Market review and technical performance of Irish hardwoods

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Foreword

Irish hardwoods are much sought after by specifiers for a wide range of applications from flooring to furniture. While the production resource is very limited it will increase substantially over the coming decades. Much of this increase will come from broadleaves planted over the last decade and a half, as well as from woodlands managed under the Native Woodlands Scheme. In addition, many broadleaved woodlands remain undermanaged and are capable of much greater levels of supply than at present.

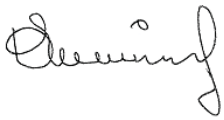
While the resource and supply are limited, now is the time to begin to address grading and quality and end-uses for Irish hardwoods. By providing market feedback to growers, quality will become a more tangible issue, and with it the realisation, that for hardwoods, quality makes a big difference to price.

Market forces will therefore provide the main incentive for owners to improve hardwood quality and increase production levels. This publication is therefore timely as it addresses in a comprehensive way: market size, utilisation patterns and market segments, species used, timber grading and drying and working properties of Irish hardwoods. It is the first time that Irish hardwood markets have been addressed in such a systematic manner. It is based on a study that was funded under the previous COFORD R&D programme, and which has been brought fully up-to-date in a number of areas for this publication.

Supporting the publication is a specially–designed segment of the COFORD-hosted Woodspec website. It includes an easy-to-follow search facility which enables users and potential users of Irish hardwoods to locate suppliers in each market segment. These range from sawnwood to joinery to specialised products. Information of this sort will serve to bring growers, processors and consumers into closer contact and will stimulate interest in, and use of, Irish hardwoods and timber in general.

The author, Stella Xenopoulou, has been involved with Irish hardwoods since the mid 1990s and has gained a considerable insight into the area over the intervening period. Most of the work that is reported here was carried out while she was working on contract to the Project Development Centre of the Dublin Institute of Technology.

We are pleased to see this publication emerge after a number of years of dedicated and intensive work. It will provide support and confidence for timber specifiers as well as processors and growers of Irish hardwoods. It will also provide a very useful benchmark in the years ahead when Irish hardwood production will undoubtedly reach a similar scale in value terms to other sectors of the forest industry.



David Nevins
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INTRODUCTION

There is an ever-growing use and appreciation of hardwoods in both domestic and non-domestic construction, in flooring and cladding, through to furniture and to other applications. The Native Woodlands Scheme, while primarily focused on woodland conservation, has a wood production component that should result in an increase in hardwood supply. At the same time the government is committed to increasing the proportion of broadleaves planted.

With these considerations in mind, the objective of this report is to increase the use and specification of Irish hardwoods by providing up-to-date information to growers, processors and specifiers about the market for and utilisation of homegrown hardwoods, including grading and drying.

In conjunction with this publication, a searchable database of suppliers of hardwoods and hardwood products is available at the COFORD Woodspec website (www.coford.ie).

This report and the database are issued in association with the COFORD *Guide to Irish Hardwoods*. These publications and the database are based on a completed COFORD-funded project on the specification, processing and use of Irish hardwoods.

MARKET RESEARCH AND COLLECTION OF EXISTING INFORMATION

This involved two stages:

Stage 1: Ninety organisations were contacted (Appendix I) and asked for information on Irish hardwoods and names of hardwood users in Ireland. As a result a users database was created, which is available in an updated and shortened version at www.coford.ie.

Stage 2: Twenty-six visits/interviews were carried out (Appendix I). Users of homegrown hardwoods were asked about the Irish hardwood market and its characteristics, problems and gaps, as well as their own particular needs and experience with homegrown species. After the visits and interviews, a questionnaire (Appendix II) was designed and posted to 722 organisations and individuals. At the same time a letter seeking information on the availability of homegrown hardwoods from forest growers was circulated with the newsletter of the Irish Timber Growers' Association (ITGA) (Appendix II).

RESULTS

From questionnaire to database

A wood-users database was created from the results of the questionnaire and from interviews (see Appendix I for list of contacts). This has been updated to provide a new web-based facility for those seeking suppliers or manufacturers of homegrown hardwood products (including sawn timber) and services (at the COFORD Woodspec website www.coford.ie).

Utilisation patterns and market segments of homegrown hardwoods

The research (including interviews and visits) was done to determine utilisation patterns and market segments of homegrown hardwoods, as well as the main species and grades used. The utilisation and market segments that were found are listed below.

It is estimated that 20% of the existing businesses answered the questionnaire. However, their market share is over 90% in terms of volume of homegrown hardwood timber, sawn and used in Ireland.

The responses to the questionnaire in terms of usage are summarised in Table 1.

TABLE 1: Summary of conversion and use of homegrown hardwoods.

USE	NUMBER OF USERS	PERCENTAGE OF TOTAL *
1. Roundwood conversion	26	46
Mobile sawmilling	(12)**	(46)**
Sawmilling	(14)	(54)
Both	(6)	(23)
2. Drying of sawn timber	20	36
3. Joinery	9	16
4. Furniture framing	7	13
5. Flooring production	2	4
6. Craft wood-turning	15	27
7. Industrial wood-turning	6	11
8. Craft cabinet manufacture	25	45
9. Industrial cabinet manufacture	11	20
10. Toy manufacture	5	9
11. Wood sculpture	10	18
12. Boat building	2	4
13. Hurley manufacture	2	4
14. Wood carving	2	4
15. Fencing	1	2
16. Pile manufacture	1	2
17. Musical instrument manufacture	2	0
18. Fretwork	1	2
19. Trailer manufacture	1	2

** The total number of users was 56. Categories of use are not mutually exclusive.*
*** Numbers in parentheses refer to the total for roundwood conversion.*

1. Roundwood conversion

1.1 Mobile sawmilling

In the majority of cases small sawmillers own a mobile saw and fell the timber themselves. Some woodcraft workers also own a mobile saw in order to have quick access to individual trees. They also feel that they have better control over the quality of the timber they are getting, and they make a higher profit.

1.2 Sawmilling

Forty-six percent of the respondents were involved in roundwood conversion (Table 1).

2. Drying sawn timber

Most sawn timber is dried by sawmillers and sold on, but this is not always the case. Some users of homegrown hardwoods, 36% of respondents, dry the timber themselves. While most of these also sawed the timber, a sizable proportion (30%) did not do so. Their main business was cabinet-making. Interviewees explained that they dry timber themselves in order to achieve better quality and lower moisture content than they can obtain from the market.

3. Joinery

Five out of the nine (56%) joinery maker respondents were also sawmillers. Five joinery makers were also involved in

either cabinet-making or turnery. None of the joinery maker respondents specialised in that alone.

4. Furniture framing

Seven of the respondents (13%) were involved in furniture framing but only one was solely involved in it (Appendix III). The other six were also involved in turnery and cabinet-making.

5. Flooring production

Only two individuals of those who answered the questionnaire produce timber flooring. They were both involved in sawmilling and both dried their own timber. One was also involved in joinery manufacture and the other in boat building, fencing and piling (Appendix III).

6. Craft wood-turning[1]

Fifteen of the respondents (27%) were working as craft wood-turners. However, only one belonged solely to that sector. The majority of craft wood-turners were also craft cabinet-makers (Appendix III).

7. Industrial wood-turning[2]

Six of the respondents (11%) were involved in industrial wood-turning. Two of these were also craft wood-turners and two were industrial cabinet-makers. There was only one industrial wood-turner who, apart from being also a sawmiller, did not belong to any other market segment.

8. Craft cabinet manufacture[3]

This was the largest market segment, in terms of number of participants, after sawmilling. Twenty-five users (45%) of homegrown hardwoods worked as craft cabinet-makers but only one belonged solely to that sector. Eight were also industrial cabinet-makers and ten were craft wood-turners. Wood sculpture and joinery were the other two areas that craft cabinet-makers were working in.

9. Industrial cabinet manufacture[4]

Eleven of the respondents (20%) listed themselves in this category. They all also listed themselves under craft cabinet-making, craft wood-turning and industrial wood-turning.

10. Toy manufacture

Five respondents (9%) used homegrown hardwoods in toy manufacture. Three specialised in this sector only, while two also converted the roundwood. They mainly used grade A of oak, ash, beech, chestnut and sycamore. One used non-homegrown birch plywood (Appendix III).

11. Wood sculpture

There were ten respondents (18%) who used homegrown hardwoods in wood sculpture. Only two, however, worked solely in the area. The remainder were also involved in wood-turning and cabinet-making. A wide range of homegrown species was used, including select grades of elm, walnut, cherry, holly, and oak. Bog oak and bog yew were also used, as was fresh yew.

12. Boat building

Two of the respondents were involved in boat building, one solely.

1 Craft wood-turning was defined as one-off, non-batch production.

2 Industrial wood-turning was defined as multiple copy, batch production.

3 Craft cabinet-making was defined as one off, non-batch production.

4 Industrial cabinet-making was defined as multiple copy, batch production.

13. Hurley manufacture

Two hurley manufacturers (4% of the respondents) responded to the questionnaire. Both specialise only in that area. Both ran sawmills; one dried the timber (Appendix III).

14. Wood carving

Two of the respondents (4%) were involved in wood carving but they were also involved in craft wood-turning and craft cabinet-making. Both used a wide range of homegrown hardwoods: ash, beech, blackthorn, birch, cherry, elm, holly, hazel, hornbeam, oak, poplar, red alder, sycamore, walnut, whitethorn, willow, rowan and 'fruit wood' (wood from fruit trees). Yew was also used.

15. Fencing

Only one respondent produced fencing (as well as flooring, boats and piles).

16. Pile manufacture

One respondent was involved in pile manufacture (in addition to sawmilling).

17. Musical instrument manufacture

Two respondents were involved in the manufacture of musical instruments. Both were also involved in other activities (one ran his own sawmill and dried timber while the other was also involved in wood-turning). Both used ash, one used select grade and the other character grade A. The former also used select grade cherry and walnut and grade A beech. The latter also used elm of character grade A.

18. Fretwork

One respondent was involved in craft fretwork in addition to wood-turning and cabinet manufacture).

19. Trailer manufacture

One respondent planked logs for use in trailers that he manufactured.

The key points regarding the market segments and utilisation patterns of homegrown hardwoods are:

- The largest activity was sawmilling, followed by craft cabinet manufacture and drying of sawn timber;
- Almost half of the users of homegrown hardwood were also involved in sourcing and converting roundwood, because they could not find the quality and quantity of wood they required;
- The majority of sawmillers were also involved in drying;
- More than one third of users dried their own timber, mainly because they could not find it elsewhere at the moisture content they required;
- About half of the users were involved in both primary and secondary processing, i.e. sawmilling and furniture manufacture;
- Almost all the users were involved in more than one activity;
- More than half (57%) of the users were in the craft sector;
- Fourteen percent were in the furniture sector.

Species used

Fifty percent of homegrown hardwood species were used by less than 10% of the users; ash was used by more than half the users (Table 2). This difference may be partially explained by shortage of supply of the lesser-used species, and lack of knowledge of their properties. Table 2 introduces five groups of homegrown species based on the percentage of users. Appendix IV (Table IV-7), also shows that species that have a small usage at present are generally highly regarded by their users.

TABLE 2: Species usage categorisation.

GROUP	SPECIES	PERCENTAGE OF RESPONDENTS USING THE SPECIES %	NUMBER OF USERS
I	Ash	>= 50	30
II	Beech	>= 40<50	26
	Oak		24
	Elm		23
III	Yew	>= 20<40	19
	Sycamore		16
IV	Cherry	>= 10<20	10
	Walnut		8
	Spanish/sweet chestnut		8
	Horse chestnut		3
	Holly		6
V	Alder	< 10	5
	Birch		4
	Willow		3
	Lime		2
	Laburnum		2
	Maple		1
	Poplar		1
	Hazel		1
	Whitethorn		1
	Blackthorn		1
TOTAL			56

** Although not a hardwood, yew was included as it is a native species that is used reasonably extensively.*

Volume of sawnwood produced

In the questionnaire, sawmillers were asked to state the quantity of sawn wood of the different homegrown hardwood species that they produced. They were also asked to estimate the potential quantity that they could sell if available (Table 3).

The main points arising from Table 3 and the questionnaire are:

- Demand exceeds supply for almost all homegrown hardwoods, and in particular oak, for which consumption could increase 11 times - at the moment, imported hardwoods fill this gap;
- For those species that have the greatest current consumption, there is also the greatest demand for expansion in production: ash, oak, beech, chestnut, sycamore and elm.

TABLE 3: Actual and potential sales of homegrown sawn hardwoods in 1999.

SPECIES	ACTUAL SALES	POTENTIAL SALES	POTENTIAL INCREASE
	m^3		%
Ash	1445	4315	199
Beech	600	688	15
Chestnut	262	271	4
Oak	143	1722	1107
Elm	137	152	10
Sycamore	105	153	45
Cherry	29	37	29
Birch	28	29	1
Alder	28	28	0
Yew	8	15	89
Poplar	5	5	0
Walnut	1	8	613
Willow	1	1	0
Holly	0	1	310
Hornbeam	0	17	
Lime	0	0	0
Subtotal	2793	7442	
Unclassified *	504	0	
TOTAL	3298	7442	

** Some sawmillers gave only the overall quantity of homegrown hardwoods they produce, without indicating quantities for each species.*

Timber drying

Timber drying is a good indicator of the state of development of a wood-using sector. The analysis in Table 4 is based on the 75 businesses that reported on their operations. In summary the results were:

- Sixty-one businesses in Ireland carry out hardwood drying;
- Fifty-two businesses do air-drying of hardwoods;
- Thirty-four businesses practice kiln-drying of hardwoods;
- Twenty-five businesses operate both air- and kiln-drying; nine carry out only kiln-drying;
- Thirty businesses reported the moisture content (mc) to which they dry timber (Table 4);
- Fifty-seven businesses used kiln-dried timber, fifty-eight would use homegrown kiln-dried timber if it were available.

A large number of businesses, over 30%, did not have their own kiln-drying facilities but use kiln-dried timber. Because there is no substantial supply of homegrown kiln-dried timber, they used imported timber instead. From the interviews it was apparent that the majority of businesses were disappointed by the quality of homegrown kiln-dried timber.

The businesses that do not have drying facilities (neither air-drying nor kiln-drying) are mainly craft cabinet manufacturers. Those businesses are mainly using imported timber but they would use homegrown timber if it were economically viable.

The following points emerge from Table 4:

- Fifty percent of businesses (that reported moisture content) dried timber to between 12-16% mc;
- Seven sawmills (almost half) dried their timber to a moisture content higher than 14%, one of these was also involved in flooring production, decking and boat building, two were hurley manufacturers while the remaining four made craft items and furniture. Five sawmills dried timber to moisture contents between 12 and 14% and three to below 12%. Out of the three sawmills that dried below 12% mc, one was involved in joinery, flooring and moulding production and the other two were involved in wood-turning and furniture manufacture;
- Thirteen out of fifteen sawmills had air-drying facilities and seven of these also had kiln-drying facilities. Two sawmills provided only kiln-drying but no air-drying (both mills dried timber down to 12% mc).

TABLE 4: Moisture content after drying of homegrown hardwood timber in relation to utilisation pattern and market segment.

TARGET MOISTURE CONTENT AFTER DRYING	UTILISATION PATTERN AND MARKET SEGMENT	PROVIDE AIR-DRYING?	PROVIDE KILN-DRYING?
<12%	Saw milling, drying of sawn timber, craft cabinet manufacture	Yes	Yes
<12%	Mobile sawmilling, drying of sawn timber, craft wood-turning, craft cabinet manufacture, industrial cabinet manufacture.	Yes	Yes
<12%	Mobile sawmilling, sawmilling, drying of sawn timber, joinery, flooring production, moulding	Yes	Yes
<12%	Drying of sawn timber, craft wood-turning, craft cabinet manufacture.	Yes	Yes
<12%	Drying of sawn timber, craft cabinet manufacture, industrial cabinet manufacture, wood sculpture.	Yes	Yes
14%	Sawmilling, drying of sawn timber, flooring production, boat building, fencing, decking	Yes	Yes
12-16%	Sawmilling, drying of sawn timber, industrial wood-turning	Yes	Yes
12-13%	Sawmilling, drying of sawn timber, craft wood-turning, industrial wood-turning	Yes	Yes
12-13%	Mobile sawmilling, sawmilling, craft wood-turning, craft cabinet manufacture	Yes	Yes
12-13%	Drying of sawn timber, craft cabinet manufacture	Yes	Yes
<12-13%	Drying of sawn timber, craft wood-turning.	Yes	Yes
<12-13%	Craft cabinet manufacture	Yes	Yes
<12-15	Craft wood-turning, craft cabinet manufacture, wood carving	Yes	No
12%	Other	Yes	No
<12%	Craft wood-turning, craft cabinet manufacture, toy manufacture	Yes	No
>25%	Mobile sawmilling, industrial cabinet manufacture, wood sculpture	Yes	No
25%	Sawmilling, hurley manufacture	Yes	No
<12% >25%	Furniture framing, craft wood-turning, craft cabinet manufacture	Yes	No
6-10%	Musical instrument	Yes	No
14-16%	Joinery, furniture framing, craft cabinet manufacture	Yes	No
17-19%	Sawmilling, drying of sawn timber, joinery, furniture framing, craft wood-turning, industrial cabinet manufacture.	Yes	No
17-19%	Mobile sawmilling, sawmilling, drying of sawn timber, musical instrument manufacture	Yes	No
17-19%	Mobile sawmilling, sawmilling, drying of sawn timber, furniture framing, industrial wood-turning, craft cabinet manufacture, industrial cabinet manufacture, wood sculpture	Yes	No
17-19%	Mobile sawmilling, drying of sawn timber, hurley manufacture	Yes	No
12-13%	Sawmilling, drying of sawn timber, craft cabinet manufacture, industrial cabinet manufacture.	No	Yes
14-16%	Craft wood-turning, wood sculpture	No	Yes
12%	Craft wood-turning, craft cabinet manufacture	N/A	N/A
12%	Sawmilling, drying of sawn timber, joinery, industrial wood-turning	No	Yes
12%	Craft cabinet manufacture, industrial cabinet manufacture.	No	Yes
18%	Craft wood-turning, craft cabinet manufacture	No	Yes

Timber grading

The main issue that was raised during the discussion with homegrown hardwood users was the insufficient supply of particular grades. The grading system is market-based (Table 5).

The usage of the different grades is given in Table 6.

It can be seen from Table 6 that character grades A and B are the most used grades for all species. The third most commonly used grade is select. The only exception is cherry where character grade A and select are the two grades that are most used.

Two recent (October 2003) developments are of relevance to the grading of homegrown hardwood:

1. On the invitation of the Forestry Commission in Scotland, COFORD and a number of industry and research representatives have been taking part in the development of a grading system for homegrown hardwoods in England, Wales, Scotland and Ireland.
2. An Irish Hardwood Council (IHC) has been established, arising from the work carried out during the course of the project. A member of the IHC is chairing a new working group of the Timber Standards Consultative Committee (TSCC) of the National Standards Authority of Ireland (NSAI) that will progress the development of a grading system for homegrown hardwoods.

TABLE 5: Market-based grading system used for homegrown hardwoods.

GRADE	DESCRIPTION
Veneer	The highest grade: minimum amount of defects, straight grain, minimum amount of pin knots, planks available in big sizes.
Select (or defect free)	Smaller sized planks than veneer quality, some small live knots present, straight grain.
Character grade A	Smaller sized planks than the select grade, mainly straight grain, big live knots that disturb the regularity of grain to a minor degree, pith excluded.
Character grade B	Any size of plank, irregular grain, large live and dead knots, pith can be included.
Pippy	Pieces with the appearance of ‘cat’s paw’ characteristic.
Beaming	Square or rectangular pieces over 300 x 300 mm and 6 m long of select grade or character grade A.
Burr*	Pieces with an interwoven, contorted or gnarly mass of dense woody tissue.
Fencing	Usually any size of small logs or big branches cut in two, bark included. It is classified just above firewood and quality of timber character grade B.
Framing	Softwood like timber in terms of softness, and whiteness in colour that is used in framing of furniture (horse chestnut, beech).
Prime	Close to veneer quality and just above select.
Rustic	It is mainly used for oak. Branches of trees over 50 years or thinnings give small pieces of oak with special character.

** In some species (Betula, Erica, Juglans, Quercus, Sequoia, Ulmus) the burrs are large and decorative and valued for veneers. For other species, burrs have no decorative value and in all cases they decrease the strength of the timber.*

TABLE 6: Usage of homegrown timber grades.

GRADE	SPECIES					
	ASH	OAK	BEECH	CHERRY	CHESTNUT	SYCAMORE
	NUMBER OF USERS					
Veneer		1				
Select	8	4	7	3	2	2
Character grade A	13	11	11	1	5	5
Character grade B	10	10	9	3	3	10
Pippy	1	2				1
Burr	1	5				2
Bog *		2				
Beaming		2				
Fencing		1				
Framing	1	1				
Spalted **			3			
Fuelwood	1	1	1			1
Prime		1		1		
Rustic		1				
Olive (ash)	1					
	WALNUT	ELM	HOLLY	YEW	ALDER	LABURNUM
Veneer						
Select	2	5	1	2		
Character grade A	2	7	1	7	2	1
Character grade B	3	9	3	5	2	1
Pippy		2		1		
Burr		4		1		
Bog				1		
Beaming						
Fencing						
Framing						
Spalted						
Fuelwood	1	1	1	1	1	
Prime		1			1	
Rustic						
	LIME	WILLOW	POPLAR	BIRCH	HAZEL	HORNBEAM
Veneer						
Select						
Character grade A	1	1	1			
Character grade B	1	1	2	2	1	1
Pippy						
Burr						
Bog						
Beaming						
Fencing						
Framing						
Spalted				1		
Fuelwood		1	1	1	1	
Prime				1		
Rustic						

* *Fossil oak timbers from bogs.*

** *Refers to beech with dark decay lines which are a decorative feature.*

Working properties

Species performance (by grade) for each of the following working properties were determined from the interviews and questionnaire:

1. Machining;
2. Nailing;
3. Splitting in screwing;
4. Gluing;
5. Sanding;
6. Turning.

The overall results are presented in Appendix IV. Although the users scored the properties subjectively, the validity of the results can be justified as each user was experienced in more than one market segment, and used a number of species.

Table 7 presents the results from Appendix IV, and can be summarised as follows:

- Over 90% of the respondents stated that the overall performance of homegrown hardwoods was satisfactory to excellent for the working properties listed;
- The majority of respondents indicated that the performance of homegrown hardwoods was excellent in three out of the six properties (machining, gluing and sanding);
- Performance in nailing, splitting in screwing and turning was mainly satisfactory;
- The poorest performance (more than 10% of answers) was in nailing which was the only property where the rating for poor performance (27%) exceeded excellent (22%);
- Splitting in screwing was rated the second worst property of homegrown hardwood after nailing.

TABLE 7: Performance of homegrown hardwoods in six working properties.

WORKING PROPERTY	RATING BY RESPONDENTS					
	EXCELLENT		SATISFACTORY		POOR	
	Number of answers	%	Number of answers	%	Number of answers	%
Machining	53	53	40	40	7	7
Nailing	14	22	33	52	17	27
Splitting in screwing	27	31	51	59	8	9
Gluing	54	56	43	44	0	0
Sanding	62	63	37	37	0	0
Turning	35	43	43	54	3	3

Machining

Species performance in machining was as follows: ash>beech>oak>elm>walnut (Table 8). When comparing only the excellent category the order was the same. Ash was the only species that was considered by a large proportion of users (30%) to have excellent machining properties.

Over 60% of the species received no poor rating and only cherry received over 20% of poor rating in machining.

The results of the questionnaire in relation to machining are presented in further detail in Appendix IV.

TABLE 8: Species most commonly used in machining and their performance.

FIVE MOST COMMONLY USED SPECIES	PERCENTAGE OF USERS WHO COMMENTED ON SPECIES %	FIVE BEST* PERFORMING SPECIES BASED ON RESPONSES	RATING		
			EXCELLENT	SATISFACTORY	POOR
			%		
Ash	23	Ash	70	30	0
Beech	20	Beech	40	60	0
Oak	16	Oak	44	44	13
Elm	13	Elm	46	38	15
Sycamore	7	Walnut	100	0	0

Nailing

Fewer respondents nailed homegrown timber than machined it (64 replies for nailing compared with 100 for machining). The performance in nailing was quite different to that for machining and the rest of the properties (Table 9). Just over half (52%) of the respondents said nailing performance of homegrown hardwoods was satisfactory, with ratings for excellent and poor, 22% and 27%, respectively. Nailing was the only property where homegrown hardwood performed badly. While the difference was distributed almost equally over species, it was mainly ash, beech, oak and sycamore that gave rise to the poor performance rating. Walnut, Spanish chestnut, poplar, lime and holly were the only species that received no poor rating for nailing performance.

The results of the questionnaire in relation to nailing are presented in further detail in Appendix IV.

TABLE 9: Species most commonly used in nailing and their performance.

MOST COMMONLY USED SPECIES	PERCENTAGE OF USERS WHO COMMENTED ON SPECIES %	FIVE BEST* PERFORMING SPECIES BASED ON RESPONSES	RATING		
			EXCELLENT	SATISFACTORY	POOR
			%		
Ash	20	Ash	23	46	31
Beech	20	Oak	31	23	46
Oak	19	Elm	25	75	0
Elm	13	Beech	17	50	33
Sycamore, Walnut	6	Walnut	50	50	0

** Best performance was based on the sum of percentages for excellent and satisfactory ratings.*

Splitting in screwing

Splitting in screwing was the property with the highest percentage of satisfactory ratings (Table 10). However, splitting in screwing and nailing were the only properties where the sum of satisfactory and poor ratings was over 60%. The majority of satisfactory answers were for beech, oak, ash and elm, in descending order. Eleven of the 13 species gave satisfactory performance.

The five most popular species were also rated in that order in terms of performance in splitting in screwing (Table 10). Beech and oak had the highest percentages of satisfactory ratings.

Character grade A was the most commonly used and received the highest percentage of satisfactory ratings (Appendix IV: Table IV-3b).

TABLE 10: Species most commonly used in screwing and their performance.

MOST COMMONLY USED SPECIES	PERCENTAGE OF USERS WHO COMMENTED ON SPECIES %	FIVE BEST* PERFORMING SPECIES BASED ON RESPONSES	RATING		
			EXCELLENT	SATISFACTORY	POOR
			%		
Ash	21	Ash	44	44	11
Beech	19	Beech	19	75	6
Oak	16	Oak	21	64	14
Elm	13	Elm	27	73	0
Sycamore, Walnut	8	Walnut	33	67	0

Gluing

Ninety-seven responses were received, almost as many as machining. Homegrown hardwood glued very well, with no poor ratings given (Table 11). It was the second best property after sanding, with 50% of replies rating the property as excellent.

The five most commonly used species in gluing were ash, beech, oak, elm and sycamore, in that order, and these were also the best performing species (Table 11).

All grades gave excellent gluing performance (Appendix IV: Table IV-4b).

TABLE 11: Species most commonly used in gluing and their performance.

MOST COMMONLY USED SPECIES	PERCENTAGE OF USERS WHO COMMENTED ON SPECIES %	FIVE BEST* PERFORMING SPECIES BASED ON RESPONSES	RATING		
			EXCELLENT	SATISFACTORY	POOR
			%		
Ash	23	Ash	59	41	0
Beech	21	Beech	60	40	0
Oak	14	Oak	43	57	0
Elm	13	Elm	46	54	0
Sycamore	7	Walnut	67	33	0

** Best performance was based on the sum of percentages for excellent and satisfactory ratings.*

Sanding

Homegrown timber sanded very well and was the most highly rated property. Sixty three percent of respondents gave an excellent rating and no poor rating was given. The five best performing species were also the most commonly used (Table 12).

Character grade A gave the best sanding performance (Appendix IV: Table IV-5b).

TABLE 12: Species most commonly used in sanding and their performance.

MOST COMMONLY USED SPECIES	PERCENTAGE OF USERS WHO COMMENTED ON SPECIES %	FIVE BEST* PERFORMING SPECIES BASED ON RESPONSES	RATING		
			EXCELLENT	SATISFACTORY	POOR
			%		
Ash	23	Ash	70	30	0
Beech	21	Beech	67	33	0
Oak	14	Oak	47	53	0
Elm	13	Elm	54	46	0
Sycamore	7	Walnut	100	0	0

Turning

Homegrown hardwood had good turning properties with 97% of the respondents rating it excellent or satisfactory (Table 13). The same order was followed in terms of performance of species usage (Table 13).

Character grade A was the most commonly used for wood-turning with 36 respondents, followed by character grade B (30 respondents) and prime/select (15 respondents). The excellent rating for character grade A followed the order of the most popular species, with the exception that beech was rated higher than ash.

The results of the questionnaire in relation to turning are presented in further detail in Appendix IV (Tables IV-6a and IV-6b).

TABLE 13: Species most commonly used in turning and their performance.

MOST COMMONLY USED SPECIES	PERCENTAGE OF USERS WHO COMMENTED ON SPECIES %	FIVE BEST* PERFORMING SPECIES BASED ON RESPONSES	RATING		
			EXCELLENT	SATISFACTORY	POOR
			%		
Ash	25	Ash	50	50	0
Beech	22	Beech	56	44	0
Oak	16	Oak	23	62	15
Elm	12	Elm	30	70	0
Sycamore	7	Sycamore	50	33	17

** Best performance was based on the sum of percentages for excellent and satisfactory ratings.*

DISCUSSION AND CONCLUSIONS

There are over 250 full-time businesses in Ireland that use homegrown hardwood. There is direct employment of about 800 people. There are also over 1,000 people that work with homegrown hardwoods on a part-time basis. They all have a high regard for homegrown hardwoods.

There is a huge demand for homegrown hardwoods from existing consumers. Also, users who are presently consuming imported hardwoods would replace them with homegrown material if the latter was readily available, at good quality and at a competitive price.

The fact that users of Irish hardwoods belong to more than one market segment shows that the species are suitable for a wide variety of applications. This is supported by the high demand for homegrown hardwoods in all market segments.

There is a need for specialisation within the homegrown hardwood market. This would mean that fewer users would have to source, saw and dry timber and could concentrate on expanding their secondary processing operations.

As has been shown, craft and industrial wood-turning as well as craft and industrial cabinet-making are practised at the same time by the majority of users. There is no preference for a particular species or grade but the traditional species (ash, beech, elm, oak and yew) are mainly used. There is, though, great enthusiasm and appreciation for all of the other 15 species that are grown in Ireland. Users work with those species satisfactorily and they want to see greater availability.

The most commonly used grades are character grade A and B. A few users prefer pippy and burr grades for elm, yew and oak, and some concentrate on select grades of ash, beech and oak. The majority of users of homegrown hardwoods would prefer to see an increase in wood supply at the present grades rather than upgrade.

Three users account for over 80% of the overall consumption. Their preference is for the select grade. These users, unlike the majority, would like to see an increase in supply of the grades that they currently use as well as an increase in the supply of higher grades, mainly select.

With reference to the desirable moisture content, answers to the questionnaire indicated that users manage to dry timber themselves or manage to find it already dried at the desired moisture content and quality.

Regarding the performance of homegrown hardwoods, it is evident that the number of people using homegrown hardwoods does not correlate directly with their opinion of the performance of those hardwoods. Given that the majority of users that answered the questionnaire have been working with homegrown hardwoods for more than twenty years and that they have experience of homegrown hardwoods as well as imported timber, it is quite safe to say that the working properties of homegrown hardwoods are competitive with the working properties of imported timbers. This can be also supported by the fact that the majority of users belong to more than one market segment, therefore their comments on the different working properties have greater value.

Further research

Additional information on the procuring operations should be obtained, specifically on drying, grading, sanding, staining and painting. The value of homegrown hardwood market in Ireland should be also studied and analysed, together with an employment study.

APPENDIX I: Organisations and individuals contacted and interviewed in the survey

Organisations contacted

Coillte Teoranta

County Councils (all counties)

Crafts Council of Ireland

CRITT (Centre Regional d'Innovation et de Transfert de Technologies Pour les Industries du Bois), France

Danish Technology Centre, Denmark

Dublin Institute of Technology

ENGREF (Ecole Nationale du Genie Rural, des Eaux et des Forets), Nancy, France

ENSTIB (Ecole Nationale Superieure des Technologies et Industries du Bois), Nancy, France

Enterprise Boards (all counties)

Enterprise Ireland

FÁS offices (all counties)

Finnish Forest Research Institute

Forest Research Institute of Athens

Forestry Department, University College Dublin, Belfield, Dublin

Furniture Technology Centre and Furniture College, Letterfrack, Co Galway

Irish Timber Growers' Association

Irish Woodturners' Guild (all chapters)

Tasmanian Country Sawmillers' Federation

The National Confederation of German Woodworking and Furniture Industries, Germany

The Tree Council of Ireland

Trateknik (Wood Science and Technology) University, Linkoping, Sweden

University College of North Wales, Bangor

Wood Marketing Federation of Ireland

Interviewees 1998 and 1999

Brickenden, David: Cratloe Woods, Cratloe, Co Clare

Carroll, Billy: Coillte sawmill, Cong, Co Galway

Doyle, Michael: Coillte Research Headquarters, Newtownmountkennedy, Co Wicklow

Dunne's Sawmill: Tullamore, Co Offaly

Fox, David and Frank: Irish Timber Products, Athboy, Co Meath

Heaney, Seamus: Coillte Sawmills, Dundrum, Co Tipperary

Knaggs, Gordon, Cahill, Declan and Conway, John: Enterprise Ireland, Glasnevin, Dublin

Moloney, Sean, Reddington Murt and Maye, Kevin: Wood Technology Centre, Limerick University

Nunn, Clive: Clive Nunn Timber Ltd., Thomastown, Co Kilkenny

O'Sullivan, Noel: Drimoleague, West Cork, Co Cork

Pearse, Eric: Lisheenaleen, Kilbrittain, Co Cork

Phelan, Pat: Kingsriver Community, Ennisnag, Stonyford, Co Kilkenny

Roche, Tom: Irish Woodworkers for Africa, Tullamore, Co Offaly

Tormey, Frank: Mount Bellew Timber Products, Mountbellew, Co Galway

Wright, Ian: Skibbereen, Co Cork

APPENDIX II: Questionnaire

Covering letter to homegrown hardwood users and producers

Project Development Centre

Dear Sir/Madam,

I am trying to build a database with all the users of homegrown hardwoods in Ireland. The purpose of this database is to provide to the users themselves better access to the sources of those hardwoods, help them find new clients as well as new uses for homegrown hardwoods.

Preliminary research has shown that a consistent and reliable source of Irish-grown hardwoods would make the majority of wood users transfer from using non-native species to native (given that the quality and price of the homegrown is competitive). It is the objective of this project to help the development of the overall market for Irish hardwoods as well as develop further the added value use for those hardwoods.

It is part of the current project to contribute towards the establishment of a "common language", between the users of Irish hardwoods, on the grading system, drying, finishing and working qualities of Irish hardwoods. That is the reason we are asking you to complete all the pages in the attached questionnaire, if they relate to you.

If you would like to be included in the database, and you want to share your experience from homegrown hardwoods, please complete the included questionnaire and return it to me in the pre-paid self-addressed envelope.

Thank you for your co-operation and I hope that the publication of this database will help you develop your business.

The project is carried out under the auspices of the Dublin Institute of Technology (DIT) and is fully funded by the National Council of Forest Research and Development (COFORD). If you would like more information about the project please tick the appropriate box in the questionnaire and I will contact you.

All information supplied will be strictly confidential to COFORD, the National Council for Forest Research and Development.

I look forward to receiving your answer.

Yours sincerely,

Stella Xenopoulou

Project Manager

COFORD
NATIONAL COUNCIL FOR FOREST RESEARCH & DEVELOPMENT

DIT

Questionnaire forms

PLEASE GIVE YOUR DETAILS:

First Name: _ _ _

QUESTION 2: If you dry homegrown hardwoods please tick the appropriate boxes below:

You are involved in:

2.1. Air-drying ☐

2.2. Kiln-drying ☐

2.3. Both ☐

2.4. What moisture content you usually dry your timber to?

2.4.1. Over 25% ☐

2.4.2. 20-25% ☐

2.4.3. 17-19% ☐

2.4.4. 14-16% ☐

2.4.5. 12-13% ☐

2.4.6. Less than 12% ☐

QUESTION 3: Please give the approximate annual amount of green, kiln and air-dried homegrown hardwoods that you are currently using (either dried by yourself or bought dry).

Given that there is a short of supply in homegrown hardwoods, please give the amount you would use if there was sufficient supply. Please give these amounts for each species and grade in cubic feet (ft^3).

Also, give the moisture content (mc) of the timber you dry or use for each species and grade.

Note that:

- The qualities/grades given are a result of discussion with sawmills and end-users of Irish hardwoods. Those grades are used during buying and selling of hardwood logs, wood and wood products.
- Different qualities/grades apply only to certain species, e.g. pippy oak, framing beech.
- An example of character grade A could be timber that is suitable for furniture or flooring and has small live knots, straight grain. Timber under character B could also be used, e.g. furniture or flooring, but its defects will be many more and severe. A lot of craft people are using character grade B wood because they find the irregularities/defects that enable them to achieve the artistic look in their products.

TABLE 3.1: Amount of dried oak, ash, beech, Spanish chestnut, sycamore, elm, walnut, alder, birch, cherry, willow, poplar, hornbeam, holly, and yew actually and potentially used (complete separately for each species).

QUALITY OR GRADE	KILN-DRIED				AIR-DRIED			
	Present annual use of kiln-dried timber (ft^3) At specific moisture content (%)		Potential annual use of kiln-dried timber (ft^3) At specific moisture content (%)		Present annual use of air-dried timber (ft^3) At specific moisture content (%)		Potential annual use of air-dried timber (ft^3) At specific moisture content (%)	
	ft^3	mc (%)	ft^3	mc (%)	ft^3	mc (%)	ft^3	mc (%)
Veneer								
Select (or Defect free)								
Character grade A								
Character grade B								
Pippy								
Beaming								
Burr								
Fencing								
Framing								
Other, please name:								

Please give the grades and amount of timber of green (where no drying has taken place) homegrown hardwood that you use. Please use the grades given above.

TABLE 3.2: Amount of green oak, ash, beech, Spanish chestnut, sycamore, elm, walnut, alder, birch, cherry, willow, poplar, hornbeam, holly, and yew used (complete separately for each species).

GRADE	AMOUNT OF GREEN HOMEGROWN HARDWOOD (ft^3)

QUESTION 4: If you preserve and/or finish homegrown hardwoods please state the species, the grades, the estimated amount of timber per annum that you currently preserve and/or finish. Also, the methods of application and type of preservative and/or finish you use (for example: 100ft^3 oak per year, select grade, brushed with Danish oil).

TABLE 4.1: Preservation and finishing of hardwoods.

Homegrown species	Grade	Amount currently preservative treated or finished ft^3	Method	Preservative/finish

QUESTION 5: Please give your opinion on the following properties for each species and grade of homegrown hardwoods you use. Please tick (✔) the corresponding box for excellent (E), satisfactory (S) or poor (P) performance.

TABLE 5.1: Workability (performance) of hardwoods.

Species	Grade	MACHINING		NAILING		SPLITTING IN SCREWING		GLUING		SANDING		TURNING	
		E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □
		E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □
		E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □	E S P	□ □ □

Letter sent to members of the Irish Timber Growers' Association

Project Development Centre
17 Herbert Street
Dublin 2. Ireland

Tel: +353-1-6611910
Fax: +353-1-6611973
Website: www.pdc.ie

Project Development Centre

Dear Sir/Madam,

I am building a database of all users and growers of hardwoods in Ireland.

The purpose of this database is to:
1. help broadleaf growers to find increased and higher value outlets for their timber;
2. provide hardwood users with better access to such timber sources, as well as to help them to find new clients and new uses for home-grown hardwoods.

Ultimately, the database will help to develop the overall market for Irish hardwoods as well as higher added value uses.

The database is part of a project run by the Project Development Centre of the Dublin Institute of Technology and funded by COFORD. Details of the project were published in a previous ITGA Newsletter.

If you would like to be included in the database, so that potential clients can find you, please send your details to:

Stella Xenopoulou
Project Development Centre,
17 Herbert Street, Dublin 2

In order for potential clients to know what you can provide please include the following information:

1. Your full name
2. Your address and phone/fax number and email address (if available)
3. An estimate of the volume of hardwood timber (preferably in cubic metres, overbark), by species, that you have available for sale at present (if volumes are not available please supply an approximate area and age for each species)
4. An estimate of the volumes (or areas) of hardwood timber, by species, that you will have available for sale in the period 2000-2004 (inclusive)
5. An estimate of the volumes (or areas) of hardwood timber, by species, that you will have available for sale in the period 2005 and beyond.

All information supplied will be used solely in the discharge of this project. As stated the objective of gathering the information is to develop the market for, and use of, Irish hardwood.

I look forward to receiving your reply.
Yours sincerely,

Stella Xenopoulou
Project Manager

COFORD
NATIONAL COUNCIL FOR FOREST RESEARCH & DEVELOPMENT

APPENDIX III: Market segments, species and grades

Summary of responses to questionnaire regarding market segment, species and grade.

MARKET SEGMENT	SPECIES USED	GRADE*
Sawmilling, hurley manufacture	Ash	Select and A
Sawmilling, drying of sawn timber, flooring production, boat building, fencing, pile driving	Irish (oak) and imported hardwoods	Selected oak: select, A, beaming, fencing, burr
Toy making	Non-native birch plywood.	
Mobile sawmilling, sawmilling, drying of sawn timber, bellows maker	Ash, elm	A
Sawmilling, mobile sawmilling, general craft manufacture	Any hardwoods (start-up phase)	
Furniture framing, craft wood-turning, craft cabinet manufacture	Oak, ash, beech, elm, cherry, yew	Oak: B, pippy Ash: Select, A Beech: select Elm: B, pippy, burr Cherry: select Yew: pippy
Sawmill, toy making	Oak, ash, beech, chestnut and sycamore	A
Craft wood-turning, craft cabinet-making	Oak, ash	B
Mobile sawmilling, sawmilling	Elm, oak, sycamore, beech and ash	
Mobile sawmilling, sawmilling, drying of sawn timber, joinery, flooring production	Oak, ash, beech, sycamore, elm, alder, birch and cherry	Oak: prime, rustic, pippy, beaming Ash: select Beech: select and spalted Chestnut: select. Sycamore: select Elm, alder, Birch, cherry: prime
Craft wood-turning, wood sculpture	Windthrown trees: cherry, yew, elm, beech	Burr elm, beech (spalted)
Craft Wood-turning	Alder, apple, ash, birch, cherry, beech, elm, holly, hornbeam, horse chestnut, laburnum, lime, maple oak, pear, walnut, willow, yew	Olive ash, spalted birch and beech, burr elm and oak
Wood sculpture	Bog wood (oak, pine, yew)	Bog oak, yew
Drying of sawn timber, joinery, craft cabinet-making	Non-homegrown hardwoods - would use homegrown if they were available, dried properly and priced accordingly	
Drying of sawn timber, craft wood production based on router technology	Ash and beech	Ash: B. Beech: B
Sawmilling, drying of sawn timber, craft cabinet-making, industrial cabinet-making	Oak, elm, walnut, cherry, yew.	
Sawmilling, joinery, racing hurdles		
Sawmilling, drying of sawn timber, craft cabinet-making	Oak, ash, beech, chestnut, sycamore, elm	Oak: A and B. Ash, beech, chestnut, sycamore and elm: B
Sawmilling, drying of sawn timber, industrial wood-turning	Ash, beech and non-native hornbeam	Ash and beech: select
Sawmilling, drying of sawn timber, craft wood-turning, industrial wood-turning	Sycamore	A
Craft wood-turning, craft cabinet manufacture, wood sculpture and carving	Oak, ash, beech, sycamore, elm, red alder, yew, walnut, holly, hornbeam, poplar, birch, willow and hazel	B and fuelwood
Craft cabinet-making, industrial cabinet-making	Oak, beech, and elm (American cherry)	A (American cherry: A)
Craft wood-turning, craft cabinet-making, craft fretwork	Oak, ash, beech, chestnut, sycamore, elm, walnut, cherry, holly, and yew	Character grade B
Craft wood-turning (20%), musical instrument manufacture (80%)	Ash, beech, walnut, cherry	Ash, cherry and walnut: select. Beech: A
Mobile sawmilling and boat building	Oak and ash	Framing
Drying of sawn timber, craft wood-turning, craft cabinet-making	Ash, beech, chestnut, elm, and yew	Ash, beech, chestnut and elm: select Yew: A
Joinery, craft cabinet-making, wood sculpture	Chestnut, sycamore, walnut, lime, yew, alder and laburnum	A and B.
Designers and manufacturers of hotel and bar furniture	Imported hardwoods, but would use homegrown if readily available	
Drying of sawn timber, craft wood-turning	Ash and beech	Beech: brown colouration
Wood sculpture	Elm, walnut, cherry, holly, yew, oak, (pear and apple)	Select.

** A and B refer to character grades A and B.*

MARKET SEGMENT	SPECIES USED	GRADE
Wood-turning	Ash, oak, yew and sycamore	B and burr
Drying of sawn timber, craft cabinet-making, Industrial cabinet-making, wood sculpture.	Beech and elm	Beech: A Elm: A and B
Furniture framing	Imported hardwoods - used to use homegrown, but stopped due to problems of sourcing and quality	
Craft cabinet-making	Imported hardwoods due to "…availability and quality of stock is so erratic. We can never be guaranteed that a particular thickness or species is available from month to month"	
Mobile sawmilling, toy making, wood sculpture	"Recycled material" He does not use solid timber, only MDF	
Joinery, furniture framing, craft cabinet-making	Oak, ash, willow. He could use all hardwoods at below fibre saturation point moisture content	A
Drying of sawn timber, craft cabinet-making	Oak, beech, chestnut and elm	Oak: select Beech: select and B Chestnut: A Elm: select and A
Furniture framing, industrial wood-turning, industrial cabinet-making		
Mobile sawmilling, drying of sawn timber, furniture framing, craft and industrial wood-turning, craft and industrial cabinet manufacture, wood sculpture	Oak, ash, beech, chestnut, sycamore and elm	Oak: select, A & B and burr Ash: select, A & B and pippy Beech: select and A & B Chestnut: A Sycamore: select, A & B, pippy and burr Elm: select, A, & B, pippy and burr
Mobile sawmilling, sawmilling, craft wood-turning, craft cabinet-making	Oak, ash, beech, chestnut, elm, yew, holly	Beech: select All other species: A
Mobile sawmilling, industrial cabinet-making, wood sculpture	Ash, sycamore, elm, yew and holly	B
Sawmill, drying of sawn timber, joinery, industrial wood-turning	Beech	A
Hurley manufacture	Ash	Root ash
Sawmilling, joinery		
Mobile sawmilling, drying of sawn timber, craft wood-turning, craft and industrial cabinet-making	Ash, yew and elm	Select
Sawmilling and trailer manufacture	Softwoods only	
Mobile sawmilling and sawmilling, drying of sawn timber, furniture framing, industrial wood-turning, craft and industrial cabinet-making, wood sculpture	Oak, ash, beech, chestnut, sycamore, yew, elm and cherry	Oak: Veneer, A (bog oak) and B Ash, beech, chestnut elm: A & B Cherry and sycamore: B Yew: A
	Non-homegrown hardwoods	
Joinery and craft cabinet-making	American hardwoods (black walnut, tulipwood, white oak). Would use homegrown hardwoods if they were available in dried state	No 1 common grade (he likes some "defects" in the timber)
Craft cabinet-making, industrial cabinet-making and toy manufacture	Used to use tropical and American hardwoods only (mahogany, white oak, walnut etc.) to manufacture solid wood furniture between 1983and 1991. Now uses only chipboard and MDF to produce bedroom furniture. Wants to resume with craft and to use homegrown timber	
Sawmill, drying of sawn timber, joinery, furniture framing, craft wood-turning, industrial cabinet-making	Poplar	Oak: A & B and burr Ash, beech elm, walnut, alder, yew and sycamore: A Poplar: A & B
Wood sculpture, craft cabinet-making		
Sawmilling, craft cabinet-making	Oak, ash, beech, sycamore, elm, and yew	A
	Only "redwood pine"	
	Spruce, pine, larch, Douglas fir	
	Non hardwood	
Mobile sawmilling, drying of sawn timber and hurley manufacture	Ash	A and hurley roots
Craft wood-turning, craft cabinet-making, toy making	Ash, beech, yew, chestnut	A
Craft wood-turning, craft cabinet-making, wood carving	Oak, ash, beech, sycamore, birch, elm, cherry, yew, whitethorn, blackthorn, rowan and "fruitwood"	Oak, ash and cherry: A & B Beech, sycamore, elm and birch: B Yew: A
Sawmilling and drying of sawn timber	Non hardwood	
Craft and industrial cabinet-making	Homegrown hardwoods: beech and sycamore and softwoods	B

APPENDIX IV:
Performance rating from the questionnaire by species and grade

Performance ratings for each property are presented in the tables below. Table numbers followed by '**a**' present a breakdown of the percentages of answers by species. For each species and performance rating (excellent, satisfactory and poor) the first column shows the percentage of answers by species for each performance rating. The second column shows the performance rating within each species.

TABLE IV-1a: Species machining performance.

SPECIES	% OF ALL ANSWERS (E)	% OF ANSWERS PER SPECIES (E)	% OF ALL ANSWERS (S)	% OF ANSWERS PER SPECIES (S)	% OF ALL ANSWERS (P)	% OF ANSWERS PER SPECIES (P)
	%					
Alder	0	0	3	100	0	0
Ash	30	70	18	30	0	0
Beech	15	40	3	60	0	0
Cherry	4	50	3	25	14	25
Elm	11	46	13	38	29	15
Holly	0	0	5	100	0	0
Lime	2	100	0	0	0	0
Oak	13	44	18	44	29	13
Poplar	0	0	5	100	0	0
Spanish chestnut	6	75	3	25	0	0
Sycamore	8	57	5	29	14	14
Walnut	11	100	0	0	0	0
Yew	0	0	0	0	14	100
Grand Total	100		100		100	

TABLE IV-1b: Species and grade machining performance.

	Rating												
	Excellent				Satisfactory				Poor				Species total
	Grade				Grade				Grade				
Species	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	
	Number of respondents												
Alder	0	0	0	0	1	0	0	1	0	0	0	0	1
Ash	6	6	4	16	5	1	1	7	0	0	0	0	23
Beech	4	2	2	8	5	6	1	12	0	0	0	0	20
Cherry	0	0	2	2	0	0	1	1	0	1	0	1	4
Elm	5	1	0	6	1	2	2	5	1	1	0	2	13
Holly	0	0	0	0	0	1	1	2	0	0	0	0	2
Lime	1	0	0	1	0	0	0	0	0	0	0	0	1
Oak	2	2	3	7	5	2	0	7	1	1	0	2	16
Poplar	0	0	0	0	1	1	0	2	0	0	0	0	2
Spanish chestnut	1	1	1	3	0	0	1	1	0	0	0	0	4
Sycamore	2	2	0	4	0	2	0	2	1	0	0	1	7
Walnut	3	1	2	6	0	0	0	0	0	0	0	0	6
Yew	0	0	0	0	0	0	0	0	0	1	0	1	1
Species grade total	24	15	14	53	18	15	7	40	3	4	0	7	100

CGA: character grade A
CGB: character grade B
P/S: prime select

TABLE IV-2a: Species nailing performance.

SPECIES	% OF ALL ANSWERS (E)	% OF ANSWERS PER SPECIES (E)	% OF ALL ANSWERS (S)	% OF ANSWERS PER SPECIES (S)	% OF ALL ANSWERS (P)	% OF ANSWERS PER SPECIES (P)
	%					
Alder	0	0	0	0	6	100
Ash	21	23	18	46	24	31
Beech	14	17	18	50	24	33
Cherry	0	0	9	100	0	0
Elm	14	25	18	75	0	0
Holly	0	0	6	100	0	0
Lime	0	0	0	0	0	0
Oak	29	31	9	23	35	46
Poplar	0	0	6	100	0	0
S. Chestnut	7	50	3	50	0	0
Sycamore	0	0	6	50	12	50
Walnut	14	50	6	50	0	0
Yew	0	0	0	0	0	0
Grand Total	100		100		100	

TABLE IV-2b: Species and grade nailing performance.

	Rating												
	Excellent				Satisfactory				Poor				
	Grade				Grade				Grade				
Species	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	Species total
	Number of respondents												
Alder	0	0	0	0	0	0	0	0	1	0	0	1	1
Ash	1	2	0	3	2	3	1	6	2	0	2	4	13
Beech	1	1	0	2	2	2	2	6	2	2	0	4	12
Cherry	0	0	0	0	0	1	2	3	0	0	0	0	3
Elm	2	0	0	2	2	3	1	6	0	0	0	0	8
Holly	0	0	0	0	0	1	1	2	0	0	0	0	2
Lime	0	0	0	0	0	0	0	0	0	0	0	0	0
Oak	1	1	2	4	2	1	0	3	3	3	0	6	13
Poplar	0	0	0	0	1	1	0	2	0	0	0	0	2
Spanish chestnut	0	0	1	1	0	1	0	1	0	0	0	0	2
Sycamore	0	0	0	0	1	1	0	2	1	1	0	2	4
Walnut	1	0	1	2	1	1	0	2	0	0	0	0	4
Yew	0	0	0	0	0	0	0	0	0	0	0	0	0
Species grade total	6	4	4	14	11	15	6	33	9	6	2	17	64

TABLE IV-3a: Species splitting in screwing performance.

SPECIES	% OF ALL ANSWERS (E)	% OF ANSWERS PER SPECIES (E)	% OF ALL ANSWERS (S)	% OF ANSWERS PER SPECIES (S)	% OF ALL ANSWERS (P)	% OF ANSWERS PER SPECIES (P)
	%					
Alder	0	0	2	100	0	0
Ash	30	44	16	44	25	11
Beech	11	19	24	75	13	6
Cherry	7	50	2	25	13	25
Elm	11	27	16	73	0	0
Holly	0	0	4	100	0	0
Lime	4	100	0	0	0	0
Oak	11	21	18	64	25	14
Poplar	0	0	4	4	0	0
S. Chestnut	4	33	4	67	0	0
Sycamore	15	57	4	29	13	14
Walnut	7	33	8	67	0	0
Yew	0	0	0	0	13	100
Grand Total	100		100		100	

TABLE IV-3b: Species and grade splitting in screwing performance.

	Rating												
	Excellent				Satisfactory				Poor				
	Grade				Grade				Grade				
Species	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	Species total
	Number of respondents												
Alder	0	0	0	0	1	0	0	1	0	0	0	0	1
Ash	2	4	2	8	5	2	1	8	1	0	1	2	18
Beech	0	2	1	3	7	4	1	12	0	1	0	1	16
Cherry	0	1	1	2	0	0	1	1	0	0	1	1	4
Elm	2	1	0	3	4	3	1	8	0	0	0	0	11
Holly	0	0	0	0	0	1	1	2	0	0	0	0	2
Lime	1	0	0	1	0	0	0	0	0	0	0	0	1
Oak	2	1	0	3	5	3	1	9	1	1	0	2	14
Poplar	0	0	0	0	1	1	0	2	0	0	0	0	2
Spanish chestnut	0	0	1	1	1	1	0	2	0	0	0	0	3
Sycamore	2	2	0	4	0	2	0	2	1	0	0	1	7
Walnut	1	0	1	2	2	1	1	4	0	0	0	0	6
Yew	0	0	0	0	0	0	0	0	0	1	0	1	1
Species grade total	10	11	6	27	26	18	7	51	3	3	2	8	86

TABLE IV-4a: Species gluing performance.

SPECIES	% OF ALL ANSWERS (E)	% OF ANSWERS PER SPECIES (E)	% OF ALL ANSWERS (S)	% OF ANSWERS PER SPECIES (S)	% OF ALL ANSWERS (P)	% OF ANSWERS PER SPECIES (P)
	%					
Alder	2	100	0	0	0	0
Ash	24	59	21	41	0	0
Beech	22	60	19	40	0	0
Cherry	4	50	5	50	0	0
Elm	11	46	16	54	0	0
Holly	0	0	5	100	0	0
Lime	2	100	0	0	0	0
Oak	11	43	19	57	0	0
Poplar	2	50	2	50	0	0
S. Chestnut	4	50	5	50	0	0
Sycamore	11	86	2	14	0	0
Walnut	7	67	5	33	0	0
Yew	0	0	2	100	0	0
Grand Total	100		100		0	

TABLE IV-4b: Species and grade gluing performance.

	Rating												
	Excellent				Satisfactory				Poor				
	Grade				Grade				Grade				
Species	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	Species total
	Number of respondents												
Alder	1	0	0	1	0	0	0	0	0	0	0	0	1
Ash	5	4	4	13	6	2	1	9	0	0	0	0	22
Beech	5	5	2	12	4	3	1	8	0	0	0	0	20
Cherry	0	1	1	2	0	0	2	2	0	0	0	0	4
Elm	5	1	0	6	2	3	2	7	0	0	0	0	13
Holly	0	0	0	0	0	1	1	2	0	0	0	0	2
Lime	1	0	0	1	0	0	0	0	0	0	0	0	1
Oak	3	1	2	6	4	4	0	8	0	0	0	0	14
Poplar	1	0	0	1	0	1	0	1	0	0	0	0	2
Spanish chestnut	1	0	1	2	0	1	1	2	0	0	0	0	4
Sycamore	3	3	0	6	0	1	0	1	0	0	0	0	7
Walnut	2	0	2	4	1	1	0	2	0	0	0	0	6
Yew	0	0	0	0	0	1	0	1	0	0	0	0	1
Species grade total	27	15	12	54	17	18	8	43	0	0	0	0	97

TABLE IV-5a: Species sanding performance.

SPECIES	% OF ALL ANSWERS (E)	% OF ANSWERS PER SPECIES (E)	% OF ALL ANSWERS (S)	% OF ANSWERS PER SPECIES (S)	% OF ALL ANSWERS (P)	% OF ANSWERS PER SPECIES (P)
	%					
Alder	2	100	0	0	0	0
Ash	26	70	19	30	0	0
Beech	23	67	19	33	0	0
Cherry	3	67	3	33	0	0
Elm	11	54	16	46	0	0
Holly	0	0	5	100	0	0
Lime	0	0	3	100	0	0
Oak	11	47	22	53	0	0
Poplar	2	50	3	50	0	0
S. Chestnut	3	50	5	50	0	0
Sycamore	8	71	5	29	0	0
Walnut	10	100	0	0	0	0
Yew	2	100	0	0	0	0
Grand Total	100		100		100	

TABLE IV-5b: Species and grade sanding performance.

	Rating												
	Excellent				Satisfactory				Poor				
	Grade				Grade				Grade				
Species	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	Species total
	Number of respondents												
Alder	1	0	0	1	0	0	0	0	0	0	0	0	1
Ash	9	3	4	16	2	4	1	7	0	0	0	0	23
Beech	6	5	3	14	3	4	0	7	0	0	0	0	21
Cherry	0	0	2	2	0	0	1	1	0	0	0	0	3
Elm	4	2	1	7	3	2	1	6	0	0	0	0	13
Holly	0	0	0	0	0	1	1	2	0	0	0	0	2
Lime	0	0	0	0	1	0	0	1	0	0	0	0	1
Oak	4	1	2	7	4	4	0	8	0	0	0	0	15
Poplar	1	0	0	1	0	1	0	1	0	0	0	0	2
Spanish chestnut	1	0	1	2	0	1	1	2	0	0	0	0	4
Sycamore	2	3	0	5	1	1	0	2	0	0	0	0	7
Walnut	3	1	2	6	0	0	0	0	0	0	0	0	6
Yew	0	1	0	1	0	0	0	0	0	0	0	0	1
Species grade total	31	16	15	62	14	18	5	37	0	0	0	0	99

TABLE IV-6a: Species turning performance.

SPECIES	% OF ALL ANSWERS (E)	% OF ANSWERS PER SPECIES (E)	% OF ALL ANSWERS (S)	% OF ANSWERS PER SPECIES (S)	% OF ALL ANSWERS (P)	% OF ANSWERS PER SPECIES (P)
	%					
Alder	0	0	2	100	0	0
Ash	29	50	23	50	0	0
Beech	29	56	19	44	0	0
Cherry	3	33	5	67	0	0
Elm	9	30	16	70	0	0
Holly	3	50	2	50	0	0
Lime	0	0	0	0	0	0
Oak	9	23	19	62	67	15
Poplar	3	100	0	0	0	0
S. Chestnut	0	0	5	100	0	0
Sycamore	9	50	5	33	33	17
Walnut	9	60	5	40	0	0
Yew	0	0	0	0	0	0
Grand Total	100		100		100	

TABLE IV-6b: Species and grade turning performance.

	Rating												
	Excellent				Satisfactory				Poor				
	Grade				Grade				Grade				
Species	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	CGA	CGB	P/S	Total	Species total
	Number of respondents												
Alder	0	0	0	0	1	0	0	1	0	0	0	0	1
Ash	4	4	2	10	5	3	2	10	0	0	0	0	20
Beech	6	2	2	10	3	5	0	8	0	0	0	0	18
Cherry	0	0	1	1	0	0	2	2	0	0	0	0	3
Elm	2	1	0	3	3	3	1	7	0	0	0	0	10
Holly	0	1	0	1	0	0	1	1	0	0	0	0	2
Lime	0	0	0	0	0	0	0	0	0	0	0	0	0
Oak	3	0	0	3	3	4	1	8	1	1	0	2	13
Poplar	0	1	0	1	0	0	0	0	0	0	0	0	1
Spanish chestnut	0	0	0	0	0	1	1	2	0	0	0	0	2
Sycamore	2	1	0	3	0	2	0	2	1	0	0	1	6
Walnut	1	0	2	3	1	1	0	2	0	0	0	0	5
Yew	0	0	0	0	0	0	0	0	0	0	0	0	0
Species grade total	18	10	7	35	16	19	7	43	2	1	0	3	81

TABLE IV-7: Comparison of the degree of species usage and the rating of their working properties (ranked as proportion with excellent performance).

Usage grouping	Species	Percentage of respondents using the species %	machine		nail		screw		glue		sand		turn	
			Rating (E)	Property regrouping	Rating (E)	Property regrouping	Rating (E)	Property regrouping	Rating (E)	Property regrouping	Rating (E)	Property regrouping	Rating (E)	Property regrouping
I	Ash	>= 50	70%	I	23%	III	44%	II	59%	I	70%	I	50%	I
II	Beech	>= 40<50	40%	II	17%	IV	19%	IV	60%	I	67%	I	56%	I
	Oak		44%	II	31%	III	21%	III	43%	II	47%	II	23%	III
	Elm		46%	II	25%	III	27%	III	46%	II	54%	I	30%	III
III	Yew	>= 20<40	0%	V	N/A	N/A	0%	V	0%	V	100%	I	0%	V
	Sycamore		57%	I	0%	V	57%	I	86%	I	71%	I	50%	I
IV	Cherry	>= 10<20	50%	I	0%	V	50%	I	50%	I	67%	I	33%	III
	Walnut		100%	I	50%	I	33%	III	67%	I	100%	I	60%	I
	S. Chestnut		75%	I	50%	I	33%	III	50%	I	50%	I	0%	V
	Holly		0%	V	0%	V	0%	V	0%	V	0%	V	50%	I
V	Alder	< 10	0%	V	0%	V	0%	V	100%	I	100%	I	0%	V
	Lime		100%	I	N/A	N/A	100%	I	100%	I	0%	I	0%	V
	Poplar		0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100%	I

Two types of grouping are shown in the above table: usage grouping is in the first column and regrouping according to properties in the other columns. In the usage grouping species are categorised according to the percentage of users that work with the particular species. In the property regrouping, species are categorised according to the percentage of users who gave an excellent rating to that particular property.

N/A: respondents had no experience in machining those species.

Note 2: Horse chestnut, birch, willow, laburnum, maple, hazel, whitethorn and blackthorn are excluded from the table because they received no specific rating from respondents. However, quite a number of respondents stated that they were quite satisfied with the performance of those species.