

# ***Scots Pine Timber Quality in North Scotland: Market Requirements and Resource Availability***



## ***Task 1: Survey of Current Utilisation of Scots pine***

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## EXECUTIVE SUMMARY

1. This report is the first output of the partnership project "Scots Pine Timber Quality in North Scotland: Market Requirements and Resource Availability".
2. The objective of Task 1 of the project, covered by this report, was to complete an analysis of the current utilisation of Scots pine timber harvested in North Scotland, identifying where it is processed, current end-uses and the timber quality requirements for different markets.
3. Three questionnaires, aimed respectively at growers, processors and end-use manufacturers, were distributed to 68 companies and forest owners during 2006.
4. Responses were received from 5 Forestry Commission Scotland Forest Districts, 20 private sector forest owners, 6 processing companies and 5 end-product manufacturers. The overall response rate was 52%.
5. Responses from forest owners/growers covered 57,766 ha of Scots pine forests, 53% of the area of Scots pine forest reported in the National Inventory of Woodlands.
6. Results of the growers' questionnaire indicated that the average age of 1<sup>st</sup> thinning for Scots pine was 30 years, that the split between clearfell and Continuous Cover Forestry (CCF) was 43%:57% and that the average age at clearfell was 62 years.
7. Respondents to the growers' questionnaire reported that just under 207000 m<sup>3</sup> of Scots pine timber was harvested during 2005. This compares to 325600 m<sup>3</sup> reported as having been processed in the processors' questionnaire and the forecast availability for the study area of 505000m<sup>3</sup>.
8. 50% of the timber harvested was processed into a panel board product, with a further 40% processed for agricultural and domestic fencing.
9. 60% of the volume of Scots pine sawn timber and timber products was sold through timber merchants, builders' merchants and DIY chains.
10. Key timber quality criteria for Scots pine logs were identified by growers and processors as bluestain, straightness, knottiness and size. Ovality, taper and crop uniformity were also judged to be important.
11. Concerns about quality were focused on variability and the inability to predict internal characteristics. Black knots were seen as a major defect. Task 2 of this project is aimed at developing techniques to assess timber quality in standing trees.
12. A number of companies currently manufacture specialist construction and joinery products from home-grown timber, generally using Douglas fir and larch. There is a potential to develop these higher value markets to use Scots pine, which will be explored in Task 4 of this project.

## **INTRODUCTION**

This report is the first output of the partnership project “Scots Pine Timber Quality in North Scotland<sup>1</sup>: Market Requirements and Resource Availability”. The overall aim of the project is to increase the value to the rural economy of the Scots pine resource by evaluating the sustainability of the current utilisation, the potential for higher value end-products and the identification of opportunities for adding value locally.

Scots pine is the only timber producing conifer species that is native to Scotland. Almost 80% of the total area of Scots pine high forest in Scotland lies in the Highland and Grampian conservancy areas. The effective management of this resource to deliver the wide range of benefits that are increasingly expected from forests is therefore of particular importance in these areas. Timber production from Scots pine forests provides important economic benefits to North Scotland as a major element of the forestry and wood processing industries.

The objective of Task 1 of the project, covered by this report, was to complete an analysis of the current utilisation of Scots pine timber harvested in North Scotland, identifying where it is processed, current end-uses and the timber quality requirements for different markets. The aim was to collect information from representative sources regarding the management of Scots pine forests, the volumes of Scots pine timber being harvested from Forestry Commission Scotland forests (i.e. the National Forest Estate) and private sources, the volumes of Scots pine timber being processed in primary processing facilities, the utilisation of Scots pine timber by end-product manufacturers and the timber quality criteria of importance at each stage. This information will be used in subsequent parts of the project to define the key timber quality attributes to be evaluated in resource assessments and to inform market development strategies.

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<sup>1</sup> North Scotland is here defined as the areas lying within the boundaries of Forestry Commission Scotland’s Grampian and Highland Conservancies.

## **METHODOLOGY**

Three questionnaires, aimed respectively at growers, processors and end-use manufacturers, were compiled to collect information about Scots pine management, timber production, processing and utilisation. Guidance on the content and format of the questionnaires was provided by the project steering group, composed of industry and funding body representatives. Information regarding timber harvested, processed and used during the calendar year 2005 was sought. The full questionnaires used in the survey can be found in Appendices 1 - 3 of this report.

In conjunction with the steering group a list of growers (both Forestry Commission Scotland (FCS) Forest Districts and private sector owners), processors and end-use manufacturers was drawn up. The first round of questionnaires was distributed by post in March 2006. Questionnaires were sent to 5 FCS Forest Districts, 15 private estate owners/managers, 15 sawmilling/processing companies and 13 end-product manufacturers. A further set of questionnaires was sent by e-mail to more 20 more private sector growers (or their agents) in September 2006. A combination of e-mail and telephone reminders was used to follow-up the questionnaires and seek responses up until the end of December 2006.

To supplement the information collected from the questionnaires a number of visits to end-product manufacturers was made, during which information relating to their use of Scots pine and their views on market development for Scots pine were sought. The companies visited were Russwood Ltd, Treecraft Woodwork Ltd, Norbuild, Deeside Timberframe Ltd and Northwoods Construction.

To provide information about the forecast trend in Scots pine timber availability in the study area a "Softwood Availability Forecast" for Grampian and Highland areas, identifying volumes of Scots pine, was run for both the private sector and FCS ownerships, by the Forestry Commission Production Forecasting Team, using the methods described by Halsall *et al.* (2006).

## RESULTS

### Response Rate

From the 40 growers' questionnaires sent out, 20 completed questionnaires for private sector forests and 5 from FC Forest Districts were received, representing an overall response rate of 62% (57% amongst private sector growers and 100% for FCS ownership). Amongst the processors, replies were received from 6 companies, a response rate of 40%. From the 6 processing companies that responded, questionnaires relating to a total of 10 sites were received, representing the majority of the large processing facilities in the study area. 5 completed end-users' questionnaires were received, a response rate of 38% (in addition information about quantities of timber used by one company was obtained during a follow-up interview). These response rates compare quite favourably with those obtained from other (mainly larger) surveys in the forestry and wood-using sectors, e.g. 52% for the 2000 Sawmill Survey (Balachandran and Henderson, 2001), 28% for the 2004 Survey of Business Health in the Forestry and Wood Industries (Forestry Commission, 2005), and 25% for a survey of builders' attitudes to domestic floor construction methods (Whale, 2002).

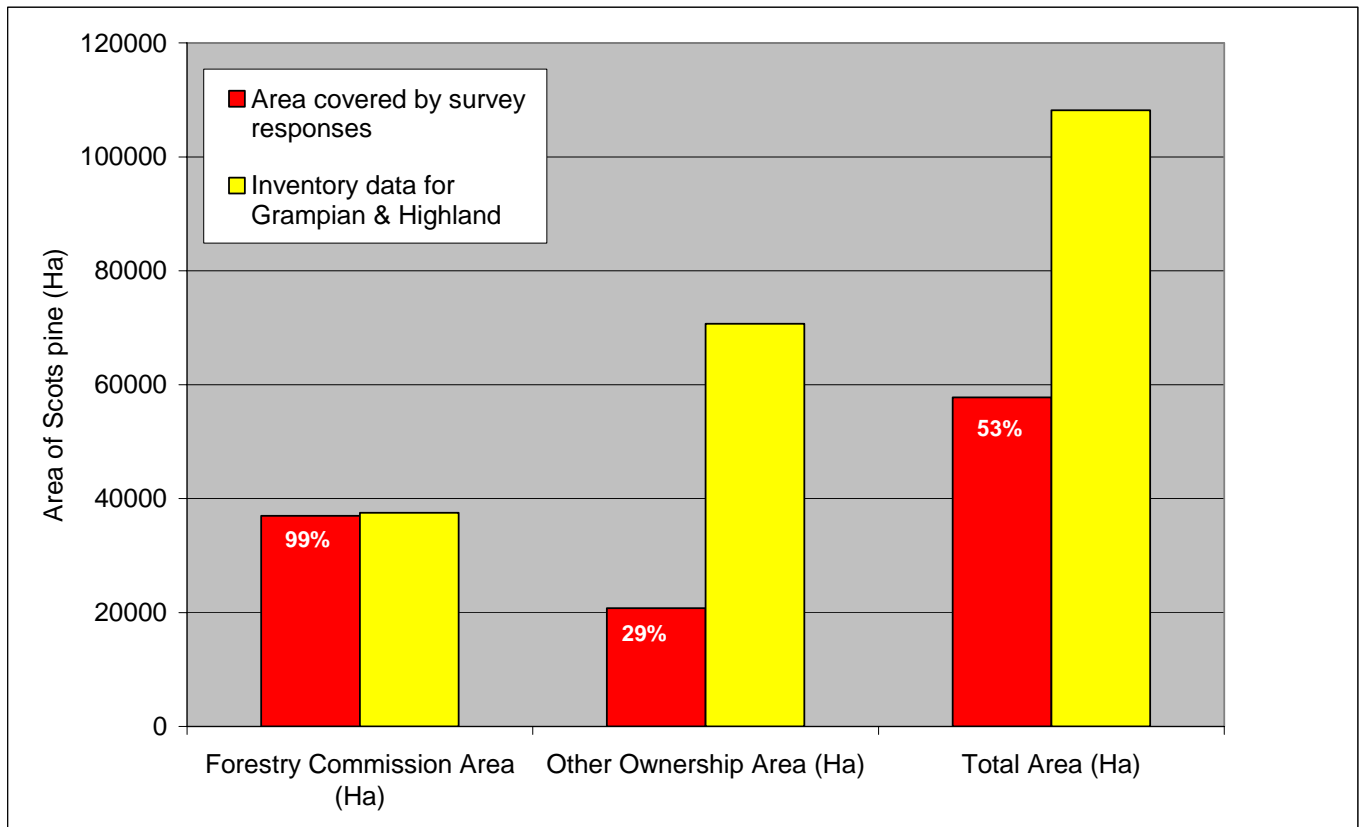
The full results for each part of the three questionnaires are summarised in Appendices 4 – 6 of this report. The main findings of the survey are presented below.

### Area of Scots pine

The area of Scots pine forest covered by the responses to the growers' questionnaires totalled 57,766 ha (Table 1, Figure 1). This represented 53% of the Scots pine high forest area reported in the National Inventory of Woodlands for Grampian and Highland (Forestry Commission, 1997, 2001). There was a wide disparity between the proportions of the National Forest Estate Scots pine forest covered by the survey responses (99% of area in National Inventory area) compared to other ownerships (29% of National Inventory area).

**Table 1: Areas of Scots pine forest covered by responses to Growers' Questionnaire, compared with National Inventory data for Scots pine high forest**

	Forestry Commission Area (Ha)	Other ownership Area (Ha)	Total Area (Ha)	% of Total
Scots pine in pure stands – survey data	25082	17214	42296	73%
Scots pine growing in mixtures – survey data	11903	3567	15470	27%
<b>Total Scots pine area – survey data</b>	<b>36985</b>	<b>20781</b>	<b>57766</b>	
% of Total Area in Survey Responses	64%	36%		
<b>Inventory data for Grampian &amp; Highland</b>	<b>37500</b>	<b>70694</b>	<b>108194</b>	
% of Total Area in Inventory	35%	65%		
Proportion of Scots pine area in National Inventory covered by survey	<b>99%</b>	<b>29%</b>	<b>53%</b>	



**Figure 1: Area of Scots pine forest covered by survey responses in relation to area of Scots pine in National Inventory**

### Scots pine management

Questions 5 – 9 of the growers' questionnaire related to the silvicultural management of Scots pine forests. 21% of the area covered by the survey was designated as “no-thin”. The age of first thinning ranged from 20 – 43 years, with an average first thinning age of 30 years (weighted by area). The most widely cited criteria used to decide when first thinning should take place were those relating to tree size, i.e. basal area, top height and age. Economic criteria were also important to many respondents, expressed as merchantable volume, harvesting costs and net return.

43% of the Scots pine area was reported as being managed under a clearfell system, with 57% managed under Continuous Cover Forestry (CCF) systems or other non-clearfell approaches. In the National Forest Estate the split between clearfell and CCF was 50:50, compared to a figure of 32:68 for other ownerships.

The average age for clearfelling of Scots pine was 62 years (57 years for the National Forest Estate and 74 years for other ownerships), with rotation lengths ranging from 53 years to 110 years. When asked what respondents expected to be the age of the oldest trees in CCF systems, the average age was 128 years (120 years for the National Forest Estate and 145 for other ownerships).

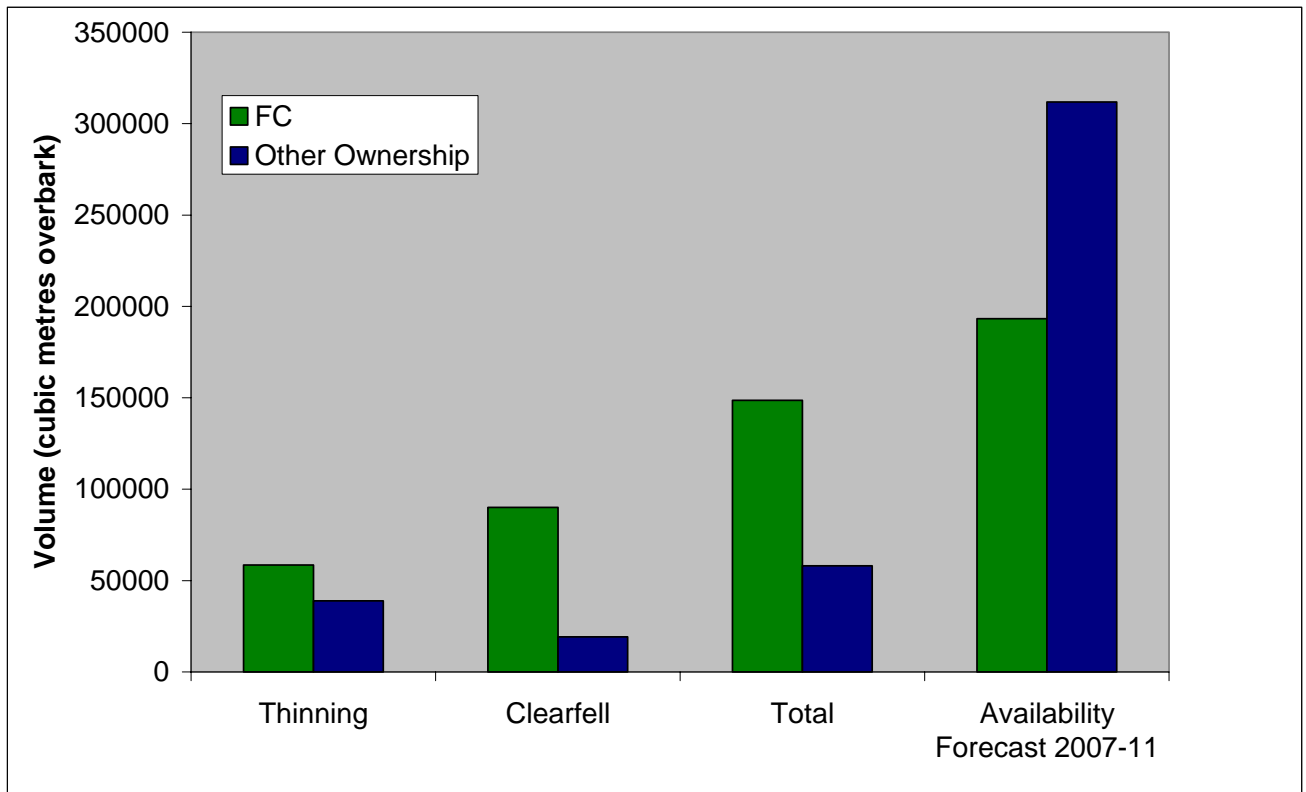
## Scots pine timber production

When asked about restriction of felling to specific times of the year responses showed that almost 90% of the volume of Scots pine timber harvested in the study area comes from forest districts or estates where harvesting takes place all year. Where felling was restricted the reasons given included winter production to minimise development of bluestain, avoiding spring because of Capercaillie breeding and summer/autumn working to minimise site and road damage and meet market demands.

A total of 206683 cubic metres overbark (m3 ob) were reported by respondents as having been harvested in the study area during the year 1st January – 31st December 2005 (Table 2, Figure 2). 47% of the volume was from thinning and 53% from clearfell. 72% of the volume was harvested from the National Forest Estate forests, with 28% from other ownerships: these proportions were broadly in line with the relative areas within each ownership type covered by the survey. Comparing the volumes harvested with the forecast availability of Scots pine (after Halsall et al. 2006) it can be seen that the quantity covered by this survey just over 40% of the estimated average annual availability. For the Forestry Commission Scotland ownership this amount harvested is closer to the estimated availability (77% of availability forecast) than for other ownerships (19% of availability forecast). The proportion of the total volume harvested that came from FCS ownership (72%) was considerably higher than that estimated in the availability forecast (38%).

**Table 2: Volumes of Scots pine timber harvested during 2005 from forests covered by Growers' Questionnaire**

	Volume of Scots pine timber harvested during 2005				Forecast annual availability of Scots pine for period 2007-11		Volume reported in survey as % of forecast availability
	Thinning Volume (m3 ob)	Clearfell Volume (m3 ob)	Total Volume (m3 ob)	% by ownership	Total Volume (m3 ob)	% by ownership	
FC	58554	90077	148631	72%	193250	38%	77%
Other Ownersh	38889	19163	58052	28%	311750	62%	19%
<b>TOTAL</b>	<b>97443</b>	<b>109240</b>	<b>206683</b>		<b>505000</b>		<b>41%</b>



**Figure 2: Volume of timber harvested during 2005 from forests covered by survey Scots pine timber processing**

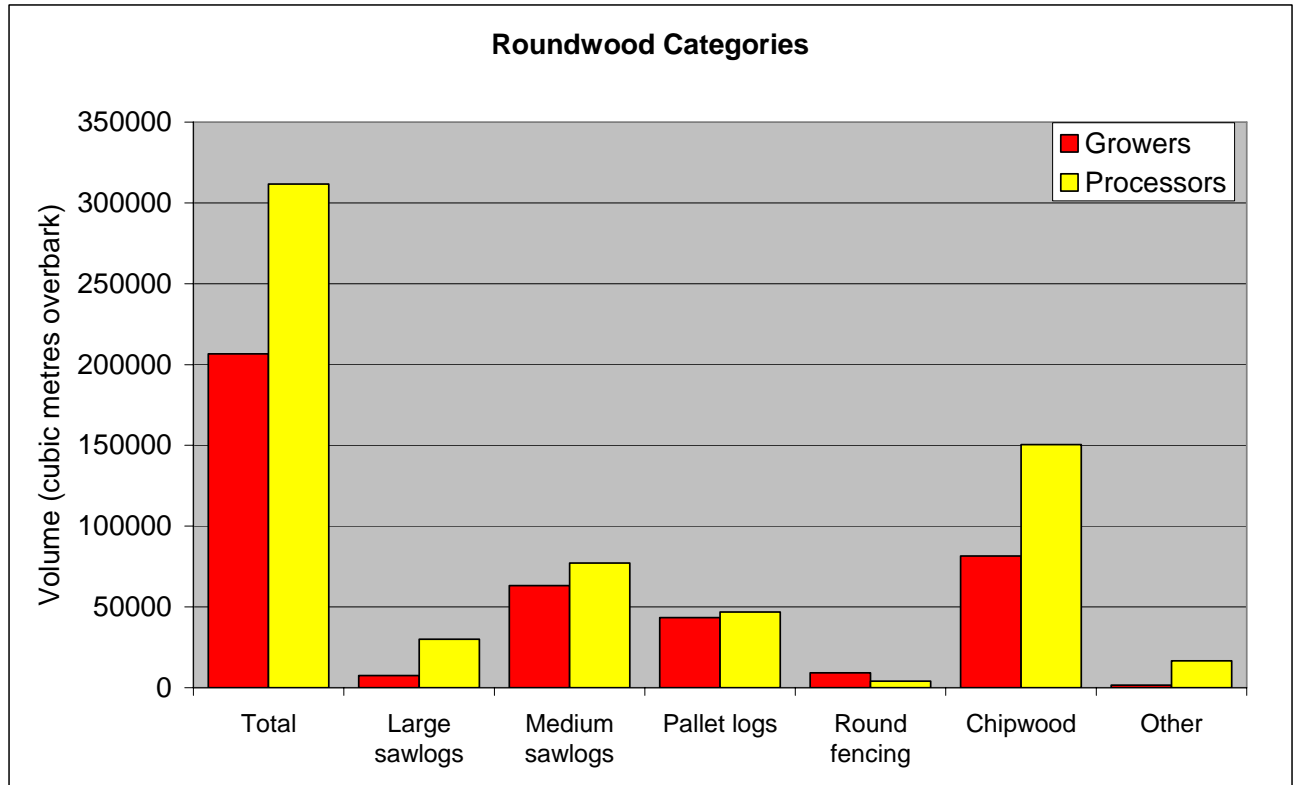
Growers were asked about the method of sale used to market their timber, about transport distances to processing facilities and about the type of processing facility to which timber was sent (Table 3). The majority of timber was sold by standing sale. Almost 80% was transported less than 50 miles for processing, with less than 1% being transported more than 100 miles. Approximately half of the timber was processed in large sawmills, with a further 40% processed in a panel board mill.

**Table 3: Harvested volume broken down by method of sale, transport distances to processing facility and types of processing facility, from growers' questionnaire**

Method of Sale		Transport Distance to Processing Facility		Type of Processing facility	
Standing sale	69%	< 50 miles	88.8%	Large sawmill	49.1%
Roadside sale	15%	50-100 miles	10.6%	Medium sawmill	8.3%
Delivered in	16%	>100 miles	0.6%	Small sawmill	0.1%
				Panel board mill	42.5%

Processors reported that they processed a total of 325600 m<sup>3</sup> of Scots pine timber during 2005. This is 57% more than the 206683 m<sup>3</sup> reported as harvested by respondents to the growers' questionnaire, and 64% of the estimated average annual volume forecast as being available within the study area. 97% was processed in facilities handling Scots pine all year round.

Both growers and processors provided a breakdown of timber harvested and processed into roundwood categories (Figure 3). The majority of the difference in volume between the quantity harvested by growers and the quantity processed falls within the chipwood category, where there is a discrepancy of almost 70000m<sup>3</sup>. The largest percentage difference is in the “other” category.



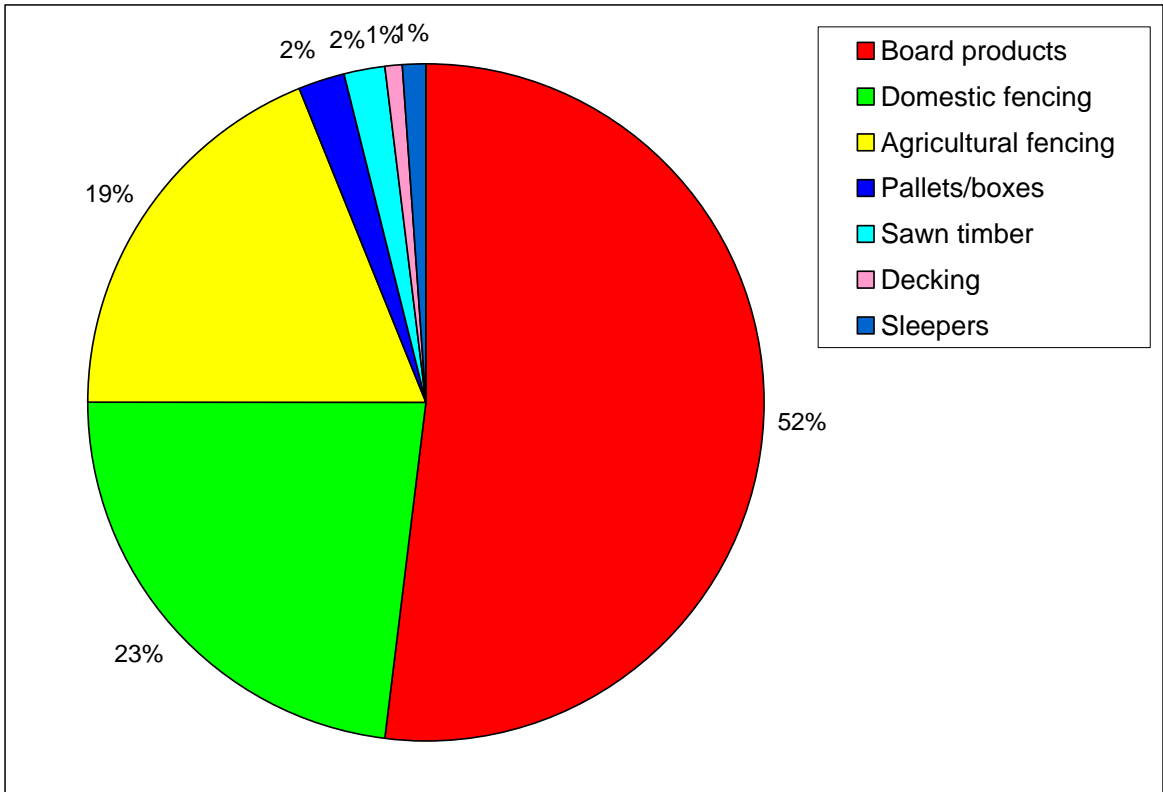
**Figure 3: Breakdown of timber harvested and processed into roundwood categories, from growers and processors’ categories**

Processors who responded to the questionnaire broke down the volume taken by the distance transported to the processing facility (Table 4), showing that the majority of the timber was sourced within 50 miles of the mill.

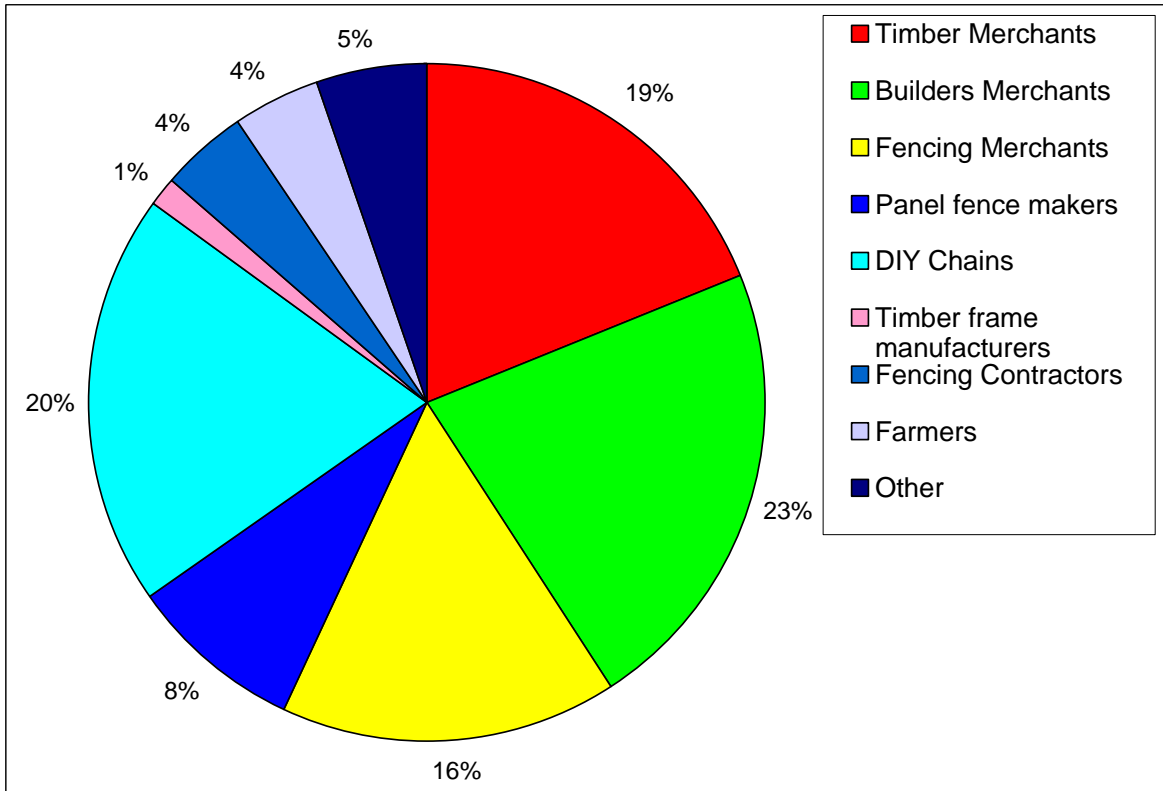
The total volume of sawn timber and timber products produced from the roundwood processed by the respondents to the processors’ questionnaire was 187700 m<sup>3</sup>. When this total is broken down by product type (Figure 4), just over 50% is going into a panel board product (OSB) with a further 40% comprising agricultural and domestic fencing. The breakdown by market category (Figure 5) shows that around 60% of the volume is sold through timber merchants, builders’ merchants and DIY chains.

**Table 4: Processed volume broken down by transport distance**

Transport distance to processing facility	
< 50 miles	76%
50-100 miles	22%
>100 miles	2%



**Figure 4: Breakdown of processed timber into product categories, processors' questionnaire**



**Figure 5: Breakdown of processed timber by market sectors, processors' questionnaire**

### Timber quality criteria

Both growers and processors were asked to rank quality criteria for Scots pine logs in order of importance (Table 5). In addition to the 4 criteria listed and considered to be of most importance to both growers and processors, other significant timber quality factors were ovality, taper, black knots and crop uniformity.

Key quality criteria	Growers	Processors
1	Straightness	Bluestain
2	Bluestain	Straightness
3	Knottiness	Size
4	Size	Knottiness

**Table 5: Key timber quality criteria for Scots pine logs identified by growers and processors**

Processors were also asked to specify timber quality attributes of importance in sawn timber and timber products (Table 6).

	Pallets	Carcassing	Domestic fencing (includes slats)	Agricultural fencing	Decking	Sleepers	Wall Sheathing (OSB)
Bluestain	1	3	1	7	3	7	9
Dimensional accuracy	2	2	2	6	2	4	1
Distortion after kiln drying	3	7			4		6
Knots- number & size	4	4	3	2	5	2	4
Knots - tight/loose	5	5	3	3	1	3	7
Moisture content	6	5	5	8	7	1	5
Pressure treatment		8	6	1	6		
Ringwidth	7	8	7	4	8	6	8
Slope of grain		8	8	5	9	5	10
Strength grading - machine		1			12		3
Strength grading - visual					10		
Uniformity of product					11		2

**Table 6: Key timber quality criteria for sawn timber and timber products**

## Responses from end-product manufacturers

Six completed questionnaires were obtained from end-use manufacturers, of which one was from a timber frame company, one from a company specialising in large dimension construction timber and external cladding and four from specialised companies producing bespoke joinery and construction products. The volumes of timber reported on were small in comparison to the total volume of Scots pine processed in the area covered by this survey (Table 7).

Total quantity of timber used	4200 m <sup>3</sup>
Total quantity of Scots pine	650 m <sup>3</sup>
Quantity of home grown Scots pine	50 m <sup>3</sup>

**Table 7: Timber used by respondents to end-users' questionnaire**

## Comments from respondents to questionnaires

In each of the questionnaires respondents were asked to give their views on the availability and quality of Scots pine timber, highlighting barriers to further market development.

Comments from growers included:

- Scots pine is increasingly managed for biodiversity and landscape reasons, which can restrict opportunities for timber production;
- An increase in the area managed under CCF systems could reduce overall availability of Scots pine timber, whilst at the same time increasing the amount of larger diameter material, with consequences for harvesting and processing operations;
- The quality of stands is mixed and difficult to predict from appearance of logs;
- There appears to be little demand for better quality logs and no premium for them;
- Bluestain causes problems;
- Pricing/economics a barrier, especially high transport costs;
- The depressed small roundwood market, (i.e. low prices to growers) may mean delayed thinnings and therefore reduced future quality;
- The domination of large sawmills in North -East Scotland may not be good news for the grower. The lack of small mills and increased mechanisation has reduced the fencing market.

Comments from processors included:

- The quality varies from good to poor, often within the same stand;
- It is difficult to obtain a consistent supply of quality material;
- Black knots are the biggest problem.

Comments from end-product manufacturers included:

- Timber frame company – would like to use more home-grown Scots pine but cannot get consistent supply at competitive price;
- Window-door manufacturer – considered use of home grown but “the gulf in quality and the lack of infrastructure to process and improve the raw material means that our needs can only be met by importing from Germany and Scandinavia” ;
- Information on the durability rating of Scots pine compared to larch is required.

## **Interviews with companies using Scots pine**

Visits to companies using Scots pine to make finished or semi-finished products were undertaken to supplement the information collected from the survey. A set format was not used for the interviews, the aim being to get a general overview of the companies, their current use of home-grown Scots pine timber and the potential for, or barriers to, greater use in the future.

### Russwood Ltd, Newtonmore (John Russell, Managing Director)

Russwood Ltd supplies a range of timber products for construction, including external cladding, flooring, decking, and beams. Both imported and home-grown timber are supplied, with the majority of the home-grown material being used to produce external cladding (European larch and Douglas fir), larch decking and large dimension oak or Douglas fir for post and beam construction. The company operates a sawmill, drying kilns and machining facilities. The sawmill at Russwood is used to process some roundwood and for re-sawing material bought from other mills to produce cladding and decking products. The majority of customers are individuals buying products for new house construction, extensions, renovation and flooring replacement.

At present the volume of Scots pine timber processed at Russwood is small, in the region of 10 m<sup>3</sup> of logs per year. Generally Scots pine would only be supplied in response to a particular customer demand, which often comes from an architect. Mr Russell noted that the key problem with Scots pine that had been processed and supplied by Russwood was dead or decayed knots, which were a serious defect in both decking and cladding products. In addition Scots pine was not favoured for external cladding as it was less durable than European larch. Despite this Mr Russell felt that there could be the potential for manufacturing a cladding product from locally grown Scots pine, suitably coated to ensure adequate durability, that could be marketed specifically as a locally sourced product, taking advantage of the image of Scots pine forests as a key element of the Scottish landscape.

### Treecraft Woodwork Ltd, Dornoch (Adrian Green)

Treecraft Woodwork Ltd manufacture high quality windows and doors, all made to order. All the timber used is imported. In addition to hardwood species around 600 m<sup>3</sup> of Scots pine is used annually, much of which is bought pre-laminated, although some laminating is done by the company. The production line is highly mechanised with sophisticated machinery for the automatic machining of different elements for window manufacture. In addition to facilities for laminating, finger jointing can also be carried out.

Mr Green explained that imported material was always used as he had found he could not produce doors and windows of the quality demanded by his customers from home-grown material. Stability in service was critical, and any movement in the wood could cause drafts and leaks which would generate customer complaints and loss of business. He emphasised that the quality requirements for windows and external doors were extremely high and that other joinery elements, such as skirting, flooring or architraving, had less stringent requirements. The pine material being

used in the Treecraft factory was extremely slow grown (probably Scandinavian or Baltic) and generally defect cut and finger-jointed to produce knot-free lengths.

Mr Green noted that he had made some windows from home grown material in the past, but not without problems. Customers did sometimes ask for home-grown timber to be used, but were generally convinced to opt for imported when he explained the difficulties. Despite this Mr Green indicated that he would like to use home-grown material, if timber of a sufficiently high quality was available.

Norbuild Timber Fabrication & Fine Carpentry Ltd, Forres (Betsy van der Lee and Sven Skatun)

Norbuild produce a wide range of structural, finishing and joinery timber components, including flooring, cladding, linings, glulam beams, post and beam frames, staircases, doors, windows and worktops. They are a specialist company producing bespoke products made almost exclusively from Scottish grown timber (imported material is occasionally used to fulfil short orders). They have a sawmill, kilns and machining and joinery manufacturing facilities. They use approximately 20-25 m<sup>3</sup> of Scots pine timber a year, mainly in windows and doors, as well as some internal joinery (skirtings, linings).

Ms van der Lee and Mr Skatun noted that they have encountered some problems with Scots pine in terms of timber movement, with defects arising in windows and doors that have necessitated remedial work. Knots are also a problematic defect, although they often paint their windows, which reduces the problem in terms of appearance. They noted that defect cutting with home-grown material resulted in very high wastage. Blue stain is also a problem that they have encountered with Scots pine timber. They have not made a post and beam frame out of Scots pine, but would not rule this out as a possibility, if logs of sufficient dimensions and quality could be sourced.

Deeside Timberframe Ltd, Stonehaven (John Wright)

Deeside Timberframe manufactures approximately 800 timber frame house kits per year, based in a factory in Stonehaven. They were the only timber frame company, of 5 contacted, to respond to the end-users' questionnaire in this study. They stated that they used a small quantity of home-grown Scots pine, but would use more if they could get a consistent supply at a competitive price.

When interviewed Mr Wright explained that the Scots pine used was generally as sarking or dwanging material, coming from the timber merchant in a mix with spruce. The majority of the timber used was imported spruce, bought through timber merchants. Mr Wright noted that the perception of home-grown Scots pine was that black knots caused problems, and that as a company they could not afford people to come back with complaints. The windows and doors used by the company were generally Scandinavian. When asked about external cladding he responded that there was some demand for this, but that in many areas planning problems restricted its use. They had supplied Siberian larch to customers for external cladding.

The company had in the past tried to produce kits from home-grown timber, but had found it too difficult to source timber of a suitable quality.

North Woods Construction Ltd, Ullapool (Bernard Planterose)

North Woods Construction plan, design and build timber buildings, specialising in the use of home-grown timber. Mr Planterose explained that to date he has not generally used Scots pine in his buildings. For post and beam frames he uses Douglas fir, because of its high strength and availability in the dimensions required. For cladding he uses mainly larch, because of its durability. For internal joinery he often uses Douglas fir, to blend with the post and beam frames. Where he has used pine it has generally been Scandinavian pine in windows and doors – selected for performance and availability. Mr Planterose would be interested in participating in trials of Scots pine products as part of this project.

## DISCUSSION & CONCLUSIONS

The information gathered in this survey is necessarily influenced by the number and nature of respondents from the different sectors approached. Within the forest owners/growers category there is a striking disparity between the proportion of Forestry Commission Scotland Scots pine forests covered by the responses and that for other ownerships, when both are compared to the total area of Scots pine forests in the study area estimated in the National Inventory of Woodlands (Forestry Commission 1998, 2001). The reasons for this are not hard to find, given the large areas covered by one FCS forest district compared to the average private sector property. However, many of the larger, well-known Scots pine growing estates did respond to the survey, suggesting that much of the remaining resource is fragmented amongst many owners. In the processing sector responses were received from almost all the major sawmilling companies, with most of the non-respondents being smaller companies. The result of this pattern of response is that whilst the majority of the volume processed has probably been covered by the survey, there may be a lack of information about processors operating on a smaller scale and supplying some niche markets. The follow-up visits to selected processors and end-product manufacturers were designed to at least partly address this gap.

The responses to questions about Scots pine management highlight some interesting differences between practice in FCS and non-FC ownerships. In general a greater proportion of private sector forests are being managed using CCF or other non-clearfell systems, with longer rotations. The apparently high proportion of timber harvested from FCS forests, compared to forecasts of availability for FCS and other ownerships, seems likely to be the result of two factors. Firstly, the lower representation of non-FC forests in the survey responses means that harvesting from this sector will be under-reported. Secondly, the longer rotations and greater use of non-clearfell systems may mean that felling from non-FC forests is delayed compared to assumptions in the availability forecasts (growers are perhaps not harvesting timber as a result of poor timber prices and limited markets).

Both growers and processors report that more than 75% of Scots pine roundwood is processed within 50 miles of where it is grown. This compares with the results of a recent study of timber road haulage in Scotland, covering all species, which found that less than 15% of journeys were less than 50 miles, with 60% between 51 and 150 miles, (Forest Research, 2007). It has been suggested that one reason for the low transport distances is the high density of Scots pine timber makes it expensive to transport, so distances are minimised. In addition there has been a long tradition of timber processing in the Moray Firth area, where sawmills were located close to the major forest resource.

The main products being produced from Scots pine in the study area are OSB and fencing, which is in line with anecdotal information gathered before the survey. The OSB plant at Dalcross is a highly significant user of Scots pine small roundwood. This is an important market for material from early thinnings, which are a key means of improving the timber of quality Scots pine stands (Worrell and Ross, 2004). In comparison to fencing and OSB, the other products represented are very small.

Decking and sleepers, which are perceived as higher-value products, comprise only 2% of the total volume of Scots pine products.

The majority of Scots pine timber is marketed through timber merchants, building merchants and DIY chains: the ultimate use of this material is therefore unknown. Work planned by FC Scotland to investigate the end-uses for home-grown timber sold through builders' merchants and DIY chains should help shed some light on this question in due course.

The views of growers and processors on the timber quality attributes of Scots pine logs confirmed the importance of straightness and knots as key quality indicators: these characteristics will form the basis for methods of assessing timber quality in standing trees being developed within this project. The problem of black knots was repeatedly emphasised. The issue of variability within the resource and the need for techniques to identify better quality stands, and the best trees within stands, was highlighted.

In terms of potential markets for Scots pine that might increase returns to growers and processors, it appears that it will always be difficult for home-grown Scots pine to compete in any volume with imported material in the most demanding end-uses such as windows and external doors. The faster growth rates, shorter rotations and wider spacing in Scottish Scots pine, compared to Scandinavian and Baltic material, mean that the timber will have wider growth rings and more knots (especially black knots). On the other hand the bulk markets currently absorbing most of the supply do not appear to make best use of the quality attributes of the best Scots pine stems, where selected straight logs with uniform growth and fewer knots can be found. Although the amount of this material may be limited, there is the potential to direct this better quality material towards uses such as joinery, flooring, external timber cladding or post and beam frames, building on the work of some of the specialised companies visited in this survey. At present these markets for Scottish grown timber are largely supplied by Douglas fir and larch.

Techniques to identify the best quality Scots pine material at a strategic and stand level will be developed in Task 2 of this project, timber quality assessment methods. Evaluating the potential for expanding higher value markets will form part of the work of Task 4, which is a market development study.

## **ACKNOWLEDGEMENTS**

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### **Survey participants:**

Altyre Estate  
Alvie & Dalraddy Estates  
Anagach Woods Trust  
Balmoral Estates  
Ben Newe Estate  
Bidwells  
Blelack Estate  
Bowls Chartered Surveyors  
BSW Timber  
Cawdor Estate  
Darnaway Estate  
Deeside Timberframe Ltd  
Duthil Estate  
Forestry Commission Scotland Aberdeenshire Forest District  
Forestry Commission Scotland Dornoch Forest District  
Forestry Commission Scotland Fort Augustus Forest District  
Forestry Commission Scotland Inverness Forest District  
Forestry Commission Scotland Moray Forest District  
Glen Tanar Estate  
Inchmarnoch Estate  
Invercauld Estate  
James Jones & Sons Ltd  
John Gordon & Son Ltd  
Munro Sawmills Ltd  
Netherton and Conval Woodlands  
Norbord Ltd  
Norbuild Timber Fabrication & Fine Carpentry Ltd  
Northwoods Construction Ltd  
Pluscarden Estate  
Rothiemurchus Estate  
Royal Society for the Protection of Birds  
Russwood Ltd  
Scottish Woodlands Ltd  
Scotwood  
Seafield Estate  
Sourden Wood  
Strathconon Estate  
Sutherland Estate  
The Ross Partnership  
Treecraft Woodwork Ltd  
Woodschool Ltd

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# APPENDIX 1: Growers Questionnaire

## Scots Pine Utilisation Study - Questionnaire for forest owners/managers

1. Name of property or FC Forest District: \_\_\_\_\_
2. Owner of property: \_\_\_\_\_
3. Person to contact regarding this questionnaire:  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Tel: \_\_\_\_\_  
E-mail: \_\_\_\_\_

### Scots Pine Management

4. Please state the area of Scots pine managed: Pure stands  Ha  
Mixtures  Ha
5. Proportion of Scots pine area designated as "no thin"  %
6. Average age of 1st thinning for Scots pine stands:  years  
Please indicate which factors determine time of 1st thinning, (e.g. basal area, age):  
\_\_\_\_\_
7. Please indicate the proportion of Scots pine area designated for management under continuous cover forestry (CCF) systems:  
CCF % Clearfell %
8. What is the average age of clear-felling for Scots pine stands managed under clearfell systems?  years
9. What do you expect to be the age of the oldest trees to be felled in CCF systems?  years

### Scots Pine Timber Production

10. Do you fell Scots pine all year round or during a specified period?  
All year round  OR From  To   
If the felling period for Scots pine is restricted please state reasons:  
\_\_\_\_\_
11. Please state the quantity of Scots pine roundwood harvested during 2005 (1 Jan - 31 Dec 2005):  
(Please indicate the units used cubic metres overbark standing [ $m^3$  obs], cubic metres overbark felled [ $m^3$  ob] or Tonnes [T])  
Quantity of Scots pine roundwood produced from thinning:   $m^3$ obs/ $m^3$ ob/T\*  
Quantity of Scots pine roundwood produced from clearfell:   $m^3$ obs/ $m^3$ ob/T\*

12. Please indicate the breakdown of Scots pine timber production into different methods of sale:

Standing sales  Roadside sales  Delivered in

13. Please provide a breakdown of the Scots pine roundwood produced into the following categories:

Transmission poles	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Large sawlogs (≥ 30 cm top diameter)	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Medium sawlogs (16-30 cm top diameter)	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Pallet logs (12-15 cm top diameter)	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Round fencing sizes	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Chipwood (for OSB, chipboard MDF etc)	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Firewood	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T*
Specialist sizes	<input type="text"/>	%/m <sup>3</sup> ob/m <sup>3</sup> ub/T* Please specify: _____

14. In order to help us build up a picture of the key markets for Scots pine roundwood, please provide the following information about your 3 main customers for Scots pine (i.e. those which buy the greatest quantity):

Type of wood processor:

Large sawmill	> 100k m <sup>3</sup> per year
Medium sawmill	25 - 100k m <sup>3</sup> per year
Small sawmill	< 25k m <sup>3</sup> per year
Panel board mill	i.e. OSB or particle board mill such as Norbord
Other	

Distance - please estimate the average distance from the forest to this customer

Quantity - please provide information as % of total SP production or give quantity

Customer 1: Type: Large sawmill/medium sawmill/small sawmill/panel board mill/other\*

Distance: <50 miles/ 50-100 miles/ 100-150 miles/>150 miles\*

Quantity:  %/m<sup>3</sup>ob/m<sup>3</sup>ub/T\*

Customer 2: Type: Large sawmill/medium sawmill/small sawmill/panel board mill/other\*

Distance: <50 miles/ 50-100 miles/ 100-150 miles/>150 miles\*

Quantity:  %/m<sup>3</sup>ob/m<sup>3</sup>ub/T\*

Customer 3: Type: Large sawmill/medium sawmill/small sawmill/panel board mill/other\*

Distance: <50 miles/ 50-100 miles/ 100-150 miles/>150 miles\*

Quantity:  %/m<sup>3</sup>ob/m<sup>3</sup>ub/T\*

**Timber quality criteria:**

15. Do you use FC Fieldbook 9 "Classification & Presentation of Softwood Sawlogs" to classify Scots pine logs for sale into green and red categories? Yes  No

Please rank the following criteria (1, lowest - 7, highest) in order of importance to you/your customers when selling Scots pine roundwood:

Growth rate (ring width)

Heartwood:sapwood ratio   
Knottiness (branching)   
Size   
Straightness   
Absence of bluestain   
Dimensional accuracy

Other important roundwood quality criteria: \_\_\_\_\_  
\_\_\_\_\_

16. Please state here your views on the availability and quality of Scots pine timber, highlighting barriers to management and marketing:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Thank you for taking the time to complete this questionnaire. All data will be treated in the strictest confidence and will be aggregated with data from other companies so that it will not be possible to identify an individual company in any publication or other report.

Please return the completed questionnaire by post, fax or e-mail to:  
Elspeth Macdonald, Forest Research, "Woodlands", Fodderty Way, Dingwall, Ross-shire, IV15 9XB  
Tel: 07810 180151 Fax: 01349 866624 E-mail: [elspeth.macdonald@forestry.gsi.gov.uk](mailto:elspeth.macdonald@forestry.gsi.gov.uk)

## APPENDIX 2: Processors' Questionnaire

### Scots Pine Utilisation Study - Questionnaire for wood processors

1. Name of company: \_\_\_\_\_

2. Name and location of processing facility: \_\_\_\_\_

3. Person to contact regarding this questionnaire:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Tel: \_\_\_\_\_

E-mail: \_\_\_\_\_

4. Please indicate whether you process Scots pine all year round or during a specified period?

All year round  OR From  To

5. Please state the quantity of Scots pine roundwood processed during 2005 (1 January - 31 December 2005):  
(Please indicate units used: cubic metres overbark [m3ob], cubic metres underbark [m3ub] or Tonnes [T])

Total quantity of Scots pine roundwood processed:  m3ob/m3ub/T\*

6. Please provide a breakdown of the Scots pine roundwood processed into the following categories:

Transmission poles	<input type="text"/>	%/m3ob/m3ub/T*
Large sawlogs ( $\geq 30$ cm top diameter)	<input type="text"/>	%/m3ob/m3ub/T*
Medium sawlogs (16-30 cm top diameter)	<input type="text"/>	%/m3ob/m3ub/T*
Pallet logs (12-15 cm top diameter)	<input type="text"/>	%/m3ob/m3ub/T*
Round fencing sizes	<input type="text"/>	%/m3ob/m3ub/T*
Chipwood (for OSB, chipboard MDF etc)	<input type="text"/>	%/m3ob/m3ub/T*
Firewood	<input type="text"/>	%/m3ob/m3ub/T*
Specialist sizes	<input type="text"/>	%/m3ob/m3ub/T* Please specify: _____

7. Please estimate the proportion of Scots pine roundwood processed that comes from each of the "distance from mill" categories given.

Distance from mill	% of roundwood
<50 miles	<input type="text"/>
50 - 100 miles	<input type="text"/>
100 - 150 miles	<input type="text"/>
>150 miles	<input type="text"/>

8. Please state the volume of Scots pine sawn timber and timber products produced during 2005 (1 January - 31 December 2005):

Total volume produced  m<sup>3</sup>

9. Please provide a breakdown of Scots pine sawn timber and timber products produced into the categories given:

Sawn timber - treated/kiln dried/graded		m <sup>3</sup>
Sawn timber - untreated/green/ungraded		m <sup>3</sup>
Agricultural sawn fencing		m <sup>3</sup>
Round fencing products		m <sup>3</sup>
Domestic fencing		m <sup>3</sup>
Railway sleepers		m <sup>3</sup>
Garden sleepers		m <sup>3</sup>
Decking/other garden products		m <sup>3</sup>
Panel boards		m <sup>3</sup>
Joinery (windows, doors)		m <sup>3</sup>
Other		m <sup>3</sup>

Please specify: \_\_\_\_\_

\_\_\_\_\_

9. Markets for Scots pine sawn timber and timber products. Please provide an estimate of the proportion (or volume) of Scots pine timber and timber products sold into different market areas:

Timber merchants		%/m <sup>3</sup> *
Builders merchants		%/m <sup>3</sup> *
Fencing merchants		%/m <sup>3</sup> *
DIY chains		%/m <sup>3</sup> *
Timber frame manufacturers		%/m <sup>3</sup> *
Fencing contractors		%/m <sup>3</sup> *
Farmers		%/m <sup>3</sup> *
Individuals		%/m <sup>3</sup> *
Other		%/m <sup>3</sup> *

Please specify: \_\_\_\_\_

10. Timber quality criteria - roundwood:

Please rank the following criteria (1, lowest - 7, highest) in order of importance to you when purchasing Scots pine roundwood:

Absence of bluestain	
Dimensional accuracy	
Growth rate (ring width)	
Heartwood:sapwood ratio	
Knottiness (branching)	
Size	
Straightness	

Other important roundwood quality criteria: \_\_\_\_\_

\_\_\_\_\_

11. Timber quality criteria - sawn timber and timber products:

Please rank the following quality criteria in order of importance (1, lowest -12, highest) to you/your customers for up to three of the main products that you produce:

**Product (e.g. carcassing)** \_\_\_\_\_

Absence of bluestain			
Dimensional accuracy			
Distortion after kiln drying			
Knots - number and size			
Knots - tight/loose			
Moisture content			
Pressure treatment			
Ring width			
Slope of grain			
Strength grading - machine			
Strength grading - visual			
Uniformity of product			

Other important quality criteria: \_\_\_\_\_

12. Do you hold any Chain of Custody Certification? If yes please state under which Certification Scheme(s):

Yes       No       Planned

Certification scheme(s): \_\_\_\_\_

13. Please state here your views on the availability and quality of Scots pine timber, highlighting barriers to the development of new or higher value markets:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Thank you for taking the time to complete this questionnaire. All data will be treated in the strictest confidence and will be aggregated with data from other companies so that it will not be possible to identify an individual company in any publication or other report.

Please return the completed questionnaire in the stamped envelope provided or by fax or e-mail to:  
 Elspeth Macdonald, Forest Research, "Woodlands", Fodderty Way, Dingwall, Ross-shire, IV15 9XB  
 Tel: 07810 180151 Fax: 01349 866624 E-mail: elspeth.macdonald@forestry.gsi.gov.uk

# APPENDIX 3: End-product manufacturers' Questionnaire

## Scots Pine Utilisation Study - Questionnaire for end-users

1. Name and location of company: \_\_\_\_\_

2. Person to contact regarding this questionnaire:

Name: \_\_\_\_\_

Tel: \_\_\_\_\_

E-mail: \_\_\_\_\_

3. Please indicate the category into which the products you manufacture fall, and use the adjacent space to provide details:

Construction	<input type="checkbox"/>	_____
Joinery	<input type="checkbox"/>	_____
Decking	<input type="checkbox"/>	_____
Other garden products	<input type="checkbox"/>	_____
Cabinetry/furniture	<input type="checkbox"/>	_____
Other	<input type="checkbox"/>	_____

4. Please state the total quantity of timber used annually:  m<sup>3</sup>/tonnes\*

5. Please state the quantity of Scots pine timber used annually:  m<sup>3</sup>/tonnes\*

6. Please state the proportion of Scots pine timber used that is UK grown:

Quantity of Scots pine timber from Highland/Grampian:  %/m<sup>3</sup>/tonnes\*

Quantity of Scots pine timber from other UK sources:  %/m<sup>3</sup>/tonnes\*

7. Please give the country of origin of your main supply of Scots pine timber: \_\_\_\_\_

8. Timber quality criteria

Please rank the following timber quality criteria in order of importance (1, lowest -12, highest) to you:

Absence of bluestain	<input type="text"/>
Dimensional accuracy	<input type="text"/>
Distortion after kiln drying	<input type="text"/>
Knots - number and size	<input type="text"/>
Knots - tight/loose	<input type="text"/>
Moisture content	<input type="text"/>
Pressure treatment	<input type="text"/>
Ring width	<input type="text"/>
Slope of grain	<input type="text"/>
Strength grading - machine	<input type="text"/>
Strength grading - visual	<input type="text"/>
Uniformity of product	<input type="text"/>

Other important quality criteria: \_\_\_\_\_  
\_\_\_\_\_

9. Please indicate your views on the future possibilities for using home-grown Scots pine timber in your business. What are the current barriers and what action would be required to enable/encourage you to use home-grown Scots pine timber? If you already use home-grown Scots pine timber what are the important issues relating to the availability and quality of the supply?

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Thank you for taking the time to complete this questionnaire. All data will be treated in the strictest confidence and will be aggregated with data from other companies so that it will not be possible to identify an individual company in any publication or other report.

Please return the completed questionnaire by post, fax or e-mail to:

Elspeth Macdonald, Forest Research, "Woodlands", Fodderty Way, Dingwall, Ross-shire, IV15 9XB  
Tel: 07810 180151 Fax: 01349 866624 E-mail: [elspeth.macdonald@forestry.gsi.gov.uk](mailto:elspeth.macdonald@forestry.gsi.gov.uk)

## APPENDIX 4: Results of Growers' Questionnaire

### Scots Pine Utilisation Study - Questionnaire for forest owners/managers SUMMARY OF RESULTS

#### Number of respondents:

FCS - 5 districts

Other ownership - 20 owners

#### Scots Pine Management

4. Area of Scots pine managed:

Area of Scots pine (Ha)			
	FCS	Other	TOTAL
Pure stands	25082	17214	42296
Mixtures	11903	3567	15470
TOTAL	36985	20781	57766

5. Area of Scots pine area designated as "no thin"

12277 Ha
----------

6. Age of 1st thinning for Scots pine stands:

Average:	30 years
Minimum:	20 years
Maximum:	43 years

Factors determining timing of 1st thinning:

Dimension (BA, age, top height)	33759 Ha
Economic (roading, harvesting costs, net return, merchantable volume)	4597 Ha

7. Area of Scots pine designated for management under continuous cover forestry (CCF) systems:

Area of Scots pine (Ha)			
	FCS	Other	TOTAL
CCF	18565	14059	32624
Clearfell	18430	6604	25034
TOTAL	36995	20663	57658

8. Age of clear-felling for Scots pine stands managed under clearfell systems?

Average:	62 years
Minimum:	53 years
Maximum:	110 years

9. Expected age of the oldest trees to be felled in CCF systems?

Average:	128 years
Minimum:	85 years
Maximum:	200 years

## Scots Pine Timber Production

10. Felling period for Scots pine?

All year round	42244 Ha
Restricted felling period	15532 Ha

Reasons for restricted felling period:

- winter production to minimise development of bluestain
- avoiding spring because of Capercaillie breeding
- summer/autumn working to minimise site and road damage
- meet market demands

11. Quantity of Scots pine roundwood harvested during 2005 (1 Jan - 31 Dec 2005):

Volume of Scots pine roundwood (m <sup>3</sup> ob)			
	FCS	Other	TOTAL
Thin	58554	38889	97443
Clearfell	90077	19163	109240
TOTAL	148631	58052	206683

12. Breakdown of Scots pine timber production into different methods of sale:

Standing sales:	115600 m <sup>3</sup> ob
Roadside sales	25518 m <sup>3</sup> ob
Delivered in	25964 m <sup>3</sup> ob

13. Breakdown of the Scots pine roundwood by category:

	Volume of Scots pine roundwood (m <sup>3</sup> ob)
Transmission poles	414
Large sawlogs (≥ 30 cm top diameter)	7582
Medium sawlogs (16-30 cm top diameter)	63200
Pallet logs (12-15 cm top diameter)	43418
Round fencing sizes	9225
Chipwood (for OSB, chipboard MDF etc)	81622
Firewood	632
Specialist sizes	590

14. Transport distances from forest to processing facility:

Distance to mill	Volume of Scots pine roundwood (m <sup>3</sup> ob)
<50 miles	151232
50 - 100 miles	18014

Type of processing facility:

Type of processing facility	Volume of Scots pine roundwood (m <sup>3</sup> ob)
Large sawmill	81672
Medium sawmill	13831
Small sawmill	165
Panel board	70589
Total	166257

**Timber quality criteria:**

15. Use of FC Fieldbook 9 "Classification & Presentation of Softwood Sawlogs" to classify Scots pine logs for sale into green and red categories?

	Volume of Scots pine roundwood (m <sup>3</sup> ob)
Yes	118443
No	88240

Ranking of timber quality criteria (1, highest - 7, lowest) in order of importance to growers and customers when selling Scots pine roundwood:

	Average ranking
Growth rate (ring width)	6.0
Heartwood:sapwood ratio	6.0
Knottiness (branching)	3.6
Size	3.2
Straightness	1.8
Absence of bluestain	2.8
Dimensional accuracy	4.5

Other important roundwood quality criteria: Ovality, taper

## APPENDIX 5: Results of Processors' Questionnaire

### Scots Pine Utilisation Study - Questionnaire for wood processors SUMMARY OF RESULTS

**Number of respondents:** 6 companies (10 processing facilities)

4. Is Scots pine processed all year round or during a specified period?

All year round	315633 m <sup>3</sup> ob
Winter/spring only	9980 m <sup>3</sup> ob

5. Total quantity of Scots pine roundwood processed during 2005 (1 January - 31 December 2005):

325613 m <sup>3</sup> ob
--------------------------

6. Breakdown of the Scots pine roundwood processed into categories:

	Volume of Scots pine roundwood (m <sup>3</sup> ob)
	1500
Large sawlogs ( $\geq$ 30 cm top diameter)	30125
Medium sawlogs (16-30 cm top diameter)	77176
Pallet logs (12-15 cm top diameter)	47075
Round fencing sizes	4097
Chipwood (for OSB, chipboard MDF etc)	150490
Firewood	0
Specialist sizes	15150
TOTAL	325613

7. Volume of Scots pine roundwood processed that comes from each of the "distance from mill" categories.

Distance from mill	Volume of Scots pine roundwood (m <sup>3</sup> ob)
<50 miles	248916
50 - 100 miles	70500
100 - 150 miles	6197
>150 miles	0
TOTAL	325613

8. Volume of Scots pine sawn timber and timber products produced during 2005 (1 January - 31 December 2005):

Total volume produced	187691 m <sup>3</sup>
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9. Breakdown of Scots pine sawn timber and timber products produced into categories:

	m <sup>3</sup>
Sawn timber - treated/kiln dried/graded	1181
Sawn timber - untreated/green/ungraded	2848
Agricultural sawn fencing	29072
Round fencing products	7179
Domestic fencing	42709
Railway sleepers	1061
Garden sleepers	0
Decking/other garden products	2050
Pallet boards	2173
Panel boards	98000
Joinery (windows, doors)	0
Other	1418
TOTAL	187691

9. Estimated of the volume of Scots pine timber and timber products sold into different market areas:

	m <sup>3</sup>
Timber merchants	31250
Builders merchants	36170
Fencing merchants	26291
Panel fence manufacturers	13840
DIY chains	32567
Timber frame manufacturers	2200
Fencing contractors	6936
Farmers	6722
Individuals	3920
Other	4914
TOTAL	164810

10. Timber quality criteria - roundwood:

Ranking of timber quality criteria (1, highest - 7, lowest) in order of importance when purchasing Scots pine roundwood:

	Average ranking
Absence of bluestain	1.7
Dimensional accuracy	3.8
Growth rate (ring width)	5.8
Heartwood:sapwood ratio	6.7
Knottiness (branching)	3.5
Size	3.5
Straightness	2.0

Other important roundwood quality criteria:

Crop uniformity, black knots

11. Timber quality criteria - sawn timber and timber products:

Ranking of timber quality criteria in order of importance (1, highest -12, lowest) in sawn timber and timber products

	Pallets	Carcassing	Domestic fencing	Agricultural fencing	Decking	Sleepers	Wall Sheathing
Bluestain	1	3	1	7	3	7	9
Dimensional accuracy	2	2	2	6	2	4	1
Distortion after kiln drying	3	7			4		6
Knots- number & size	4	4	3	2	5	2	4
Knots - tight/loose	5	5	3	3	1	3	7
Moisture content	6	5	5	8	7	1	5
Pressure treatment		8	6	1	6		
Ringwidth	7	8	7	4	8	6	8
Slope of grain		8	8	5	9	5	10
Strength grading - machine		1			12		3
Strength grading - visual					10		
Uniformity of product					11		2

12. Chain of Custody Certification?:

FSC: 5 companies

TRADA TRAK: 1 company

## APPENDIX 6: Results of End-users' Questionnaire

### Scots Pine Utilisation Study - Questionnaire for end-users SUMMARY OF RESULTS

**Number of respondents:** 6 companies, of which only 3 currently use Scottish grown Scots pine

3. Categories of products manufactured by end-users:

	No. of respondents
Construction	4
Joinery	4
Decking	1
Other garden products	1
Cabinetry/furniture	1
Other	

4. Total quantity of timber used annually: 4451 m<sup>3</sup>

5. Quantity of Scots pine timber used annually: 680 m<sup>3</sup>

6. Quantity of Scots pine timber used that is UK grown:

Quantity of Scots pine timber from Highland/Grampian: 80 m<sup>3</sup>

Quantity of Scots pine timber from other UK sources:

7. Country of origin of your main supply of Scots pine timber: For 3 companies - Scotland  
For 1 company - Latvia

8. Timber quality criteria

Ranking of timber quality criteria in order of importance (1, lowest -12, highest) by end users:  
(Note: based on responses from only 3 end-users)

Absence of bluestain	2
Dimensional accuracy	3
Distortion after kiln drying	1
Knots - number and size	3
Knots - tight/loose	2
Moisture content	5
Pressure treatment	1
Ring width	1.5
Slope of grain	2
Strength grading - machine	1
Strength grading - visual	2
Uniformity of product	2

Other important quality criteria: Constant supply of consistent quality  
To be felled when sap stopped rising