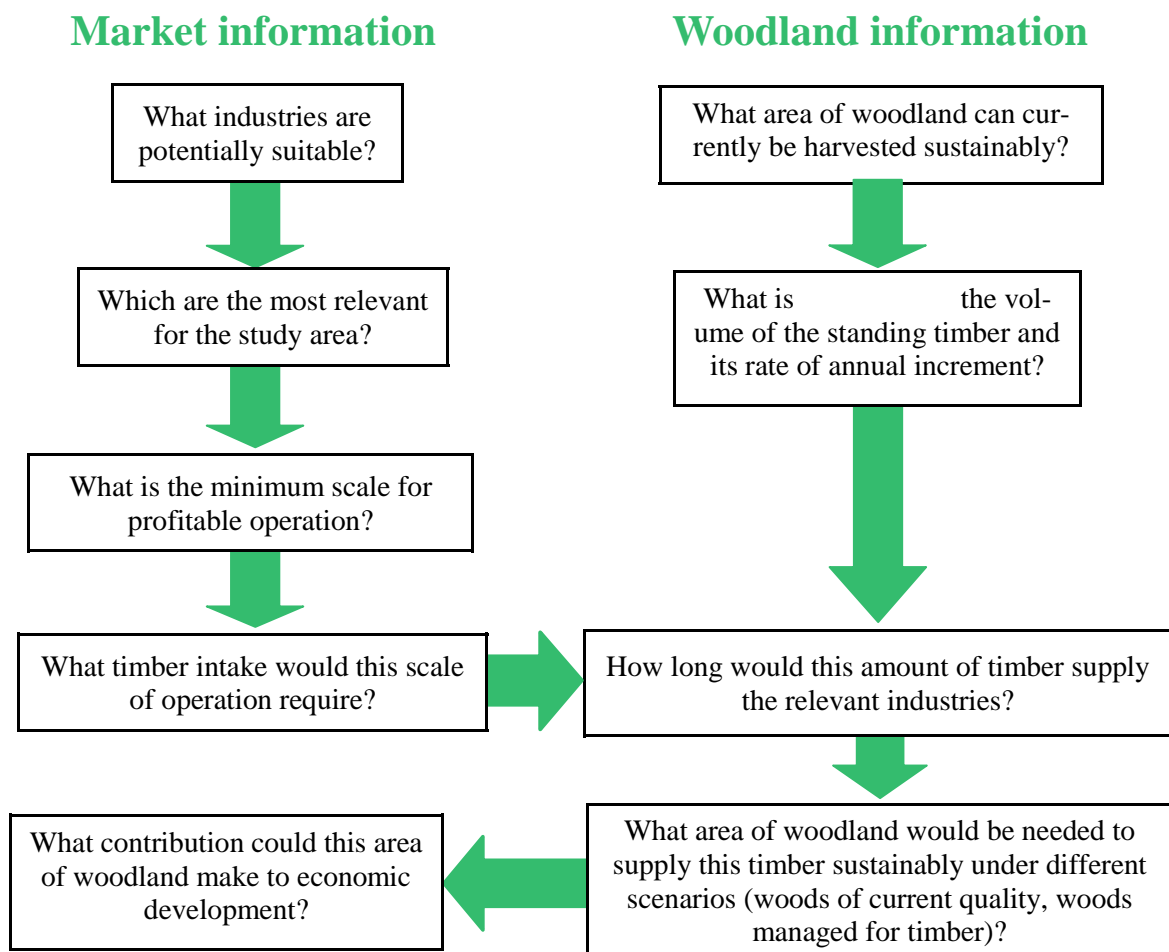
UTILISATION OPTIONS

Context

The current market opportunities for native timber from semi natural woodland in the highlands are limited. However, given the fragile and fragmented nature of many, indeed most, of the semi-natural woodlands in the area then the current market conditions are an uncertain guide as to what economic development impacts might be possible given proper management and extension of the resource. Native timber production from plantations can significantly increase the resource available but even here, as we have seen in the previous chapter, there are many uncertainties.

The central problem is how the current state of the resource and market conditions can be used as a guide to the economic benefits these woodlands could achieve in the future. Ideally, the approach to solving this problem would be that illustrated in figure 4. Unfortunately, whilst sufficient information exists to enable processing options to be described the same is not true in relation to the resource where as we have already seen the gaps in quantified knowledge renders much analysis speculative at best.

Figure 4. Combining market and woodland information as a guide to the economic development potential of a native timber resource



The native woodland being established or brought into management today will not mature as a timber resource for at least another 40 to 60 years. Predicting the future in detail over this time-scale is of course impossible. Market demand for timber in the middle of the next century will bear little resemblance to market conditions today; new markets will have been developed and some current markets will have disappeared. That being said, it is feasible to make some more generic assumptions about future market conditions based upon past history and current supply and demand.

In any industry utilising primary resources the types of businesses that develop in an area are determined by their proximity to market, the resources available and how effectively those resources can be used. Assuming that a viable market exists or can be developed then the factors that determine where an enterprise is established might include:

- The availability and location of land or raw materials relative to the market;
- The availability of suitably skilled labour;
- The availability of capital for buildings, machines and working capital;
- The availability of entrepreneurs willing to risk business investments.

Unlike some other parts of the UK there is currently no significant shortage of skilled labour for the timber processing industries in the Scottish Highlands. Indeed given the continuing reduction in labour requirements throughout the forestry, sawmilling and secondary processing industries there is currently a considerable over-supply of suitably skilled workers in the area. However, there are considerable challenges regarding some of the other aspects listed above.

- **Capital availability and return on capital invested**

Small wood processors tend to be the main market for native broadleaf species. Much of this sector is severely fragmented and undercapitalised often working on the margins of profitability, and well below modern health and safety standard. In contrast the larger mainstream soft-wood processors, who market all the Scots pine, are a well capitalised, viable part of the UK forestry industry.

- **Timber quality, availability and continuity of supply**

Although there is some very high quality native timber available in the area it is fair to say that the overall resource is generally poorer quality than much of the timber being imported into the area. There are also severe constraints on its availability and continuity of supply. These problems are common to both the broadleaf species, such as oak or birch, and also, in many instances, to Scots pine.

- **Location, local infrastructure and distance to market**

The Scottish Highlands are a long way from the volume markets of Central Scotland or Southern England. Many parts of the highlands are further constrained by poor inter-regional transport infrastructure.

None of these constraints are by themselves insurmountable barriers to a successful business. Taken together, however, they do tend to determine the types of wood processing operation which might establish in the region. For example, an investor looking to build a large modern saw-mill will always look for an area with both a good transport infrastructure and large volumes of suitable quality timber within a reasonable distance. Not surprisingly such businesses tend to concentrate on key transport routes, such as ports, railheads, or arterial roads like the A9 corridor, with little scope to move outside these areas. Consequently the three factors of capital availability, location and timber quality can, to a limited extent, be used to characterise the types of wood processing industries that tend to be viable in the highlands, both now and into the future. The relationship between these three factors is shown diagrammatically in figure 5, and detailed in table 4.

Table 5 extends this approach to create a matrix which groups wood processors on the basis of the relative importance of the three factors outlined above. Whilst there is considerable overlap between the nine categories in the table they do serve to illustrate how timber quality, location and capital constrain the wood processing options. In terms of the groupings in figure 5, most of the current, principally exotic conifer based Scottish industry can be characterised as ‘mainstream’ or ‘international’. Timber

Figure 5. Using timber quality, geographical location and capital availability to characterise timber processing business.

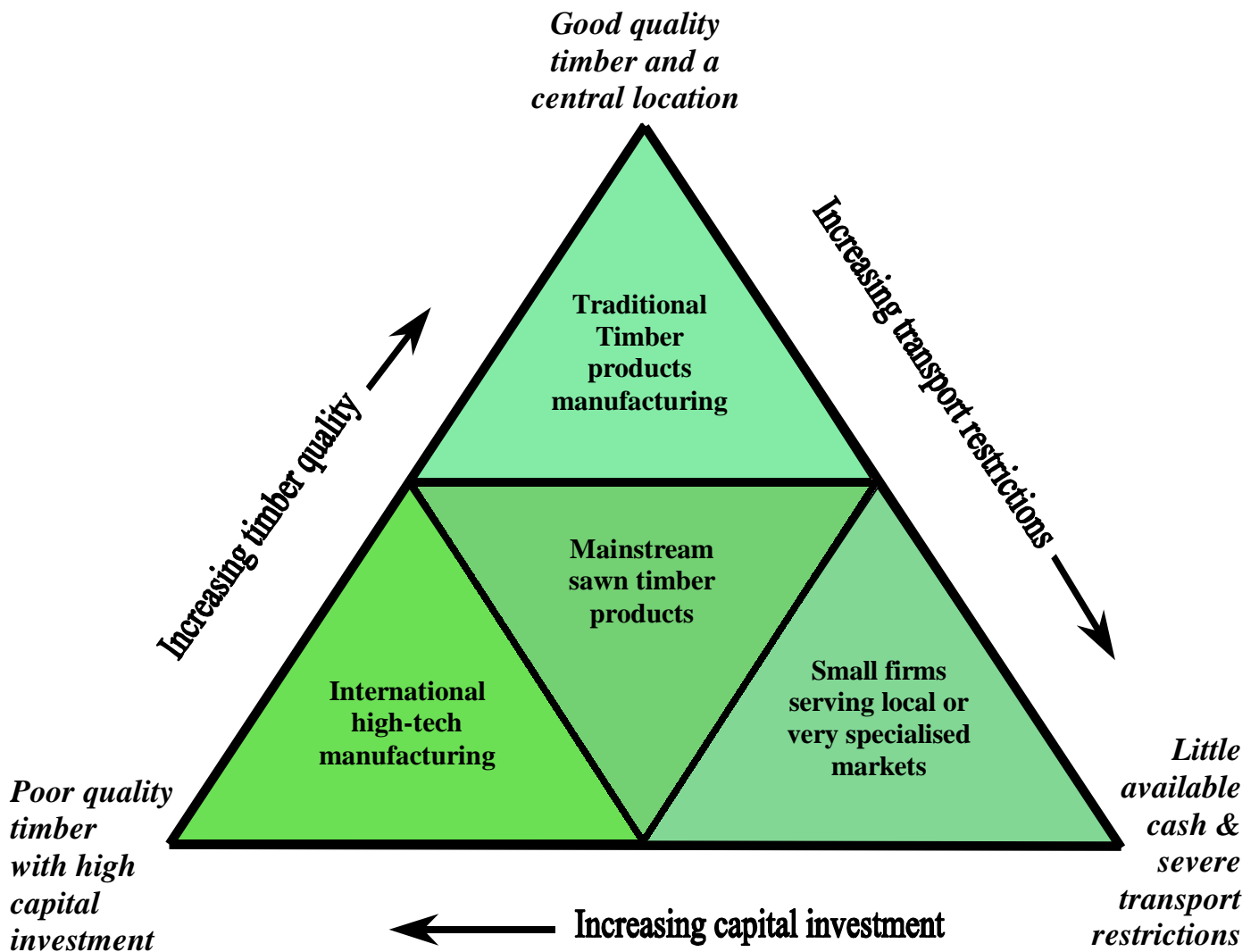


Table 4. Descriptions of the four main categories of the timber industry arising from figure 6.

<u>Traditional</u>	<u>Mainstream</u>	<u>International</u>	<u>Local</u>
Typified by a large hardwood sawmill or a large hardwood furniture manufacturer	Typified by family owned softwood sawmill group	Typified by a modern panel products or paper mill	Typified by a small cabinet maker or mobile sawmill
Long established companies relying on reliable timber supplies	Modern concentrated production facilities	International companies	One person working predominates
Often dated or labour intensive technology	Good standard of technology	High capital low labour cost products	Often undercapitalised
Vulnerable to displacement by other materials	Reduced labour costs	World class but not locally responsive	Small dispersed operators locally responsive
	Limited range of products	Very high volume manufacturing	Business decisions often driven by 'lifestyle choices'




processing is a hugely competitive, international, commodity industry subject to constant market pressures to increase scale, rationalise or merge. Consequently, the industry is dominated by medium to large processors clustered in categories 2,3,5 and 6 below. There are a large number of smaller, more ‘traditional’ or ‘local’ firms in categories 4, 7, 8 and 9 and it is in these categories that most of the native timber using industries can be found.

Processing Options in the Scottish Highlands

Using the nine groups identified in the matrix above it is possible to consider the role each currently plays or could play in the use of native timber utilisation in the Scottish Highlands.

Table 5. Wood processing technologies grouped according to the relative importance of capital, location and resource quality

Large-scale capital investments $\geq \text{£}10\text{m}$	Category 1 <u>Large-scale processing of high quality timber</u> e.g. Plywood Premium grade hardwood flooring	Category 2 <u>Large-scale processing of mid quality timber</u> e.g. Large softwood sawmill supplying construction timber etc Manufacturers of glulam beams or laminated flooring	Category 3 <u>Large-scale processing of low grade logs</u> e.g. Panel products Paper mill Large scale electricity generation	Good location Close to transport infrastructure with easy access to large volume national or international markets
Medium capital investments $\geq \text{£}1\text{m} - < \text{£}10\text{m}$	Category 4 <u>Medium-scale processing of high quality timber</u> e.g. Large hardwood sawmill Furniture Transmission poles	Category 5 <u>Medium-scale processing of mid grade timber</u> e.g. Mid-sized softwood sawmill Supplying construction timber Pallets & packaging	Category 6 <u>Medium-scale processing of poor quality logs</u> e.g. Packers and bearers Fencing Combined heat and power	Medium location Because of some locational problems these businesses tend to serve regional markets or only distribute compact or high value added goods
Small capital investments $< \text{£}1\text{m}$	Category 7 <u>Small-scale processing of high grade timber</u> e.g. Small static sawmill Cabinet maker & crafts Horse jumps	Category 8 <u>Small-scale processing of mid grade timber</u> e.g. Mobile sawmill Mid grade hardwood flooring Cabinet making & crafts	Category 9 <u>Small-scale use of very low grade logs</u> e.g. Crafts Small-scale fuelwood operations	Poor location Remote location giving limited access to any volume markets. Firms serving local needs or niche markets predominate along with ‘on-farm’ use.
Good quality timber		Mid quality timber	Poor quality timber & small roundwood	

Few constraints  Moderate constraints  Severe constraints 

Category 1 - Large-scale processing of high quality timber

(E.g. a plywood mill or premium grade hardwood flooring mill)

Birch plywood is probably the only industry within this category that is occasionally proposed as a future option in the area. It is conceivable that high quality birch could be grown in parts of the highlands in the future (Worrell 1999) and, if the rest of Scotland is included, the potential for growing quality birch is considerable. However, given that a plywood mill requires not only a large capital investment but also in the order of 50,000 m³ of very high quality timber per annum to be viable, (B Stubbs pers comm.) it is unlikely that a sufficient volume will ever be grown in Scotland to justify setting up such a mill here. A more achievable scenario is that any such quality timber produced in the highlands will find a ready export market for processing into birch plywood abroad.

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Over £10 million	At least 50 thousand high quality sawlogs

Category 2 - Large-scale processing of mid quality timber

(E.g. a large softwood sawmill)

The highlands already have large one sawmill in this category producing products such as machine strength graded softwood timber for the construction market. While such mills can use limited volumes of native pine they are predominantly dependent on exotic conifers and are likely to remain so for the foreseeable future. Indeed, the recently published Jaakko Poyry report (1998) estimated that whilst the total annual conifer harvest in Scotland will increase significantly over the next 20 years, and might exceed 10 million m³ per annum by 2016, only 8% of this projected volume will be Scots pine from the highlands.

To put such operations in context, the minimum consumption for this scale of large modern sawmill is around 200,000 m³ of sawlogs per annum and, in a European context, mills with an annual log consumption of 500,000 m³ are not unusual. Thus given this scale of mill and the future

domination of softwood production by spruce there would appear to be little realistic prospect, in the foreseeable future of a large sawmill being developed to concentrate solely on processing Scots pine. There is probably little scope for expanding this category in the highlands, even when the full non native conifer resource is included (B Stubbs pers. comm.).

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Over £10 million	Between 200 & 500 thousand medium to high sawlogs

Category 3 - Large-scale processing of low grade logs

(E.g. a panel product or pulp mill)

As outlined by the Jaakko Poyry (1998) report the supply of conifer timber in Scotland will increase dramatically over the next 20 years with much of this increase comprising predominantly poor quality and small diameter exotic conifer sawlogs. Such timber is unlikely to be fully utilised by the sawmill sector and so it is projected that there will be considerable growth opportunities in panel product and paper manufacture.

Most such processors will take a range of species, although the Oriented Strand Board (OSB) mill near Inverness, which typically consumes around 400,000 m³ of small roundwood yearly (FICGB 1998), prefers Scots pine. However, due to quality constraints on the available supply, its use of Scots pine has declined from 81% in 1990 to only 38% in 1999, despite a reduction in the quality criteria accepted by the buyers (D. Lamont, pers. comm.). That said, OSB producers have indicated that Scots pine would still be the feedstock of choice, if the supplies were available.

Engineered Wood Products may have some potential as products in this category. They include a wide range of reconstituted timber products such as I Joists, Laminated Veneer Lumber, or glulam beams which are designed to fulfil a particular structural application. Encouragingly one I Joist factory has recently been established in the area and there would appear to be scope for growth in this sector.

There has recently been much speculation about the possibility of establishing a large electricity generation plant in the highlands, utilising the lowest grades of conifer log along with sawmill and forest residues (Jaakko Poyry 1998). Such a plant would cost several million pounds to commission and would consume in the order of 50,000 m³ of roundwood per annum irrespective of the species concerned (British Biogen 1998). This type of operation is likely to be most viable if it is developed alongside another large wood processor such as a sawmill or pulp mill within the confines of an established transport infrastructure.

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Over £10 million	Between 50 & 500 thousand poor quality roundwood logs.

Category 4 - Medium-scale processing of high quality timber

(E.g. a large hardwood sawmill)

The only dedicated medium-scale hardwood sawmill in Scotland recently switched to softwood. There appears to be little likelihood of a similar scale of high quality hardwood mill reopening in the foreseeable future, especially in the highlands, unless a much greater timber resource becomes available.

The remaining specialist product which falls into this category, and is grown in the highlands, is transmission pole quality Scots pine. Whilst the percentage of the pine resource which can meet the tight specification is very limited it is still likely to remain an important income earner for those growers who can meet it. As the processing of such material is highly specialised and is only carried out by a limited number of UK based operators it is unlikely that highland involvement will extend beyond log production. New products such as laminated poles are a potential threat to this market.

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Between £1 & £10 million	At least 2 thousand high quality hard or soft-wood sawlogs

Category 5 - Medium-scale processing of mid grade timber

(E.g. medium sized softwood sawmill)

There are currently 5 medium-scale softwood sawmills operating in the highlands, each with an annual log consumption of between 50,000 – 100,000 m³. None of these mills exclusively process Scots pine and the general raw material supply described under the Category 2 above is applicable here, as are the markets supplied. It typically costs around £6 million to set up such a mill (B Stubbs pers comm., FICGB 1998).

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Between £1 & £10 million	Between 50 & 200 thousand high to medium grade sawlogs

Category 6 - Medium-scale processing of low grade logs or small roundwood

(E.g. a fencing mill or combined heat and power plant)

In Scotland the medium-scale processing of low grade logs is restricted to fencing along with packers, bearers and props for various industries. Scots pine has some advantage in the fencing market because it has good permeability to preservatives. Oak is also in demand for applications requiring particular strength or durability. However, most of the sawn timber products produced by this group are in steady long term decline and are vulnerable to displacement by cheaper, imported supplies. The UK is already self sufficient in these products and so there is little scope to increase the market. In order to remain viable, there is substantial pressure to achieve economies of scale by increasing the size of sawmill, and new mills in this group have an annual capacity to saw between 50,000 and 100,000 m³. Many of the long established existing processors in this sector are much smaller than this.

The other main processing option for utilising medium quantities of low grade timber or small roundwood is electricity generation, perhaps in combination with heat production. A medium-scale wood fired plant could cost at least £1,000,000 to establish and would consume around 10,000 m³ of roundwood yearly. Such an operation would utilise both exotic and native species of any quality, and it could work

well along side a sawmill or other wood processor. According to British Biogen (1998) this scale of development could supply the electricity needs of around 5000 homes. At the time of writing there are proposals for four combined heat and power plants of this scale in the highlands and so it is likely that new markets for small roundwood will open in the next few years.

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Between £1 & £10 million	Between 10 & 100 thousand hard or soft-wood sawlogs

Category 7 - Small-scale processing of high grade timber

(E.g. a small hardwood sawmill)

This group includes a very wide range of wood processing businesses, ranging from mills utilising a few hundred cubic metres of timber annually, down to part-time estate sawmills. What most of these businesses have in common is a focus upon local or regional markets and a requirement for good quality logs.

Unfortunately many of these operations are undercapitalised and have limited knowledge of marketing or financial management. There are at least fifteen such small sawmills operating in the Scottish Highlands, split equally between static and mobile mills, the latter often working part time. All of the static and half of the mobile mills are located near the A9 trunk road mostly within a half hour drive of Inverness. The mobile sawmills are further described under Category 8 as they tend to process more mid-grade timber.

The small static sawmills in the area divide into two groups. Half of the mills sell untreated fencing or pallet wood and similar low value added products. The others have additional equipment enabling them to produce higher value-added products such as preservative treated timber, kiln dried hardwoods or various construction or joinery products. Each of these mills employs a few staff in timber processing and the smaller mills typically utilise 200 – 500 m³ of roundwood annually, while the largest might process nearer 1,000 m³ of predominantly exotic conifer logs. The set-up and running costs for a small sawmill are increasing dramatically and many of the small mills in the highlands

have closed over recent years. It is difficult to generalise in such a variable sector, but set-up costs are now at least £100,000 for a small, simple sawmill adding some value, such as limited kiln drying. If a joinery shop, large kiln or a small preservative treatment plant were included the costs would be considerably higher than this.

In total the small static sawmills in the highlands probably consume between 2,000 to 3,000 m³ of roundwood annually. None of these mills process native hardwoods or softwoods exclusively as their survival depends upon being flexible and spreading their production across a number of markets. Possibly up to 500 m³ of their annual consumption is native hardwoods, principally oak, with the remainder being softwoods including Scots pine, Douglas fir and European larch. At this scale of operation continuity of timber supply does not appear to be a constraint for any of the timber species currently being utilised.

Key requirements for a typical operation:	
Capital	Timber (m ³ per annum)
Over £500 thousand	At most 1 thousand high quality hard or soft-wood sawlogs

Category 8 - Small-scale processing of mid grade timber

(E.g. a mobile sawmill)

One of the most characteristic types of business in this group is the mobile sawmill, such as Woodmiser. These mills are generally used to provide an on-site sawmilling service for small parcels of timber, which are uneconomic to transport to a static mill. None of the mobile saws in the area are currently working near full time and it is probable that there is overcapacity at present. This may be a function of the limited amount of suitable timber available, but the main factor is more likely to be the general downturn in farming and wood processing.

A mobile sawmill can typically convert between 4 and 7 m³ of roundwood per day. Allowing for travel and downtime, a full time operation would equate to a yearly total of around 150 to 200 days sawing, processing around 1,000 m³ of roundwood. However, an annual log consumption of 200-300 m³ is probably more representative of the mills based in the area at present. A consumption of 300 m³ per annum is probably

the minimum viable for a one person, part time mobile sawmill business, and 900 m³ per annum for profitable full time operation. Of course these volumes assume that the business only operates as a mobile sawing service. If the business also adds value to timber through, for example, kiln drying then these volumes could be reduced. Given the variable nature of what can be processed by mobile sawmills, the resultant product range is equally varied depending on the extent of secondary processing undertaken and ranges from firewood to blanks for tongue and grooved flooring. As with small static mills described in the previous category, few if any mobile sawmill operators specialise exclusively in native timbers.

Key requirements for a typical operation:	
Capital	Timber (m³ per annum)
At most £100 thousand	Up to 1 thousand medium quality sawlogs

Category 9 - Small-scale processing of very low grade logs

(e.g. a charcoal kiln)

The wood processing options in this category are limited to small-scale use of mobile sawmills (already covered in the previous section) along with various roundwood products such as landscape furniture. Several non timber products such as shiitake mushroom, cultivated on logs, and fuelwood are sometimes viable. Even at this scale fuelwood utilisation can include small woodchip heating schemes. Because the product options are so distinct each one is dealt with separately in this section.

Roundwood products – several products can be manufactured utilising round poles however, few if any of these can realistically provide a full time, viable business. The most frequent being landscape furniture, such as bollards and way markers, while pole buildings of various kinds are also sometimes produced. What most of these types of product have in common is that they tend to be most suitable for ‘own use’ by community woodlands or other producers of low volumes of small roundwood. These products are normally low value addition so, although there is scope for development, business success is dependent on considerable technical and marketing skills.

Charcoal - There are currently two part time charcoal producers in the highlands supplying the local barbecue fuel market over the summer. This market is severely constrained by the short season combined with the high marketing costs involved in supplying regular small orders to a remote rural population. Charcoal production is a dirty business with low financial returns. The product is a cost sensitive commodity and (timber certification notwithstanding) there is little scope to differentiate a local supplier in any meaningful way. Cheap imported charcoal will continue to dominate the industry and it is unlikely that the local market will grow much beyond its current size. Similarly there is little scope to export charcoal from the area, as it would have to compete on price with large volumes of cheap, easily available imports.

Within the three case study areas there may be scope to establish a part time business in south Argyll supplying charcoal into Glasgow. As with the existing businesses the market would be restricted to the summer months. Six cubic metres of a medium density hardwood timber, such as oak, converts to 1 m³ of charcoal. Assuming the season is restricted to eight weeks over the summer, the business would require a yearly supply of at least 50 m³ of oak small roundwood. This would need to be available within a small area in order to minimise transport costs.

Firewood - In Scotland the small-scale utilisation of fuelwood is generally only seen as firewood burned either on open fires or in more efficient closed stoves. These systems supply space heating for individual houses and are often used in combination with a conventional central heating system. This is an effective solution for remote households with easy access to timber. However, the inconvenient bulk handling limits the market uptake, a fact compounded by poor marketing from many of the existing firewood producers. Smokeries are a further firewood outlet and the smokery at Taynault in Argyll currently utilises around 40 m³ of low grade oak annually (B. Black pers. comm.).

Woodchip heating - Potentially a more convenient and marketable approach is to use small woodchip heating systems. Small woodchip burners offer a clean and largely automated system comparable to existing oil-fired central heating. While such systems have potential they do require a considerable infrastructure of chipping

machinery, drying facilities and bulk storage and transportation. Whereas a farm, school or small community facility might make such an investment, an individual household could expect to be supplied with chips. It is likely that there will be considerable developments in this industry in the highlands over the next few years.

Small-scale Electricity Generation - It is also conceivable that very small-scale electricity generation plants applicable to the needs of remote rural communities could be developed. Over capacity, as a high value addition product, could be readily exported out the area, whereas the transport of low value chips would not be viable. The minimum scale for each plant is currently around 500 m³ of roundwood, of all species, per year and whilst it will cost a few tens of thousands of pounds it can supply the electricity needs of around 250 houses (British Biogen 1998). These plants are relatively indiscriminate in terms of the type, although not condition, of wood chips they use and could be supplied from native or non-native woodlands.

Gourmet Mushroom Cultivation – Growing speciality mushrooms such as shiitake and oyster mushrooms on hardwood logs can be a viable part time business in some circumstances. The two limiting factors are climate (the mushrooms grow best in a mild and wet climate) and markets (the grower needs easy access to sufficient high quality restaurants). Argyll has the most suitable gourmet mushroom growing climate in Scotland and given the proximity to Glasgow there would appear to be scope for one or more growers in the area. A part time business requires a supply of at least 1,000 logs annually, equating to around 10 m³ of small roundwood. The preferred species are oak, beech and birch. A full time business would require at least 5,000 logs each year, equating to around 50 m³ of small roundwood.

Plant Extracts - Food and pharmaceutical extracts are also occasionally proposed as a development opportunity. A few products in this sector are already produced in the highlands, most notably wine and various preserves, and it is conceivable that such production could expand. However, most of the raw materials for these products are wild harvested at present with little or no financial benefit to the landowner. For this reason it is sometimes argued that plantations of suitable trees and shrubs (e.g.

juniper or bog myrtle) should be established where the harvesting could be controlled and made more efficient. More extensive production from semi natural woodland would be unlikely to provide continuity of supply or to be competitive with lower labour-cost economies.

Cattle Bedding - Woodchips are also utilised in large quantities for animal bedding. Most of these markets require dry chips which are supplied from recycled timber such as old pallets. Recycled timber is available in large volumes and at little or no cost and thus there is little prospect of being able to sell virgin timber into these markets. However in remote areas where no recycled timber is available there may be scope to utilise unseasoned chips for cattle bedding.

Key requirements for a typical operation:	
Capital	Timber (m³ per annum)
Up to £50 thousand	At most 1 thousand poor quality roundwood logs

Vertical Integration in the Supply Chains

Most wood processors are dependant upon a healthy secondary processing sector that can utilise the timber products that the primary processors produce. The larger processors described in the first six categories tend to have established markets with their customers and long term supply agreements with their roundwood suppliers. This vertical relationship is probably essential for long term stability and planning. The wood processors in categories seven to nine above tend to have much less developed vertical relationships. There are several reasons for this:

- Under-capacity - the mills are too small to service the larger orders.
- Under-capitalisation - a large job may be profitable but without sufficient working capital a small firm will be unable to undertake it.
- Poor marketing - many small firms do not have the time or skills required.
- A desire to preserve the maximum amount of flexibility and independence.

Allied to these internal difficulties are the following external issues:

- Softwood processors, historically, have had a raw material supply underpinned by the large Forest Enterprise estate. Broadleaf ownership is much more fragmented with no equivalent market support for the hardwood industry in the UK.
- The roundwood supplies accessed by the smaller mills are adhoc and fragmented. Most of the larger parcels of native hardwood timber are exported to England for processing.
- The secondary processing sector is poorly developed in Scotland. The few existing firms have no tradition of using Scottish timber.

The secondary processors that exist in the highlands are typically joinery shops, cabinet makers and craft businesses utilising limited quantities of high grade timber. Such firms offer few additional opportunities for developing native timber utilisation because:

- Many firms rely solely upon imported

timber;

- Smaller firms utilise very low volumes of timber and tend to have very limited capacity for growth. Often this is because they are focused upon supporting a lifestyle rather than creating a market driven business.

Taken together these constraints mean that the categories of smaller wood processors have severe limitations upon the amount of native timber they can utilise. Any growth would be dependant upon these constraints being overcome. In this context two recent developments are worth highlighting:

- The establishment of industry wide market development initiatives such as the Scottish Hardwood Timber Market Development Group and the Forest Industries Cluster group which are attempting to address many of the issues discussed in this section.
- The increasing interest in horizontal and vertical integration amongst some of the small sawmills in Scotland. This includes both co-operative arrangements, for example in marketing or timber sourcing, and increasing links with downstream specifiers and secondary processors.

While it is too early yet to assess the success of such initiatives it is clear that they offer the best prospects for improving the utilisation of native timber in the highlands and in Scotland as a whole.

FUTURE PROSPECTS FOR NATIVE TIMBER UTILISATION AND PRODUCTION IN THE HIGHLANDS

Argyll

Utilisation issues

It is clear that the native woodland resource in Argyll offers relatively limited development opportunities as assessed from the current condition and opportunities given on pages 10 & 11. The long term sustainable annual production is likely to be limited to about 1,000 m³ of oak and birch sawlogs. Add to this the modest resource of mature standing oak available for harvest in the shorter term and the likely viable manufacturing options are:

- at best: **Category 8 - small-scale processing of mid grade timber**
- or more likely: **Category 9 - small-scale use of very low grade logs**

The main local utilisation opportunities are:

- Continued small-scale harvesting of sawlogs with most of the timber exported out of the area for processing.
- A mobile sawmill producing small amounts of sawn hardwoods for local markets.
- Outdoor landscaping products such as bollards and signs made from poor quality oak sawlogs. With appropriate design and marketing this might be a profitable venture.
- A small-scale manufacturing business such as a flooring mill using both hardwoods and softwoods. However, such a mill would require a roundwood intake of at least 3000 m³ annually in order to be viable. This is an unlikely prospect in the near future unless additional timber was imported into the region.
- A fuelwood business using both native

hardwoods and introduced conifers. This has considerable potential if developed at an appropriate scale, and could be a key use for the downy birch resource.

- It may also be possible to develop a few non-timber businesses, such as charcoal or Shiitake mushrooms production, each with an annual consumption of around 50 m³ of oak or birch small roundwood .

Production issues

If utilisation of Argyll's native woodlands is ever to move beyond the limited scale outlined above, it is clear that a substantial and sustained woodland management commitment is required. In the short term the most likely prospect is the production of small volumes of hardwood as a by-product of conservation management, mainly from thinnings and small felling coupes designed to break up the age structure and encourage regeneration. Such management could be developed by the public agencies with a view to demonstrating its feasibility to private owners. Critically, the predominance of older age classes in the current oak crop, whilst contributing considerable volumes of standing timber, also indicates the lack of longer term sustainability of supply.

Ideally, a rate of harvesting and woodland expansion needs to be encouraged on some of the more easily harvestable sites which would lead, to the progressive restructuring of the woodlands to include a full range of age classes. This could, however, only be implemented as part of a much wider management strategy which considered the sustainability of the full resource. If this were to happen it is conceivable that the harvesting of oak in Argyll could potentially increase in the short term as a by-product of restructuring these woodlands.

However, in the interests of sustainability, the timber harvest would, in time, have to decrease again as the oakwoods developed a more normal age structure. This implies that any harvesting or utilisation business developed would need to take account of a variable oak supply from the outset.

It is probable that significant native timber utilisation opportunities may exist where native broadleaves have regenerated within conifer plantations. This raises the question as to what should happen to conifer plantations at the end of the current rotation. It is likely that as these plantations are felled and restocked, birch will establish and, if left, form variable proportions of the canopy. It would appear that properly managed birch in conifer plantations has the potential to produce reasonable timber that could be an important component of the total native woodland resource. It is thus important that consideration is given as to how this opportunity is realised through, for example appropriate thinning or perhaps no-cleaning regimes.

North west Sutherland

Utilisation issues

Given this area's poor resource quality and exceptionally poor infrastructure and remoteness, then the local timber utilisation potential is clearly severely constrained. In terms of the nine categories of manufacturing options given in table 5 above, north west Sutherland is certainly limited to:

Category 9 - Small-scale use of very low grade logs

Thus the current utilisation for firewood and occasional craft item manufacture probably represents best practice for the foreseeable future. Other opportunities might include:

- Pine sawlog export, particularly in combination with exotic sawlogs, may occasionally be viable providing sufficient volumes were available. Given the remoteness of the area there is no scope to export birch sawlogs for processing. Local processing will certainly have to be based on a mobile saw transported into the area from outside. Given the

low volumes of timber available there is no potential to sustain such an operation within the area.

- There may be potential to improve the local fuelwood markets through better management of the existing timber resource, coupled with effective product marketing.
- Craft use of downy birch and alder could also potentially be increased if it were possible to generate a continuous supply of suitable timber. The volumes required need not be large but any small manufacturer would need to be confident that, if they created a market for say 1 m³ per week, the timber supply would be there on a regular and sustained basis. High quality woodturning is an example of the type of business that might perhaps be viable.
- Producing wood-chips for cattle bedding may be possible on a small-scale, although the economic viability of such an approach is, as yet, unproven.
- Wood-chips could also be used for heating providing a critical mass of infrastructure and a sufficient market could be developed.
- Pole buildings for use on farms or estates are certainly feasible in the area although this would never have much prospect of becoming even a part time business.
- On a very speculative note the establishment of a small-scale electricity generation plant consuming around 500 m³ of timber per annum may perhaps be feasible in the longer term. There would be few timber supply constraints providing that the large resource of low grade exotic conifers are also included as part of the feedstock.

Production issues

Downy birch in north west Sutherland probably grows at about Yield Class 4 and is capable of a mean annual production of about 2.2 m³ per hectare taking account of the limitations on productivity as outlined on pages 12 & 13. Alder in the north west probably grows slightly faster at around Yield Class 5 to 6. However, given the greater limitations upon harvesting that apply when utilising wet woodlands, the mean annual production would probably be similar to downy birch.

Given this low level of productivity and the parlous state of much of the resource, sustainable production on any scale is inconceivable. As with Argyll, it is clear that a substantial and sustained woodland management commitment is required if the existing native woodlands are ever to be brought to the level of providing the basis for sustainable local industry. Along with this management commitment a detailed ownership and condition inventory would be required in order to begin the production planning needed to ensure continuity of supply. Again, as with Argyll, the potential role of birch in the next rotation of conifer plantations should be considered.

Badenoch and Strathspey

Utilisation issues

In terms of the matrix of manufacturing options given in figure 6, Badenoch and Strathspey has few to moderate constraints. Depending upon future resource quality and availability the opportunities could be characterised as:

Categories 2 or 5 – mid to large scale processing of mid quality logs
along with:

Category 3 – Large-scale processing of low grade timber

This provides the wood processing industry with a range of manufacturing opportunities including:

- Continuation and possibly growth of the existing mix of large softwood sawmills and panel product manufacture.
- Market profiling of Scots pine in order to differentiate it from the more common spruce timber. This type of market differentiation would require specialist diversification, probably of a large mainstream sawmill, to allow the better logs to be graded out and separately processed for these markets. In addition to the sawmill, secondary processors would be needed to produce the finished product. Products might include low volume laminated furniture, although, given the seasonality of pine sawlog harvesting, continuity of supply is the biggest challenge facing such an operation. Alternatively, premium brand decking has a seasonal, spring/summer market where

felling and processing can all be undertaken during the autumn, winter or early spring.

- Firewood or small-scale bio-energy markets also present development potential, particularly given the proximity of population centres such as Nairn, Elgin, and Inverness.

If some of the hardwood resource in Strathspey and the surrounding region could be brought into management for timber production then a small hardwood flooring factory typifies the type of business which could successfully add value to small volumes of medium to high grade oak and birch sawlogs. A small flooring factory buying in sawn boards and selling finished flooring at trade prices would require an investment in the region of £100,000 on plant and working capital, assuming some equipment was purchased second hand. In order to be viable such an operation would require access to over 3,000 m³ of roundwood per annum. Only a proportion of this could originate in Strathspey and such a development would need to import timber from out with the area, such as Moray and Grampian where feedstock could be supplied at economic haulage rates.

Production issues

Supplies of Scottish timber are set to double over the next 20 years, dropping back to today's level 50 years ahead (FICGB 1998). Given recent woodland establishment trends a much larger percentage of this future volume will consist of Scots pine than at present. In principle, therefore, Scots pine could supply all of the timber required by a medium-scale sawmill. However, the pine currently being established often has conservation as the primary objective and thus its potential timber quality may be questionable. If even a part of the future mainstream sawmilling industry is ever to use Scots pine as its principal raw material then management for timber quality is an urgent priority. The same requirements pertain to the hardwood resource in the Strath, where the constraints to be overcome are demonstrably greater.

FINDINGS AND PROPOSALS

A number of key findings have emerged from this review and these, with the suggested proposals for action, can be summarised as follows:

In all three case study areas woodland management issues emerge as the key constraint facing any proposal to increase the utilisation of native woodlands. Much of the resource is in a relatively fragile and over-mature state and there is at present little prospect of continuity of timber supply over the medium to long term. The future economic benefits of these woods depend to a large extent upon the public agencies perception of the potential and their willingness to engage with the problem. Therefore we suggest that:

- ⇒ **with some urgency, public agencies define what rural development benefits they wish to achieve from a future healthy, sustainable native woodland based timber resource and how these are to be achieved, for example through integrated incentive schemes and regulations.**

The report has identified that there are often large disparities between woodland management outputs and downstream market requirements. Local economic benefit will be maximized where production and utilisation are in tune with each other, and it is suggested that:

- ⇒ **silvicultural systems are adopted which best fit the local market requirements for regular timber production at an appropriate scale.**
- ⇒ **support is provided for timber utilisation ventures which are developed to cope with wide variations in quality and quantity of raw material supply. In practise this may mean supplementing the local native supply with non-native and imported timber.**

Although high quality woodland inventory information is now being made available, it is clear from this report that there is little quantified data on timber in the current or emerging woodland resource. Key gaps include very remote areas such as north west Sutherland or isolated areas of native broadleaf timber growing within conifer stands. We suggest that:

- ⇒ **detailed woodland resource and timber quality assessments are undertaken of the main commercial native woodland species in semi-natural woodland and within non-native plantations.**

The report has argued that harvesting sustainable amounts of timber from designated sites can be compatible with best practise conservation management, particularly when encompassed within a strategic plan for a wider forest area. The development of this approach would provide considerable opportunity to demonstrate the integration of economic and conservation objectives to the benefit of small local wood using industry, and improve the image of conservation as a benefit to rural development. We suggest that:

- ⇒ **public agencies take the lead in developing strategic area plans for the sustainable harvest of timber from native woodland, including designated sites. Such management should be implemented on agency owned designated sites and promoted as best practise exemplars to private woodland owners.**

Few recent planting schemes have been designed with the objective of timber production. The report predicts that this will severely restrict future timber utilisation options and so we suggest that:

- ⇒ **the current designs for new and existing woodlands should be reviewed to ensure that appropriate priority is given to native timber production on suitable sites.**

A number of opportunities for increasing the local use of native timber, often in conjunction with the use of exotic conifers, have been identified in this report. In order for them to be realised we suggest that:

- ⇒ **support be made available for rural communities wishing to develop small scale utilisation of local native and exotic conifer timber resources, through demonstration, advice and funding.**

Fuelwood markets are the largest development opportunity for the high volumes of very low grade timber. But, they are dependent on the establishment of a critical mass of infrastructure and to facilitate this we would suggest that:

- ⇒ **well targeted promotion of fuelwood, through demonstration, advice and funding, should be undertaken**

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APPENDIX 1

POTENTIAL TIMBER PRODUCTION IN NATIVE WOODLANDS

Production estimates from native species plantations

Current inventory data for native woodlands tends to provide estimates of area and does not usually include values for standing volume, timber increment or quality. Estimates of timber volumes can be made by combining such inventory data with information from Forestry Commission Yield Models. However, these Models give estimates based on plantations managed solely for timber and in order to provide meaningful information for other types of woodland, considerable reductions in both the quantity and quality of timber have to be made. The process adopted for estimating timber production from native species plantation were as follows:

- Estimates of felling and thinning volumes per hectare for the relevant species were made using Forestry Commission Yield Models, assuming a number of different scenarios for yield class and rotation length. Volumes were allocated to:
 - a. large saw logs (>24 cm top diameter)
 - b. small sawlogs and roundwood (diameters between 7 and 24 cm).
- These volumes were reduced to take account of the impact of compliance with Forestry Commission Forest Standard, and other regulations, in the form of unproductive forest areas, such as open space, long term retentions, non-productive species. This converts the estimates of timber output to those applicable to gross areas of woodland. For example, in an oak wood of Yield Class (YC) 4, on a 90 year rotation the timber production in a stand of trees is 302 m³ per hectare,

but when open space is taken into account the volume for the woodland as a whole drops to 212 m³.

- In oak, the timber volumes of large sawlogs were reduced to take account of timber defects (shake).
- The allocation of large sawlogs to different product categories was estimated. In oak this means high quality sawlogs, fencing / beam logs and chockwood. These subdivisions allow the total volume production per hectare per rotation in the different log categories to be estimated for different YC (see table 6).
- Mean annual timber production, of each product, over the rotation was then estimated by dividing the volumes per hectare by the rotation lengths (see table 7).
- The gross woodland area necessary to produce 100 m³ per year of the different product categories was then estimated (see table 7).

For these procedures described above, the following **assumptions** were made:

Rotation length: Two scenarios were considered:

- Woods are felled on average at the age of maximum mean annual increment (R_{max}). This maximises wood production and is rather later than felling ages determined by maximising discounted economic returns to the owner.
- Woods are felled at R_{max} plus 30 years to take account of likelihood of extended rotations (R_{+30}). This is limited to a maximum of 100 years for pine as this is the maximum value given in yield tables.

Table 6. Timber production (in m³) at various growth rates (YC = yield Class) over the rotation for native species plantations of oak, birch and pine.

Rotation length	Oak YC 4		Oak YC 6		Birch YC 6		Scots Pine YC 8		SOURCE
	R _{max} 90 yr	R ₊₃₀ 120 yr	R _{max} 80 yr	R ₊₃₀ 110 yr	R _{max} 45 yr	R ₊₃₀ 75 yr	R _{max} 75 yr	R ₊₃₀ 100 yr	
Fellings									
> 24 cm top	100	155	155	215	35	120	170	256	FC Production forecast felling yields
7-24 cm top	70	25	60	20	95	55	110	70	
Thinnings									
> 24 cm top	4	37	13	84	1	20	18	76	FC Production forecast thinning yields
7-24 cm top	128	167	167	204	89	160	198	240	
Total									
> 24 cm top	104	192	163	299	36	140	178	332	
7-24 cm top	198	192	227	220	184	215	308	360	
Adjustment for non-productive forest areas (open space) (- 30%)									
> 24 cm top	73	134	114	209	25	98	125	232	
7-24 cm top	139	134	159	154	129	150	216	252	
Further adjustment for Shake (oak) (- 20%)									
> 24 cm top	58	107	91	167	Highland Birchwoods				
7-24 cm top	154	161	182	196					
Breakdown by category									
Sawlog	12	21	18	33	Note that small roundwood includes small sawlogs.				
Fencing & Beams	20	37	32	58					
Chockwood	26	49	41	75					
<i>All large logs</i>	58	107	91	167					
Small roundwood & firewood	154	161	182	196					

Non-productive area: The following allowances are made for non-productive areas in the plantations:

- the standard 15% for roads, rides, riparian strips, turning places etc
- 10% for other open space
- 5% for other non-productive tree species and felling retentions etc

Average Yield Class: The following scenarios for average yield classes (maximum mean annual increment in m³/ha/yr) are used:

- Oak: Yield Classes 4 and 6;
- Scots pine: Yield Classes 8;
- Birch: Yield Class 6.

Note: no estimate was included for the volume

of branch wood suitable for fuelwood.

Minimum log lengths: A conventional minimum log length of 1.3 m is assumed in volume estimates in Forestry Commission yield tables. Longer logs would tend to reduce outturn as a result of increased wastage at conversion.

Timber quality: The following assumptions are made about timber defects in sawlog material:

- **Oak**
Shake and other defects effects 20% of oak sawlog material; this quantity is assumed to be firewood/pulp. Estimates of the volume of different categories of sawlog were derived from relative values given on page 13. The breakdown

Table 7. Potential mean annual production (m³) of different products from native species plantations and the areas required to produce 100 m³ of those products annually.

Rotation length	Oak YC 4		Oak YC 6		Birch YC 6		Pine YC 8	
	90 yr	120 yr	80 yr	110 yr	45 yr	75 yr	75 yr	100 yr
Mean annual production (m ³) of good sawlogs >24 cm top.	0.13	0.17	0.22	0.30				
Mean annual production (m ³) of all sawlogs >24 cm top.	0.64	0.89	1.14	1.52	0.56	1.31	1.67	2.32
Mean annual production (m ³) of small roundwood, fuelwood (7-24 cm).	1.71	1.34	2.28	1.78	2.87	2.0	2.88	3.6
Area (ha) required per 100 m ³ good sawlogs >24 cm top annually.	769	571	444	333				
Area (ha) required per 100 m ³ all sawlogs >24 cm top annually.	156	112	131	121	180	76	60	40
Area required for 100 m ³ small roundwood, firewood (7-24 cm) annually.	58	75	44	56	35	50	35	28

was assumed to be:

- 20% sawlog grade
- 35% beam & fencing grade
- 45% chockwood grade

- **Scots pine**

As indicated in table 3, page 15, Forest Enterprise estimate that a typical post war plantation of Scots Pine in Strathspey yields, at present:

- 11% Red logs
- 32% Green logs
- 15% Pallet
- 42% Small roundwood

- **Birch**

Most of the birch in the study areas is downy birch or, in the eastern part of Strathspey, unmanaged silver birch. In either case the quality will be generally poor and at best variable. There will be a negligible proportion of conventional sawlog material and birch in the study areas is thus conventionally graded as chipwood or firewood. That being said 15-25% of the volume of most chipwood stacks is of a quality suitable for conversion on a double slabber type sawmill.

Timber production estimates

Table 7 shows that the mean annual production of all grades of large sawlog for the three species

range from 0.64–1.52 m³/ha/yr for oak, to 0.56-1.31 m³/ha/yr for birch and 1.67-2.32 m³/ha/yr for pine. The equivalent woodland areas to produce 100 m³ annually of large sawlogs (all categories) range from about 40-60 ha for pine up to 112-156 ha for oak. The equivalent areas for producing 100 m³ of good quality oak sawlogs annually range from 333 –769 ha. The areas required to produce 100 m³ of small roundwood and firewood (i.e. assortments under 24 cm top diameter, assuming that larger material is used for sawlogs) range from 28 ha for pine to 35 ha for birch, and 44 ha for oak.

Factors affecting the reliability of estimates

The estimates in table 6 are based on plantations which comply with both the Forestry Commission yield tables and with modern standards (i.e. in terms of non-productive area). The figures for pine at R_{max} give a reasonably realistic picture of current output in pine plantations in Strathspey, the majority of which are managed for timber production. However, as outlined below, the figures would provide overestimates of timber production for semi-natural pinewoods and new native woodland. Similarly, the figures for oak give a reasonable reflection of those sites which are fully stocked and well managed, but will overestimate the outturn of sawlogs from both poorly stocked and overstocked woods. The figures for birch overestimate the production of

birch sawlogs because of the ubiquitous poor past management of birch woodland.

Estimates of potential timber production from existing Argyll oak and birch

- The Caledonian Partnership inventory (see figure 1, page 11) provides values of area for oak and birch in Argyll, derived from a 21% sample of the resource (i.e. 21% by area of woodlands), broken down by diameter at breast height (DBH) and stocking (stems per hectare). As noted this inventory did not sample isolated semi-natural woodland within conifer stands and so it may under-represent the volume and quality of the total resource. Timber volume estimates were then measured from a sample of these woodlands (see figure 6, opposite).
- Estimates of the proportion of “utilisable” woodlands and those which are potentially “accessible” were then made using the Caledonian Partnership inventory woods where “access and terrain condition” was ascribed “F” (i.e.: terrain Class 3.4.3 or better, a lorry loading point within 500 m of the woodland boundary and a machine track to the wood). From this information it is estimated that about 20% of the whole woodland resource appears to be relatively easily harvestable.

The average long term timber outturn from the “accessible” woodlands can be calculated by multiplying the area estimates in figure 6 with the annual volume production estimates in table 7. For example, this suggests an *average* long term production of all sawlogs from these woodlands of approximately 704-1672 m³ for oak and 470-1346 m³ for birch. (1100ha x 0.64 m³/yr - 1100ha x 1.52 m³/yr, 850ha x 0.56 m³/yr - 850ha x 2.32 m³/yr). Obviously these estimates would vary from year to year according to the pattern of felling and restocking.

Factors affecting reliability of estimates

Feasibility of harvesting

It should be noted that the assessment of whether woodlands are “accessible” does *not* take account of limitations due to statutory designations or owner attitudes. Any reductions due to these factors may be off set to some extent by the fact that a proportion of those woods regarded as being un-harvestable (80% of the total) could be made accessible by some access works or by using appropriate machinery.

Timber quality

For oak, the breakdown figures given for each log category (table 6, page 36) are based on samples of timber regarded as above average for Argyll. For the resource as a whole the proportion of good sawlogs may be rather lower.

The timber quality of birch in Argyll is so low that effectively no production of conventional sawlogs is considered likely. The entire volume estimated above is regarded as potentially suitable only for lower value end uses.

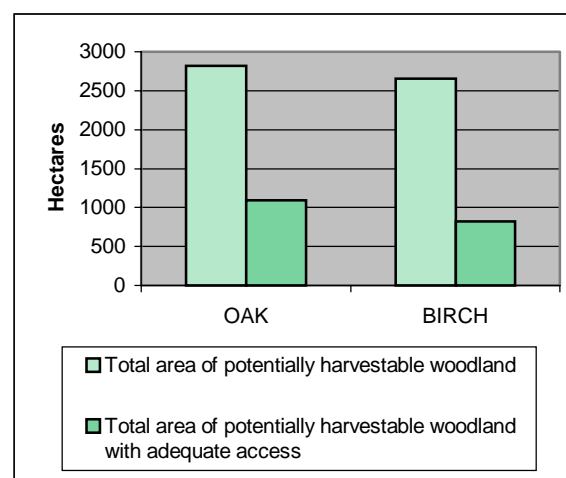


Figure 6. Areas of potentially harvestable oak and silver birch woodland in Argyll.

Highland Birchwoods is grateful to the following organisations for their support for the Millennium Forest for Scotland project, the Native Woodland Demonstration Programme.



The project was part funded by the European Agricultural Guidance and Guarantee Fund under the Highlands & Islands Partnership Programme



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