

Economic Evaluation of the Forest Sector in Moray

Final report for Forestry Commission Scotland

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CJC Consulting

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Contents

Executive Summary.....	i
1 Introduction.....	1
1.1 Remit and Objectives.....	1
1.2 The history of forestry in Moray	1
1.3 Definition of the forestry sector	2
1.4 Measurement of impacts on economy and society	2
1.5 Sources of information and data.....	3
1.6 Structure of the report.....	3
2 The economy of Moray.....	5
2.1 Introduction.....	5
2.2 Demography.....	5
2.3 Economic Activity	6
2.4 Earnings.....	9
2.5 Unemployment and vacancies.....	11
2.6 Economic Prospects	12
2.7 Tourism	14
2.8 Conclusions.....	15
3 Woodlands and growers	16
3.1 Woodlands.....	16
3.2 Survey of growers	17
3.3 Outputs and prices.....	17
3.4 Income	20
3.5 Expenditure	21
3.6 Employment	21
3.7 Future trends (grower sector).....	22
3.8 Wild fungi and other products	24
3.9 Conclusions.....	24
4 Sawmills and timber processing	26
4.1 Introduction.....	26
4.2 Timber and wood purchases	26
4.3 Income	27
4.4 Expenditure	27
4.5 Employment	27
4.6 Secondary processing.....	28
4.7 Workforce and skills.....	29
4.8 Future Developments	29
4.9 Conclusions.....	30
5 Forestry supply sector	32
5.1 Introduction.....	32
5.2 Income	32
5.3 Expenditure	33
5.4 Employment	34
5.5 Workforce and skills.....	34
5.6 Trends	35

5.7	Conclusions.....	35
6	Social, environmental and tourism benefits.....	37
6.1	Introduction.....	37
6.2	Recreational benefits.....	37
6.3	Biodiversity benefits.....	38
6.4	Carbon sequestration benefits.....	40
6.5	Landscape benefits.....	40
6.6	Tourism.....	41
6.7	Community benefits from woodlands.....	42
6.8	Educational use of woodlands.....	44
6.9	Conclusions.....	45
7	Economic contribution of the forestry sector to the Moray economy.....	46
7.1	Employment in the forestry sector.....	46
7.2	Labour costs and skills shortages in the forestry sector.....	46
7.3	Incomes in the forestry sector.....	47
7.4	Multiplier effects.....	47
7.5	Contribution to Forestry Commission, Scottish Executive and regional policies.....	50
8	Conclusions.....	52
8.1	The Moray economy.....	52
8.2	Impacts of forestry on the Moray economy.....	52
8.3	Social and environmental benefits.....	53
8.4	Prospects.....	53
8.5	Recommendations for developing a transferable framework.....	54
9	References.....	56
10	Annex I Forestry Commission forecasts of timber output.....	59
10.1	Private sector.....	59
10.2	Forest Enterprise.....	60
11	Annex II Social and environmental benefit values.....	61
11.1	Recreation benefits.....	61
11.2	Biodiversity values.....	64
11.3	Carbon sequestration benefits.....	68
11.4	Landscape benefits.....	70
12	Annex III Biodiversity assessment.....	73

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Abbreviations

ABI	Annual Business Inquiry
CE	Choice experiment
CV	Contingent valuation
CWS	Community Woodland Supplement
FCWT	Forres Community Woodland Trust
FC	Forestry Commission
FCS	Forestry Commission Scotland
FE	Forest Enterprise Scotland
FTE	Full time equivalent (jobs)
FWPS	Farm Woodland Premium Scheme
GIS	Geographic Information System
GDP	Gross Domestic Product
GHGs	Greenhouse gases
GRIT	Generation of Regional Input-Output Tables
GRO	General Register Office for Scotland
HAP	Habitat Action Plan
HIE	Highlands and Islands Enterprise
HPM	Hedonic price model
HTC	Hedonic travel-cost
i-o	Input-output
IDBR	Inter-Departmental Business Register
LA	Local Authority
LEC	Local Enterprise Company
MBSE	Moray Badenoch and Strathspey Enterprise
MOD	Ministry of Defence
MPA	Most Preferred Alternative
NES	New Earnings Survey
NIWT	National inventory of woodlands and trees
ONS	Office for National Statistics
RSPB	Royal Society for the Protection of Birds
SAP	Species Action Plan
SFGS	Scottish Forestry Grant Scheme
SIC	Standard Industrial Classification
SG	Stated gamble
SNH	Scottish Natural Heritage
SP	Stated Preference
TDC	Diameter Class Grouping
UKBAP	UK Biodiversity Action Plan
USP	Unique selling point
WGS	Woodland Grant Scheme
WTP	Willingness-to-pay
ZTCMs	Zonal travel-cost models

Executive Summary

Remit

This study was commissioned by Forestry Commission Scotland (FCS) to evaluate the outputs from forests, woodlands and related activities in Moray. The overall aim of the study was to 'evaluate the contribution of forests and woodlands to the economy and society of Moray'.

The forestry sector

This was defined as consisting of growers, primary timber processors, first stage suppliers closely associated with forestry and other businesses using primary production from forests (e.g. fungi collection).

Methods

Data were derived mainly from postal surveys and interviews with forest owners (growers), timber processors and suppliers. Additional information was obtained from government statistics, literature sources and interviews with stakeholders.

The economy of Moray

The Moray economy has a high dependence on the RAF bases at Kinloss and Lossiemouth, but is an otherwise mixed economy, with a relatively high proportion of its manufacturing employment in low paid food and drink processing. In general, its full time employees earn less than the Scottish average, although skilled manual workers and professional staff tend to be paid at national rates. Population growth has been strong, but a significant decline is projected in the next 15 years, especially amongst younger people.

The local labour market is extremely tight by historical standards, with less than 2% unemployment recorded during 2004. This has led to the beginning of what is expected to be a significant influx of workers from overseas (especially the new EU countries), which applies to skilled as well as unskilled occupations.

The region's economy is facing major negative effects from the rundown of defence activity. The forest sector will not be directly affected. The sector is a relatively stable one in terms of employment and incomes, and this is a valuable asset in the current context.

Woodlands and growers

Twenty-eight percent of the land area of Moray is in forestry (64,335 ha). Of this 35% is managed by Forest Enterprise Scotland. Much of the private forestry is in large estates. Eighty-eight percent of the total area is in conifers and 38% of this is Scots Pine. The woodland area is expanding slowly (at c. 0.9% per year).

Sales of timber from Moray growers in 2003-2004 were 263,000t and forestry-related employment in the grower sector is 55 FTEs. The income from forestry is heavily dependent on timber prices which have been depressed for several years.

The rate of future expansion in the woodland area is uncertain. The introduction of the SFGS has created a more positive attitude amongst some growers but timber prices remain depressed and the impact of CAP single farm payments on land prices is unclear. FC forecast that there is potential for timber output to increase by 40% over the next 20 years, mainly from private woodlands. This will assist in maintaining forestry employment and provide the basis for an expansion in processing. The income forestry growers derived from forestry was £3.8m in 2003-2004, excluding grant aid.

Timber processing

There are only two sawmills of a significant size in Moray; most of the timber produced there is processed in Highland or Aberdeenshire. The nine timber processors who purchase virtually all the timber output from Moray account for 452 direct FTE employees of which 97 are resident in Moray.

There is significant secondary timber processing in Moray with three major businesses employing 120 people producing mainly for the construction and building industry. Other secondary processors consist of a small number of businesses either using laminated board or engaged in bespoke joinery (7 FTE jobs in total). Jobs in secondary processing are excluded from the totals given above because they are not normally considered as part of the forest sector and their use of Moray timber was minimal.

Some mills are investing in additional capacity to process the expected increase in timber output from Moray. Other sources of demand for wood may develop in the medium term. Proposals have been made for a £1bn multi-purpose processing facility at Invergordon. A 20MW combined heat and power plant at Tomintoul is also proposed. If built, these plants would transform the market for wood in the region by creating major additional demand for timber and coproducts.

Suppliers

A range of forestry sector businesses supply inputs to growers and processors. We estimate that there are 115 forestry agent, nursery and contracting businesses associated with Moray forestry, and that these account for 171 FTE employees resident in Moray. Those suppliers located in Moray have an aggregate income of £8.6m of which around 60% was derived from work outside the region.

The outlook for the supply sector is mixed, with increased activity expected from harvesting and restocking but uncertainty about the rate of new planting.

Labour and skills shortages

There is considerable concern in all parts of the forest sector at the shortage of skilled labour, especially in more specialised businesses. A shortage of unskilled labour was noted amongst nurseries. The shortages were attributed to a decline in interest in outdoor jobs, housing difficulties and low unemployment in Moray. Migrant labour was being used to a limited degree for both skilled and unskilled jobs and this is expected to increase.

Social and environmental outputs from forests

The forests in Moray are a major resource for recreation and tourism. They also contribute to landscape, biodiversity conservation and carbon sequestration. Several community groups are actively involved through woodland ownership and management. There are around 790,000 visits to woodlands each year, mostly for walking, biking and horse riding.

Forests in Moray provide habitats for important species including capercaillie, red squirrel, wildcat, and pine martin. Pinewood and sand dune habitats are important contributors to the UKBAP and major oakwood, coastal and river valley sites are protected by SSSI designation. There are five forest-related SSSIs. Some evidence exists for negative effects of afforestation (e.g. acidification on salmon fisheries) which have been addressed through FC guidelines.

The various non-market benefits from forestry were valued using the best available estimates (Table S1). The total value of these social and environmental outputs is estimated at around £10m per year. However, the estimates should be interpreted as

indicative only especially for biodiversity, because of limited information and the use of benefit values from studies made in other locations.

Table S1 Non-Market benefit values of forests in Moray (£m)

Type of benefit	Benefit per year (£m)	Beneficiaries
Recreation	0.90	Local and tourists
Biodiversity	5.39	Scottish
Landscape	2.90	Local
Carbon sequestration	1.20	Global
Total	10.39	

Tourism

Of the visits or woodlands 231,00 are estimated to be by tourists from outside Moray. Their expenditures benefit the local economy, and the employment impact is estimated at 64 FTE jobs. There appears to be scope to increase tourism stays and expenditures through more activities that use woodlands (biking, horse riding), and a number of initiatives are underway in the area.

Economic impacts

Multipliers were initially derived from the national input-output table using GRIT procedures but were found not to be very reliable because of the extrapolation involved, and other sources were used. The total impact on the Moray economy taking account of direct, indirect and induced effects was estimated at around 468 FTE jobs and £26.3m in income (Table S2). Of this, 397 FTEs were derived from timber and related activities. This can be compared with the separate estimate of the number of forest sector employees who were resident in Moray (323 FTEs), but this latter figure does not account for knock-on employment generated by their expenditures.

Table S2 Total impacts of forestry on the Moray economy

	Employment generated (FTEs)	Income (£m)
Timber and related activities	397	24.1
Forest related tourism	64	2.25
Other products (mainly fungi)	7 (direct)	Not estimated
Total	468	26.3

Contribution to Forestry Commission, Scottish Executive and regional policies

The forests in Moray are amongst the most competitive in Scotland by virtue of their favoured soils and climate. The forests provide a major recreational and environmental resource and contribute to the Executive's health agenda. FE staff and other woodland managers also engage with government and voluntary bodies in providing facilities and activities for socially excluded groups and for education.

The woodlands in Moray are emblematic in contributing strongly on all the strategic directions set in the Scottish Forestry Strategy. The larger estates and public forestry constitute a well-established and productive resource that also provides a wide range of highly valued environmental and recreational benefits. The active community woodland groups are evidence of strong interest in community engagement in woodland

management, a development that the Commission is keen to encourage and where possible facilitate.

The Moray Forestry Strategy (Moray Council, 2003) aims to assist the implementation of the Scottish Forestry Strategy by guiding and promoting sustainable forestry within Moray. The study demonstrates the income and employment generated by the forest sector, and the contribution made by the forest sector to the community and environmental agendas of the Council.

Recommendations for a transferable framework

We make the following recommendations for future regional studies:

- Regions larger than Moray should be used in future to avoid problems with cross-border transfers, confidentiality and imprecise GRIT estimates.
- A combination of local surveys and GRIT estimated multipliers provides the most cost-effective method for obtaining total economic impacts of forestry.
- Whilst it may be worth exploring IDBR data as a source of business addresses, this will not substitute for local information.
- The methods used to derive social and environmental benefits are transferable but would be improved by more reliable estimates of visitor and tourist numbers.
- More information is needed on the effect of landscape improvement and environmental quality on the attraction of people and businesses to a region.

1 Introduction

1.1 Remit and Objectives

This study was commissioned by Forestry Commission Scotland (FCS) to evaluate the outputs from forests, woodlands and related activities in Moray. The overall aim of the study was to 'evaluate the contribution of forests and woodlands to the economy and society of Moray'.

Specific objectives were to:

- ❑ Identify the range of outputs that are generated by forestry in Moray;
- ❑ Conduct research to evaluate these outputs;
- ❑ Use methodological techniques that can be replicated in evaluating the outputs of forests and woodlands in other geographical settings;
- ❑ Produce recommendations for developing a transferable framework for evaluating the outputs of forests and woodlands in different localities and regions; and,
- ❑ Identify the actual and potential contribution of forestry in Moray to the policies of the Forestry Commission, the Scottish Executive and other relevant bodies.

1.2 The history of forestry in Moray

Traditionally Moray was the preserve of the large landed estates such as Seafield and Strathspey, The Duke of Richmond and Gordon, Moray Estates and Altyre Estate. There are numerous published accounts of the importance these landowners placed on woodland management, particularly throughout the 1800's and into the early part of last century.

The processing of timber has inevitably been linked with this resource, with most of the estates having had their own sawmill. Industrial sawmilling was also carried out, notably at Rothes and Forres, and the shipbuilding industry at Garmouth relied heavily on this resource. Timber exports were also carried out through the Moray ports with the main rivers being used as the main transport link for floating logs to the coast or to mills for conversion.

With such a wealth of experience in the local workforce, Moray was an obvious choice for growth when the state forest service was set up in 1919. This expansion started early in the Forestry Commission's life with afforestation of areas such as Culbin, and continued in the post WWII period in the upland parts of the district such as Archiestown, Ballindalloch and Glenlivet. Throughout the 1900's Moray played a significant part in the development of forestry practice in the UK with research being carried out at sites such as Teindland and with the forest Nursery at Newton.

Most of the large estates continued to take advantage of the favourable tax position for forestry by expanding their holdings through the latter part of the 1900's. This was supplemented by investment forestry, which resulted in an increase in forest cover of almost 8% from 1980 onwards. The soils and climate in Moray are particularly suitable for the growth of Scots Pine and this now represents a third of the forest cover. The favourable mix of age classes and species within the district has been instrumental in the reinvestment by processors and sawmillers in the region, such as the James Jones & Sons Sawmill at Mosstodloch, and the outflow of timber is important in supporting processors such as Norbord at Inverness.

While always important for employment; recreation and the informal use of the woodlands by the public has increased significantly over the last 20 years. The habitat and amenity benefits delivered by the long established and varied forest and woodland cover are well recognised in the inclusion of woodland within the

Cairngorms National Park and the number of important species listed in the Habitat and Local Biodiversity Action Plans.

Moray now has 28% of its land area in forestry (64,335 ha) and, with its long history of established forestry, it will be integral to delivering the aims of the Scottish Forestry Strategy.

1.3 Definition of the forestry sector

The remit refers to forests and woodlands in Moray and related activities, and their impact on the economy of Moray. In the Standard Industrial Classification (SIC, National Statistics, 2004) forestry as a primary activity is category 02.0 (*Forestry, logging and related service activities*). It includes growing of timber, planting, thinning and felling but only where these are the principal activity of the business. Many farms, estates and nurseries involved in forestry operations will be recorded in other sectors of the SIC. Operations by forest contractors are included, but sawmills and timber processing are covered under manufacturing sub-sections.

The FC employment survey (Forestry Commission, 2001) defines the sector more widely, as consisting of private woodland owners, forestry companies and contractors and primary wood processing industries. We broadly follow this definition, although to maintain consistency when using income multipliers we follow the SIC sector definition. However, there are two 'boundary' problems. The first is how to deal with businesses with mixed forest/non-forestry operations, and the second is how to treat firms whose activities cross the regional (Moray) boundary. The growers in Moray are widely dispersed and supply timber to a few large processors who are mainly located outside the region in Highland and Aberdeenshire. Suppliers to growers and processors in Moray may be based outside the region and those based in Moray may also work elsewhere.

We used a range of information sources to identify businesses with significant forestry activity but when firms were surveyed we obtained information only on their forestry-related activities. In terms of activities that crossed the regional boundary we considered businesses to be located in Moray if they had an office there, and employees to be part of the Moray economy if they were resident there.

We therefore defined the businesses of interest in terms of the following elements:

- Growers located in Moray;
- Sawmills and related first stage outputs for timber from Moray;
- First stage suppliers closely associated with growers and sawmills in Moray (roads, fencing, planting, maintenance, timber transport, consultancy, management, harvesting); and
- Other businesses closely associated with the production from forests in Moray (e.g. fungi marketing).

Secondary wood processors are not normally included in the forest sector. We follow this convention but did explore the extent to which secondary processors in Moray used local timber.

1.4 Measurement of impacts on economy and society

1.4.1 The regional economy

It was beyond the scope of the study to construct a regional input-output table based on the expenditure flows between all sectors of the economy. Instead we derived multipliers from the Scottish input-output table using the Generation of Regional Input-Output Tables (GRIT) technique (Jensen, 1990; Johns and Leat, 1987). We undertook a detailed survey of forestry businesses to provide information on

employment, income and trade. Impacts of forest-related tourism were also estimated.

1.4.2 Impacts on society

Forestry provides benefits to society other than those derived through direct or indirect income or employment. Some information is available on the value to society of benefits from non-market outputs, including recreation, biodiversity, landscape and carbon sequestration. We used benefit values derived from the literature to value these outputs.

1.5 Sources of information and data

The Moray economy

Data on the Moray economy were obtained from national statistical sources (including the Census of Population and Annual Business Inquiry), Moray Council, HIE, MBSE and several consultants' reports.

Businesses in the forestry sector

The study faced a major problem in that no comprehensive information exists on the population of private businesses within the forestry sector in Moray (or elsewhere). In order to establish a database that was as complete as possible and that would serve as a basis for sampling and postal surveys, we developed address lists and business details from a number of sources. The main source was a series of interviews with major forestry-related businesses (FE, agents, processors, contractors). Information on landowners and their agents was also obtained from the FC WGS database. From this we listed all properties in receipt of grant aid from the inception of WGS (1991). This may have excluded what was expected to be a small number of growers (estates, farms) who had not engaged in new planting or restocking since 1991. Finally we obtained information from the Forestry Contractors Association and used the survey of growers and processors to give further details on contractors.

A postal questionnaire with telephone follow-up was used to obtain information about the activities of forestry businesses. These were classified as follows:

- Growers (Forest Enterprise, estates and farms).
- Suppliers of forest services (land agents, forest managers, forestry contractors, merchants, nurseries).
- Sawmills and other first stage processors.

In addition we undertook a mainly telephone-based study of selected second stage timber processors located in Moray. The aim was to assess their link to the forest sector in Moray and their contribution to the economy. These businesses were not treated as part of the forest sector.

The details of the populations and sampling frames used are given in the respective chapters.

Other stakeholders

Major stakeholders from the forestry production and processing sectors were contacted through interviews or the postal survey. These included Scottish Natural Heritage, the Cairngorms National Park Authority, RSPB, and the Spey, Findhorn and Lossie Salmon Fisheries Boards.

1.6 Structure of the report

Chapter 2 describes the economy of Moray. Chapters 3, 4, and 5 assess the income, expenditures and employment of the growers (woodland owners), processors and suppliers. Chapter 6 examines the social and environmental outputs from forestry, including the impacts of tourism. The various impacts on the Moray economy are

integrated in Chapter 7, and Chapter 8 lists the conclusions of the study and the contribution of forestry in Moray to higher level government and regional policies.

2 The economy of Moray

2.1 Introduction

The analysis below of the structure of the Moray economy and of recent trends provides a context for development in the forest sector and enables its proportionate importance to the Moray economy to be gauged.

The most reliable source of detailed information on economic activity is the 2001 Census, and much of the analysis below is based on figures from the Census. Census data are now four years out-of-date, but the 100% coverage of the Census means that it is a more reliable guide to an area's employment structure¹ than more recent data from national surveys such as the Annual Business Inquiry, which are based on incomplete surveys of businesses. Also, the Census is the only source that disaggregates employment in the forest sector. In interpreting the figures from the Census given below, it is important to bear in mind that these relate to Moray residents (who may be employed outside the area) rather than to workplace, which is the basis for national business surveys.

Where appropriate, comparisons are made with Scotland as a whole, and for some indicators, with the Highlands and Islands. Moray is now covered by Highlands and Islands Enterprise rather than Scottish Enterprise, but it sits between the rest of the Highlands and Islands and the rest of Grampian (Aberdeenshire and Aberdeen City), and has links with both areas – through trade and through travel-to-work.

Moray was combined with Badenoch and Strathspey (in Highland Council's area) to create the Moray Badenoch and Strathspey (MBSE) Local Enterprise Company area, but through geography and road and rail access, the Spey Valley communities generally have more links with Inverness than with Elgin or other main centres in Moray. The east side of Moray tends to merge into the Inverness / Nairn economy and the west side into the Grampian economy. The Barmac fabrication yard at Ardersier was an important external employer of people resident in Moray, but since its demise, the area has reverted to being a relatively self-contained labour market in terms of travel-to-work (although, as will be shown in this report, forestry is to an extent an exception to this generalisation).

As will be shown, Moray's economy is distinctive in a number of ways. In some respects, its characteristics and trends are comparable to those of the Highlands, whereas in others it is closer to the Scottish average.

2.2 Demography

Table 2.1 compares the population trend in Moray with Scotland and the Highlands and Islands (defined as the Highlands and Islands Enterprise area) between the 1991 and the 2001 Population Censuses.

Table 2.1 Resident populations (1991 and 2001)

Year	Moray	Scotland	Highlands & Islands
1991	83,616	5,083,330	430,361
2001	86,940	5,062,011	433,745
Change 1991-2001	+3,324 (+4.0%)	-21,309 (-0.4%)	+3,384 (+0.8%)

¹ Provided that any major changes since 2001 are identified and taken into account

The population of Moray increased significantly over the ten-year period. The rate of increase was higher than for the Highlands and Islands as a whole, although this trend in Moray reflected strong growth in the Inner Moray Firth area – the population of the Inverness and Nairn LEC area increasing by 6.6%. Moray’s male population grew by 5.5% to 43,447, while its female population grew by 2.5% to 43,493.

Mid-year population estimates from the General Register Officer (GRO) show a further increase in the Moray population between 2001 and 2003 of 0.6%.

Moray’s population density in 2001 was 0.39 residents per hectare, which compares with Scotland’s density of 0.65 residents per hectare. This low density suggests that Moray’s relatively high degree of afforestation is not constraining its population growth (although, as elsewhere, there is pressure on land around towns for new housing). The age structure of the Moray population in 2001 is shown in Table 2.2.

Table 2.2 Age structure of the population (%)

	Moray (%)	Scotland (%)	Highlands & Islands (%)
0-4	5.7	5.5	5.4
5-19	19.0	18.7	18.6
20-44	34.6	35.5	32.0
45-64	24.4	24.5	26.7
65-84	14.5	14.2	15.2
85+	1.7	1.8	2.0

Moray’s age structure is similar to that for Scotland as a whole, and younger than the Highlands and Islands average. The RAF bases at Kinloss and Lossiemouth will influence Moray’s age balance as military personnel tend to be young. In common with the UK as a whole, however, Moray’s population is becoming older (Table 2.3)

Table 2.3 Change in population in Moray, 1991 to 2001

Age band (years)	Increase / decrease	% change
0-4	-572	-10
5-19	-222	-1
20-44	-238	-1
45-64	+2,919	+16
65-84	+1,047	+9
85+	+390	+35
Total	+3,324	+4

This increasing dependence of the retired on those of working age is a factor in the recent tightening of the labour market discussed below.

78.5% of Moray’s population in 2001 were born in Scotland and 17.8% elsewhere in the UK. Ethnic groups are a small minority in Moray, with White British people representing 97.3% of the area’s population in 2001.

2.3 Economic Activity

The Labour Force Survey (March 2003 to February 2004) shows that the rate of economic activity of people of normal working age in Moray (16-64 for men and 16-59 for women) is relatively high at 83%, compared with the Scottish average of 78%. Growth in activity rates in Moray, as elsewhere in the UK, has stemmed mainly from

more women in the labour force (often in part-time work), and the female activity rate in Moray is now 80%, compared with a Scottish rate of 74%. An implication of the high male and female activity rates, combined with low unemployment (see Table 2.4 below), is that the scope for employers to expand through taking on additional Moray residents is extremely limited.

The analysis in Table 2.4, from the 2001 Census, covers a wider age band (16-74).

Table 2.4 Economic activity in 2001

	Moray		Scotland (%)
	No	%	
Economically Active			
Employed full time	26,306	41.6	40.3
Employed part time	8,417	13.3	11.1
Self-employed	5,109	8.1	6.6
Unemployed	2,225	3.5	4.0
Full time student	1,234	2.0	3.0
Economically Inactive			
Retired	9,304	14.7	13.9
Student	1,859	2.9	4.3
Looking after home/family	3,896	6.2	5.5
Permanently sick/disabled	2,886	4.6	7.4
Other	1,955	3.1	3.9

Moray's proportion of people aged 16-74 in each of the three categories of full time employees, part time employees and self-employed is higher than in Scotland as a whole.

The industrial structure of Moray in 2001, from Census returns, is compared below with that of Scotland (Table 2.5). Annual Business Inquiry (ABI) figures are available for 2002, but due to sampling this is not as accurate a guide to industrial structure as the Population Census of a year earlier, and further disaggregation (see Table 2.5 below) is not available. Indeed, the results of the 2003 ABI have not been released at local level because of margins for error in the statistics. As previously noted, the Census figures relate to residence rather than workplace.

Table 2.5 Industry of employment (all people aged 16-74 in employment)

	Moray		Scotland (%)	Highlands & Islands (%)
	No	%		
Agriculture, hunting, forestry	1,569	3.8	2.1	4.2
Fishing	364	0.9	0.3	2.1
Mining and quarrying	948	2.3	1.2	1.5
Manufacturing	5,410	13.2	13.2	9.7
Electricity, gas, water supply	211	0.5	1.0	0.9
Construction	3,162	7.7	7.5	8.9
Wholesale, retail trade	5,567	13.6	14.4	13.9
Hotels, catering	2,211	5.4	5.7	8.2
Transport, storage, communication	2,064	5.1	6.7	7.1
Financial intermediation	692	1.7	4.6	1.8
Property, renting, business	3,039	7.4	11.2	8.8
Public administration, defence	6,138	15.0	7.0	8.6
Education	2,710	6.6	7.3	6.7
Health, social work	4,225	10.3	12.4	12.1
Other	2,581	6.3	5.3	5.4
Total	40,891			

In some sectors, Moray's economy is more similar to that of Scotland than that of the Highlands and Islands (in particular in manufacturing, hotels and catering, and construction), while in other sectors, it is similar to the economy of the Highlands and Islands (in particular in the primary sector, wholesaling and retailing, financial intermediation, property etc, and education). The area's most notable feature is its high proportion of employment in public administration and defence, which is due to the RAF bases at Kinloss and Lossiemouth. The current employment at the two bases is shown in Table 2.6, although a significant reduction is likely to occur (see 2.6.1 below).

Table 2.6 RAF base employment in Moray

	Full time equivalent employment (FTEs)		
	Lossiemouth	Kinloss	Total
Military	2,342	1,864	4,206
MOD Civilian	377	311	688
Contractors	114	281	395
Total	2,833	2,456	5,289

Source Reference Economics (2005).

2.3.1 Forestry employment

Table 2.7 shows the number of Moray residents employed in forestry-related sectors. The information is derived from the detailed employment by sector data in the 2001 Census of Population. The employment figures refer to both full time and part time workers and include the self-employed.

Table 2.7 Employment in forestry-related activity in Moray (2001 Population Census)

Sector	Number
Forestry; logging and related service activities	188
Manufacture of wood and of products of wood and cork (except furniture); manufacture of articles of straw and plaiting materials	204
Manufacture of pulp, paper and paperboard	32
Manufacture of furniture	57
Total	481

In total, the sectors represent 1.2% of Moray's employment by residence in 2001. Some of the employment included under the second and fourth headings will not be forestry-related, but there will be further forestry-related employment under headings such as farming, where staff will have some involvement in woodland work, haulage (of wood and wood products), etc.

If employment not classified as forestry-related for the purposes of this study is excluded from Table 2.7, there might have been c350 full time equivalent jobs in the sector in 2001 held by Moray residents (not all located within Moray).

The occupational structure of the Moray economy in 2001, from Census returns, is compared in Table 2.8 with that of Scotland.

Table 2.8 Occupational groups

	Moray		Scotland
	No	%	%
Managers and senior officials	4,405	10.8	12.6
Professional	2,941	7.2	11.2
Associate professional/technical	7,058	17.3	14.3
Administrative/secretarial	3,859	9.4	13.0
Skilled trades	6,743	16.5	12.6
Personal service	3,096	7.6	7.1
Sales/customer service	3,280	8.0	7.3
Process, plant/machine operatives	4,164	10.2	10.0
Elementary occupations	5,345	13.1	11.8

Employment in Moray in selected occupational category was:

- Paper and wood machine operatives: 81
- Forestry workers: 127
- Furniture makers; other craft woodworkers: 86

These people will not all be forestry-related as defined for this study, while others employed in forestry-related activities will be covered by non-specific occupational classifications. This explains the differences between these figures and those in Table 2.7.

2.3.2 Educational qualifications

17.9% of Moray's resident population had "Group 4" qualifications in 2001 (first degree, higher degree or professional qualification) compared with 19.5% of Scottish residents, and 6.8% of Moray's residents had "Group 3" qualifications (HND, HNC, RSA higher degree, SVQ level 4 or 5, or equivalent) compared with 7.0% of Scottish residents. This reflects the relatively low proportions of managerial and professional employment in Moray. According to the 2003/04 Labour Force Survey, graduates account for 12% of Moray's workforce (compared with 20% for Scotland and 16% for the Highland Council area). The need (in general) to move away from Moray for a University education is also a factor in reducing the labour supply of graduates in Moray (as elsewhere in the Highlands and Islands). At the time of the Census, 1,192 normal Moray residents were studying outside the area.

2.4 Earnings

A new Annual Survey of Hours and Earnings was introduced by the Office for National Statistics (ONS) in 2004, replacing the New Earnings Survey (NES). The NES had been of questionable statistical validity at local area level in rural Scotland, and the new survey is more comprehensive and weighted to the number of jobs given by the Labour Force Survey (which has been enhanced in the Highlands and Islands). As with the NES, the focus is on the rates of pay of adults whose pay is unaffected by absence, which means that average annual incomes calculated from the results will be higher than the overall averages for an area. Also, the self employed are not covered by the survey.

The results for Moray (April 2004) are compared in Table 2.9 with the Scottish and UK averages.

Table 2.9 Gross weekly pay, 2004

	Median			Mean		
	Moray (£)	Scotland (£)	UK (£)	Moray (£)	Scotland (£)	UK (£)
All employees	286.1	326.2	350.0	322.4	382.0	421.0
All male employees	386.5	405.5	440.5	419.6	472.7	524.3
All female employees	212.6	258.5	261.7	251.6	301.1	312.8
All full time jobs	333.0	394.5	423.0	387.6	460.0	506.9
All male full time jobs	407.2	433.2	463.7	445.4	506.6	558.6
All female full time jobs	272.1	345.5	360.5	320.9	397.5	422.3
All part-time jobs	127.5	129.3	130.2	158.9	152.9	161.7
All male part time jobs	*	114.1	118.9	*	140.8	172.9
All female part time jobs	127.6	132.1	132.3	158.6	155.4	159.1

Note: * = unreliable (not published)

These figures show that Moray employees earn significantly less than the average Scottish or UK employee. For all employees, median earnings in Moray are 14% lower than the Scottish average and 20% lower than the UK average, while mean earnings in Moray are 16% lower than the Scottish average and 23% lower than the UK average. These differentials are mainly explained by rates of pay for full time jobs, as Moray's rates for part time jobs are comparable to Scottish rates and only around 2% lower than the UK average rates. The mean full time job in Moray pays only 76% of the UK average.

According to the 2001 Census, males employed in Moray worked an average of 45.8 hours per week, compared with 43.1 hours for Scottish residents, while females in Moray worked an average of 30.4 hours per week, compared with the Scottish average of 32.2 hours. Table 2.10 shows the annualised rates of pay obtained by multiplying the Moray weekly rates of pay by 52

Table 2.10 Annualised pay in Moray, 2004

	Male (£)	Female (£)	Male and Female (£)
All employees	20,098	11,055	14,877
Full time employees	21,174	14,149	17,160
Part time employees	n/a	6,635	6,630

As nationally, the lower rates of pay for female employees in Moray are largely, but not wholly, explained by occupational structure.

Average mean earnings in Moray were the lowest of the six Local Authority areas that comprise the Highlands and Islands, and 7% lower than the mean in the Highland Council area. This concurs with findings over a period of years from the New Earnings Survey, which showed rates of earnings in the MBSE area as the lowest of the ten LECs in the Highlands and Islands (indeed they have been the lowest of all 22 LECs in Scotland).

These low average earnings by Scottish standards apply to all percentiles, but rates of pay for skilled workers and professionals in Moray nevertheless can be high as staff are mobile and national rates tend to prevail. This can create difficulties for

employers on tight margins who need to pay relatively high rates to attract particular skilled staff.

76% of households in Moray own at least one car or van compared with the Scottish average of 66%. This enhances ability to travel to work – especially relevant for forestry work not close to public transport routes.

This context of relatively low pay may have helped the forestry sector in Moray to obtain labour in the past, but low paid sectors in Moray (as elsewhere in the Highlands and Islands) with relatively unattractive working conditions are now finding serious difficulties in recruiting and retaining staff. This was a principal finding of the study on tight labour markets in the Highlands and Islands (University of Warwick, 2004).

The Moray economy has a number of major employers in the food and drink sector whose profitability (nationally and internationally) depends on competitive pricing, which is helped by the relatively low average pay rates in the area. The RAF bases at Kinloss and Lossiemouth, in contrast, pay relatively high wages and salaries, but these are relatively isolated from the rest of the Moray economy.

The costs of housing and consumer products in Moray have reflected, to an extent, the area's relatively low earnings, but there are dangers of sustainability in an economy that fails to converge with neighbouring areas.

2.5 Unemployment and vacancies

Over the past year, Moray's unemployment proportion has been well below that for Scotland and also lower than the UK proportion, as illustrated by the quarterly figures below. Although with seasonal variation, the underlying unemployment rate in Moray has been falling (Table 2.11).

Table 2.11 Recent unemployment trend (proportion %)

	Moray (%)	Scotland (%)	UK (%)
January 2005	2.3	3.0	2.4
October 2004	1.7	2.7	2.2
July 2004	1.9	3.0	2.3
April 2004	2.3	3.1	2.5
January 2004	2.5	3.4	2.6

The proportion of unemployment, as given in the above table, is the percentage of working age residents who are claimants in an area.

It is interesting to note that the Census of Population gives a higher number of unemployed people than the Government's unemployment statistics. In April 2001 (Census month), approximately 50% more people resident in the MBSE area stated that they were unemployed on their Census return than the number of unemployed claimants in the area.

By gender, January 2005 unemployment in Moray comprised 856 males and 361 females, a total of 1,217 (2.3% of the population).

Moray's economy has virtually full employment at present. Many of those unemployed would not be considered for employment by employers – although there are programmes in progress to improve employability, and individuals on these programmes, together with work experience trainees, can represent good value as workers in well supervised and sympathetic employment circumstances.

110 of the people unemployed in Moray in January 2005 (9% of the total) had been out of work for at least a year and 465 (38% of the total) for at least three months. 390 people aged 24 and under were unemployed in January 2005.

There were 372 vacancies notified to Jobcentres in Moray in January 2005, including just 6 in the Agriculture and Fishing sector (including forestry) – although this is not a sector that traditionally uses Jobcentres extensively for finding employees. The main sectors with vacancies were Public Administration and Health (149), Distribution, Hotels and Restaurants (129) and Banking, Finance, Insurance, etc. (117). Retailing has been a growth sector in Moray (including a major new Tesco store in Elgin), and this seems to be an increasingly popular choice for young people. Occupationally, the main categories of vacancy in January 2005 were in Elementary Occupations (334), Sales and Customer Services (159) and Personal Service (94).

In addition to currently low unemployment in Moray, both relative to Scotland as a whole and in relation to the rate in previous years, the 2004 Tight Labour Markets report referred to above showed that the MBSE area had:

- a higher proportion of hard-to-fill vacancies as a percentage of employees (3.5%) than any other LEC area in Scotland in 2002 (according to Futureskills Scotland Skills in Scotland employers survey)
- the second highest proportion of skill-shortage vacancies as a percentage of employees (1.0%) of Scottish LEC areas (after Grampian).

Taking a longer term perspective, the claimant unemployment rate for Moray fell from over 4% in January 2000 to less than 2% late in 2004. In January 2000, the Moray rate was slightly above the Scottish rate, but, as shown above, Moray's unemployment relative to Scotland has since improved considerably. Moray's unemployment trend over the past five years has broadly followed the Highlands and Islands trend, with a rate generally around 25% lower, and with slightly less (though marked) seasonality, reflecting the importance of tourism.

2.6 Economic Prospects

Prior to the threat to employment at Moray's RAF bases (discussed below), the prospects for the area's economy were promising, albeit that the area needs to increase its share of higher technology employment and employment in higher value added sectors to reduce dependence on relatively low paid processing work. A report by the Fraser of Allander Institute for Moray Council, for example, anticipated growth in Moray's GDP of 2.7% per annum between 2004 and 2006 – although with the Agriculture, Forestry and Fishing sector growing at only half of this rate.

In the longer term, nevertheless, as in the Highlands and Islands as a whole, demographic trends have been pointing to a reduction in Moray's population, with implications for labour supply and the sustainability of population-related public services employment. The GRO's population projections for Moray between 2003 and 2018 show an expected fall in the area's population of 9% (Table 2.12), compared with an anticipated fall in Scotland's population of 2%.

Table 2.12 Population projections for Moray and Scotland

	Moray (%)	Scotland (%)
Below working age	-28	-17
Of working age	-13	-6
Above working age	+27	+24

2.6.1 The threat to Moray's air bases

A recent report by Reference Economics (March 2005) has assessed the current impact of the Kinloss and Lossiemouth RAF bases on the Moray economy, and estimated the negative impact of a range of rundown/closure scenarios. A significant degree of staffing reduction now appears certain, but the scale and timescales are not yet clear.

Including induced effects through employee spending and indirect effects through the spending of the bases, Table 2.13 shows the estimated employment and income impacts generated currently in Moray:

Table 2.13 Impacts of the Moray RAF base closures

	Employment (FTEs)	Gross Income (£ million)
Lossiemouth	3,850	79.9
Kinloss	3,407	76.6
Total	7,257	156.5

This represents 21% of all full time equivalent jobs in Moray (by residence). The average gross income of £21,565 per FTE is some 45% higher than the average for Moray as calculated in Table 2.8 above.

Within the civilian economy, the bases' combined impacts are estimated at 3,051 FTEs and gross income at £44.1 million – a lower average gross income of £14,454 per FTE, which is comparable to the overall Moray average. 3,051 FTEs represent 9% of Moray's FTEs (by residence).

The consultants assumed in their rundown/closure scenarios that one in four RAF military personnel would join civilian life in Moray were their post at one of the Moray bases to be lost. The area's economy has benefited significantly up to now through RAF personnel retiring early locally or experienced military staff leaving the RAF to work in local businesses (or set up businesses).

2.6.2 Future development strategy

The Moray Badenoch and Strathspey Local Economic Forum, a broad partnership of agencies and representative organisations, produced a Local Economic Development Strategy in 2003 that comprised a range of strategic priorities. The Business Development priorities included:

- Encourage sustainable development opportunities arising from the maturation of local timber resources
- Encourage community woodland projects
- Promote themes of scenic/environmental quality, outdoor recreation and area specialities (in relation to tourism development)
- Maximise tourism opportunities of Cairngorms National Park

Development priorities might be refocused in response to the possibly very substantial employment impact from job cuts at the RAF bases, with an emphasis on diversifying the economy, and it is likely that resources will be made available through the public agencies to support any new initiatives in existing sectors, including forestry, that would create additional employment.

The supply of labour to the forestry sector could improve through the rundown, as miscellaneous service businesses in the area shed labour in response to the overall decrease in local demand and new recruitment slows down. Also, the upward pressure on rates of pay for less attractive work which the tight labour market in the area will currently be exerting could ease.

2.7 Tourism

Tourism is an important industry in Moray, and one with scope for future growth. Moray's woodlands play a role in its tourism industry by:

- Providing places where visitors can engage in walking, mountain biking, horse riding, birdwatching, etc.
- Complementing the area's coastline (arguably its USP), e.g. at Culbin and Roseisle.
- Providing a backdrop to castles, distilleries, etc.
- Generally enhancing and diversifying the landscape.

The 2002/03 Highland and Moray Visitor Survey included interviews with 488 visiting parties at six locations in Moray. The main findings are given in Table 2.14.

Table 2.14 Highland and Moray Visitor Survey findings

	Moray	Whole Survey Area
Origin of Visitors		
Scotland (%)	39	38
Other UK (%)	38	39
Overseas (%)	23	23
Type of Trip		
On holiday (%)	63	77
Day trip (%)	16	9
Visiting friends and relatives (%)	19	11
Main holiday (%)	37	41
Mean length of stay (nights)		
In the Highlands	9.7	9.0
In Moray	3.3	n/a
Average number of visits to Moray in past 10 years	5.9	n/a
Activities		
Visit woodland/forest (%)	19	18
Low level walking (2-8 miles) (%)	38	45
Off road cycling (%)	1	4
Bird watching (%)	15	16
Watching land-based wildlife (%)	8	13

Note % are % of respondents

Snedden Economics (2004) estimated the volume and value of tourism in the Highlands and Moray, based on the 2002/03 visitor survey and other data. The key findings from this study for Moray were:

- 908,000 bednights were spent in the area.
- The average spend per person per night by people staying overnight was £56.79. and the average spend per day tripper was £14.60.
- Total visitor expenditure was £55.9 million.
- This visitor expenditure supported 1,357 FTEs in the area (approximately 3.9% of all FTEs).

2.8 Conclusions

The distinctive features of the Moray economy include the following:

- ❑ A high rate of population growth since 1991.
- ❑ A high economic activity rate.
- ❑ High dependence on the defence sector.
- ❑ A low dependence on tourism by Highlands and Islands standards.
- ❑ A low proportion of managerial and professional staff.
- ❑ A low percentage of graduates amongst its residents.
- ❑ Relatively low average earnings from full time jobs.
- ❑ Unemployment low and falling.

The relevance of the analysis of the Moray economy in this Section to its forestry sector can be summarised as follows:

- ❑ Labour supply is tight, but average rates of earnings in the area remain low by regional and national standards and significant numbers of jobs are likely to be lost in the short – medium term in sectors dependent on the spending of the RAF bases and their military and civilian employees.
- ❑ Even before the significant outmigration likely to result from rundown/closure of the RAF bases was anticipated, demographic structure indicated a reduction in Moray's population over the next 15 years.
- ❑ The area will depend on enhancing and promoting its landscape and other qualities to attract new businesses and residents to compensate for the rundown of the bases, and to increase its share of the north of Scotland's tourism.
- ❑ New development that creates employment is likely to attract good levels of public sector financial and other support to help cushion the area's economy from the impact of the job losses.

In the short term, nevertheless, the forestry sector is likely to become increasingly dependent on migrant labour (especially from the new EU countries) for contract work. This is the general trend, both in Moray and the north of Scotland as a whole, in sectors that require either relatively unskilled labour or people with skills that are in short supply.

3 Woodlands and growers

3.1 Woodlands

3.1.1 Areas and species

The forest area in Moray is 64,335² ha; this is 28% of the total land area (225,673 ha). Of this, 22,268 ha (35%) is managed by Forest Enterprise Scotland (FE) with the remaining 65% in private ownership³ (42,067 ha). Much of the private forestry is owned by large estates.

More information on the structure of forestry is provided by the FC species survey (Table 3.1). Unlike the GIS data, the aggregated area statistics in this dataset do not include open ground or recent WGS planting. This explains a Moray forest area of 56,107 ha which is 13% lower than the GIS estimate. The estate is predominantly in conifers (96% in the public FE estate and 84% elsewhere). The FE estate is notable for its near absence of broadleaves (4%), a reflection of its mainly commercial objectives, at least in the past. Taken as a whole the combined public and private estates in Moray show considerable diversity and an unusually high proportion of Scots Pine (34% overall). This reflects the good growing conditions for this species in Moray.

Table 3.1 Area of high forest by principal species and ownership

Species	Forestry Commission (FE)		Private		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Scots pine	7,752	37	10,497	31	18,250	34
Corsican pine	1,127	5	125	0	1,253	2
Lodgepole pine	4,431	21	5,340	16	9,771	18
Sitka spruce	3,443	17	7,818	23	11,261	21
Norway spruce	778	4	834	3	1,612	3
European larch	172	1	670	2	842	2
Jap/Hybrid larch	1,122	5	1,250	4	2,372	4
Douglas fir	503	2	493	1	997	2
Other conifers	89	0	260	1	348	1
Mixed conifers	449	2	589	2	1,038	2
Total conifers	19,867	96	27,876	84	47,744	88
Total broadleaves	922	4	5,457	16	6,380	12
Felled	809		1,175		1,984	
Total High Forest	21,599		34,509		56,107	

3.1.2 Restocking and new planting

The WGS database reveals that the average rate of restocking on private land (2001-2004) has been 212.7 ha per year, with additional new planting at 531.3 ha per year (Table 3.2). Forestry has been expanding at a fairly modest rate in recent years - around 0.9% per year. Clear felling and restocking of the private forest appears to be

² Unless otherwise stated, woodland, area and distance statistics were provided by FC Edinburgh. The woodland area was derived from the NIWT supplemented with WGS new planting data to April 2004 and includes open ground within woodland boundaries. There are small differences in the areas reported for FE in the survey and calculated in the GIS query.

³ All non-FE woodlands are referred to as private in the text to distinguish them from the 'public' FE estate, even though some may be owned by public bodies.

at a rate of 0.8% per year (based on the conifer area in Table 3.1). The overall picture is one of a relatively stable forest area with some expansion from new planting. However, this does not take into account the extension of continuous cover forestry. If the combined private and state conifer area of 47,744 ha had an average rotation length of, say, 60 years, then clearfelling would be moving towards 800 ha per annum.

Table 3.2 WGS grant payments

Year	New planting (ha)	Management (ha)	Restocking (ha)	Total (ha)	Total grant aid (£)
2001/02	577.4	1,114.0	267.1	1,958.6	433,038
2002/03	334.0	1,885.1	112.9	2,331.9	210,930
2003/04	682.5	1,606.0	258.0	2,546.6	533,238
Mean	531.3	1,535.0	212.7	2,279.0	392,402

The total area approved for grant aid of any type under SFGS at the end of December 2004 was 120.4 ha. This indicates a downturn in activity in the 2004 year which can probably be attributed to uncertainty about the rules governing single farm payments and changes in the FCS grant scheme.

3.2 Survey of growers

21 major estates were identified and surveyed together with a random sample of 17 smaller businesses that had received WGS grant aid for at least 20 ha of new planting or restocking (Table 3.3). Since the total population of growers is not known the population data were estimated by first raising the sample of major businesses to allow for non-response. This gave an estimated area of 30,279 ha. The GIS area of private woodlands is estimated at 40,985 ha, leaving 10,706 ha for minor growers. A raising factor of 13.9 was used to convert the survey responses on an area basis to this total area. This may be an overestimate of the area of actively managed woodlands.

Table 3.3 Sampling frame for growers

	Number in population	Number of businesses surveyed	Number replying to survey	Raising factor	Area attributed (ha)
Major growers (mainly estates)	21	21	14	1.5	30,279
Minor growers	Not known	17	12	13.9 (see text)	10,706
Forest Enterprise	1	1	1	1	22,268
Total		39	27		63,253

The questionnaire asked growers to reply with respect to their 2003-2004 accounting year in order for data to be drawn directly from annual accounts. This meant that the time context of the responses varied between respondents and cannot be ascribed to a calendar or specific accounting year.

3.3 Outputs and prices

3.3.1 Prices

Timber prices started to fall in the mid-1990s following increased supplies from the Baltic states, unfavourable currency fluctuations and increasing use of recycled wood

fibre. The average GB price for coniferous standing sales in 1997 was £15.72 per m³ overbark (Forestry Commission, 2005). Since then prices have fallen to a low point of £5.08 in September 2003 with a slight recovery to £6.19 in September 2004.

Local tender prices received by FE in Moray confirm the pressure which producers have been facing. In November 1996 the tender price for green logs was £42.34. In 2001/2002 it had fallen to £29.81, and then to £27.69 in 2003/2004. Prices in the current year have averaged £29.09. Timber price figures within the private sector are not available, but a similar trend has been experienced.

This collapse in prices has put great pressure on the incomes of all producers and led to efforts to reduce costs, especially for restocking (CJC Consulting, 2004b). There has been widespread use of natural regeneration and continuous cover forestry, at least in part to reduce expenditure.

3.3.2 Timber

The timber output data obtained from the survey of growers is given in Table 3.4. It indicates a total output of 263,212t. The private sector and FE outputs were similar at around 130,000t. We asked respondents to indicate where the timber was processed or whether it was destined for export out of Moray. 24% of the total output was processed in Moray, the majority being sold for processing in Highland. This trade is determined by the need to match the types of timber to types of sawmills and processing plants. A small volume of small roundwood was recorded as being exported – a trade that mainly takes place through Inverness, Buckie and Montrose. The questionnaire did not specifically ask about hardwood sales but none were reported by any respondent.

Table 3.4 Timber output from Moray (2003-2004) tonnes

	Total sales	Processed in			
		Moray	Highland	Aberdeenshire	Export from UK
Private woodlands					
Small roundwood	45,917	0	39,915	0	6,000
Pallet wood	11,796	9,540	1,109	1,146	0
Saw logs	16,821	11,787	3,684	1,350	0
Standing timber	58,226	20,261	32,658	4,046	1,260
Other	465	465	0	0	0
Private woodlands total	133,224	42,053	77,366	6,542	7,260
Forest Enterprise					
Small roundwood	60,649	0	60,649	0	0
Pallet wood	17,561	8,254	9,307	0	0
Saw logs	30,614	11,021	19,592	0	0
Standing timber	15,248	2,592	12,655	0	0
Other	5,916	0	5,916	0	0
FE Total	129,988	21,867	108,119	0	0
TOTAL	263,212	63,920	185,485	6,542	7,260

3.3.3 Forecast timber output

The Forestry Commission produces forecasts of timber output for both state and private woodlands. Details of their annual forecasts for Moray until 2026 are given in

Annex I and summarised in Figures 3.1 and 3.2 below. The years are five-year periods ending in the date on the x axis.

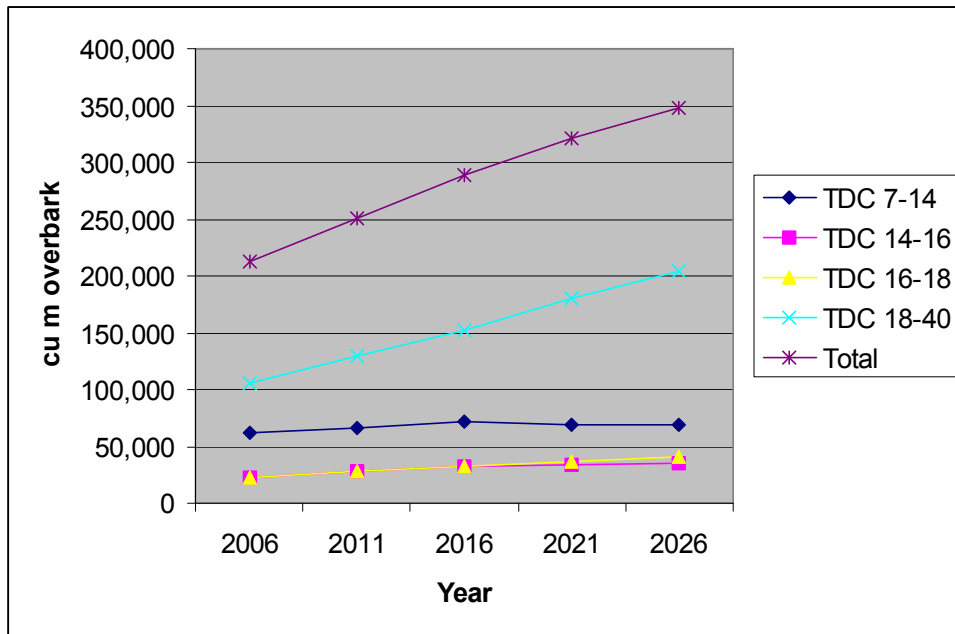


Figure 3.1 Forecast private woodland annual conifer output (m³ overbark)⁵

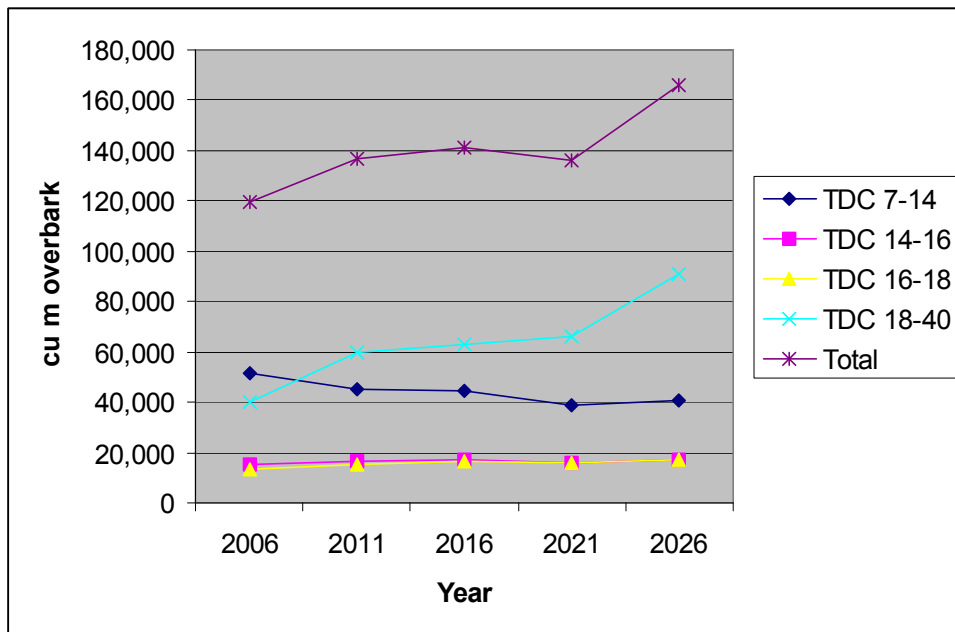


Figure 3.2 Forecast Forest Enterprise annual conifer output (m³ overbark)

The private sector total output in 2003-2004 was expected to be 206,700 m³ and this is forecast to increase steadily to 348,300 m³ per year in 2022-2026, an average rate of increase of these outputs may be around 6,000 m³ per year. The increase in roundwood production is 4,100 m³ per year. The forecast is for some increase in

⁵ 1 cu m overbark=0.909 tonnes wet wood. The utilisable volume is normally considered to be 15% lower than the potential volume indicated in the forecasts to allow for harvesting losses and wastage.

broadleaved output from the 2003-2004 forecast of 3,970 m³ in total. The level of hardwood output is very small when compared with that for conifers.

These private sector forecasts are an assessment of production potential for private forestry only; they do not reflect the intentions of the owners and forecasts have historically been consistently under achieved. Thus these forecasts have to be interpreted with caution because they may not represent actual future supply.

Forest Enterprise produces almost entirely coniferous timber. Production in recent years has been at or slightly below 140,000 m³ per year and this is expected to continue into the future. Although the predictive model suggests an increase in the 2022-2026 period we consider it more realistic to expect continuing FE output of around 140,000 m³ per year. The FE production forecast is derived directly from their Forest Design Plans with scheduled fellings determining volume flows. This is then a forecast of intended rather than just potential production and includes effects of all current management plans including the important focus on continuous cover silviculture.

Despite the uncertainty about actual supply from private woodlands it is clear that output will increase in Moray during the next 20 years, and the increase could be substantial. According to the forecasts the Moray forests have the potential to increase annual output to 430,000 m³ in 2012-2016 and 488,000 m³ in 2022-2026.

3.4 Income

The income from woodlands is primarily from timber with small additions from sport and other activities (including car parking) (Table 3.5). The total income from Moray woodlands was £3.81m⁶. 31% of this was received from businesses in Moray; this reflects the fact that most of the timber is exported out of Moray for processing (see Section 3.3.1 above).

Table 3.5 Income from forestry related activities (grower sector, 2003/2004)

	Invoice value (net of VAT) (£)	Received from businesses in Moray (£)
Private woodlands		
Timber (roundwood, standing timber etc.)	1,455,340	723,950
Sporting lease/venison sale	11,640	6,270
Other	1,390	1,390
Total	1,468,370	731,610
Forest Enterprise		
Timber (roundwood, standing timber etc.)	2,278,000	455,600
Sporting lease/venison sale	33,000	19,800
Mineral rights, signage	35,000	10,500
Total	2,346,000	485,900
TOTAL (FE and private woodlands)	3,814,370	1,217,510

Grant aid under WGS was £533,238 in 2003/2004 (Table 3.2). Aid for new planting was the main element, and this has varied between 59% and 76% of the total paid. These payments do not include payments under the FWPS which are treated here as compensation for loss of farm income.

⁶ Care must be taken in comparing FE with the private sector because much of the private output is sold as standing timber. The private sector would thus face lower harvesting costs than FE.

The total income stream from forestry activity is thus estimated at around £4.34m, of which £1.22m (32%) was received from businesses in Moray.

3.5 Expenditure

The aggregated expenditure of growers was estimated at £5.23m, of which 75.6% was spent in Moray (Table 3.6). Around 70% of the direct and contract expenditures were directed at individuals and businesses in Moray. For plant and equipment purchases, the proportion was lower at 53%.

Table 3.6 Expenditure on forestry related activities (grower sector, 2003/2004)

Expenditure	Total (ex VAT) (£)	Paid to businesses in Moray (£)	% of expenditure in Moray
Direct costs – Nursery stock, fertiliser, tubes, fencing, repairs, fuel etc.	712,799	497,874	69.8
Direct labour/management (excluding NI, pension)	914,381	872,681	95.4
Contractors	2,884,185	2,187,524	75.4
Purchase of new woods/planting land	142,500	0	0.0
Purchase/lease payment for plant, machinery, vehicles	225,547	120,622	53.5
Overheads incl. office, insurance, power, administration and other costs	358,068	281,761	78.7
TOTAL	5,237,480	3,960,463	75.6

There are two main reasons that may explain the excess of expenditure over income for these forestry businesses. First, the very low timber prices in recent years have reduced income and put pressure on margins. This is clearly evident in the FE accounts where the deficit between income and expenditure was £551,000. In addition, some of the businesses were not into a full forestry cycle with the consequence that they were investing in establishment and maintenance but not receiving income from timber.

3.6 Employment

Responses to the survey indicated that direct employment by the public and private growers totalled 54.6 FTEs. All the labour was resident in Moray. We also asked respondents to estimate their employment of forestry sector suppliers (harvesting, planning, fencing, transport etc.). This totalled 83.3 FTEs, of whom 62.9 FTEs resided in Moray (Table 3.7).

Hence the total direct forestry-related employment associated with the growers was estimated at 137.9 FTEs, of whom 117.5 FTEs were resident in Moray. This is not a complete estimate of forestry sector employment in Moray, however. There is probably some under-reporting of contractor employment, especially when contractors are used sporadically which is the typical situation with small areas of woodland. In addition, forestry contractors are employed by merchants and processors, and by other growers located outside Moray. Estimates made from contracting businesses take these elements into account (see Chapter 5).

Table 3.7 Employment in forestry-related activities (FTEs)

Full Time Equivalent jobs (FTEs)	Total FTEs	FTEs resident in Moray
Direct (own business labour, partners, directors)	54.6	54.6
Contract - Ground prep, roads, planting, establishment, fencing, harvesting, repairs, maintenance, management	71.9	51.5
Contract – Transport	9.5	9.5
Contract – Conservation, recreation, other	1.9	1.9
TOTAL	137.9	117.5

3.6.1 Skills and training

Respondents to the survey reported a shortage of skilled forestry staff, especially in the more specialised forestry businesses. FE and 62% of the major growers indicated that there was a shortage of skilled staff. There was less concern about skills shortage amongst small units.

The concern was mainly in the contracting area of harvester/forwarder and machine operators, planting, fencing, maintenance, and skilled forest workers for chainsaw and general estate work. The shortage was put down to low remuneration, tough working conditions and the seasonal demand for labour that is typical of the forest industry. There is competition for labourers from other industries, such as oil, and a current boom in the building industry, and in general forestry cannot compete in terms of wages, conditions and continuity of work. Difficulty in obtaining housing was also seen as a deterrent to attracting workers and keeping them in the area. The contracting labour pool is thought to be ageing, and there is difficulty attracting new entrants to replace natural wastage, particularly due to high cost of machinery and training in harvesting. This field of work is not attractive for younger labourers. As one respondent put it; 'formerly the rural farming communities were a source of staff but increasingly their numbers are declining, expectations are changing and many do not wish to work on farms etc. The building trade is currently paying more for unskilled labour than forestry pay for skilled labour.

In terms of recruitment some forest growers commented that it is hard to find full time staff and small scale harvesting contractors, and that there is less possibility of overtime than in agriculture. For some the staff shortage may be offset by increased production using new technology, while others thought that the shortage is not currently critical but that lack of recruitment is a concern.

When asked what might be needed in terms of training, respondents suggested that the problem for contractors is a shortage of funding towards training costs given the low incomes. Training is seen as generally available if one is able to pay for it, but that this is difficult given the low returns from subsequent work. Others thought that training might be made available, possibly via the Forestry Contracting Association, with grant assistance being given to contractors so that new sub-contractors can be properly trained.

3.7 Future trends (grower sector)

FE expected relatively stable output from the public estate over the next 10 years but a slight reduction in direct employment due to increased efficiency. The major growers expect slight increases in woodland area (up 3%), employment (up 0.8%) and timber output (up 18%). The small growers did not expect to increase the area under forestry but, on average, there were expectations that both employment and

timber output would increase. Taken together some reduction in direct employment is expected, possibly by 5 FTEs, although this work will be taken up by contractors.

Timber output in the private sector was expected to increase by 20%, a lower level than indicated in the FC forecasts (see Annex I). The FC data should be a more reliable source, nevertheless, because they are based on well-defined methods of estimation.

When asked about changes to their businesses in the next five years some respondents indicated positive changes in terms of increased income or activity that would also benefit the forestry sector as a whole. Increases in felling, thinning and harvesting on several properties were cited as boosting local employment and contractors' incomes. Other landowners indicated that public access provision and other environmental works in woodlands were increasing forestry expenditure and therefore generating local employment.

On other properties changes to the business in the next few years were thought to have a more negative effect. Where woodlands become established expenditure is reduced, thus reducing forestry incomes. Timber prices for thinnings being at breakeven point on some properties mean that in the short term private estates may hold back on thinning. While this may have minimal effect on some businesses, it was suggested that this could reduce employment and timber flow. One property considered that their possible reduction in employment, due to increases in harvesting and haulage costs, will reduce supply to the mills, while a reduction in working hours to be introduced during 2005 for road hauliers will increase the price of haulage. One respondent thought that SFGS has not been seen as an incentive for forest management so that there has been a general reduction in turnover. 'Timber prices remain at a very low levels; even with increased timber sales income to estates is still marginal due to very poor prices for small roundwood and pallet timber. Both these factors mean a decline in the number of contractors but surviving contractors will be much larger outfits and highly mechanised.' Increased regulatory bureaucracy was also seen as increasing costs, with the only way to maintain returns being by increasing efficiency and technology for businesses and also at a sectoral level.

In relation to the estate managed by FE, CJC Consulting (2004b) reviewed the performance of the total public estate in Scotland and recommended that cost-saving measures be introduced to stem the financial deficit. There has been some minor shedding of direct jobs in Moray. The continued move from clear felling and replanting towards lower input natural regeneration is having some impact on restocking work, with one of the main impacts being on the nurseries. A new regional structure for the delivery of forest operations with FE instituted in early 2004 is not expected to lead to a significant loss of employment in Moray.

3.7.1 Impacts of policy developments

Respondents were also asked in the questionnaire about any impacts of forest policy, management, and timber markets on their businesses. Responses were mixed but many identified positive impacts for the forestry sector. One respondent indicated that increased grant rates and better markets for quality timber and non-timber benefits meant improved profitability for their own business and the sector. Several others commented that, in relation to policy factors, SFGS grant improvements were thought to have the potential to encourage expenditure to facilitate public access and have a positive impact on local contract work. The recent introduction of a location premium and other incentives for planting and management was seen as one of the main factors in encouraging increased planting and management. Opportunities for new markets, e.g. renewable energy, utilising lower value timber products was considered to be a factor in increasing the amount of

thinning and restructuring carried out in the private sector. Individual properties foresaw a stronger market for timber, thus increasing personal sales and generating more forestry activity in the sector.

There was some dissent from these positive comments, however. Some landowners perceived increased constraints, leading to reduced profitability and forest activity. Environmental and planning controls were seen as increasing costs and reducing the volume of sawlogs available, especially Scots pine. The increased requirement to produce public benefit and the consultation process caused significant financial concerns that are not matched by the grants available, and were seen as reducing sectoral productivity and profitability. Increased fuel costs were also seen as having a depressing effect on the value of timber, with an impact at the business and the sectoral level.

3.8 Wild fungi and other products

Some woodlands in Moray provide habitats for wild mushrooms and berries, and there is a small trade in foliage for florists. Wild mushrooms are the most important of these in value terms. Five species are principally collected, with chanterelle (*Cantharellus cibarius*) forming 90% of the output. In a Scottish context, Moray is a relatively minor source of chanterelle, which are found mainly in birch woods which are uncommon in Moray. Collection is by people who are either 'self-employed' or do it as a seasonal weekend activity. In general, land owners receive no income from collectors of these products and the activity is not one in which they would want to be commercially involved. It is labour intensive and mushroom collection requires specialist knowledge of the habitats in which the wild mushrooms occur. Collecting is a seasonal, largely casual activity with a corresponding lack of clear information about who is involved and what they earn.

The impact of collecting wild products on the Moray economy is via the incomes of the collectors and the activities of the marketing firms. There are two mushroom marketing firms with offices in Moray although only one has a collecting point there. A further business in Aviemore takes some output from Moray. The firms market the fresh mushrooms to the Glasgow, Edinburgh, SE England and international restaurant trade. There is some drying and processing in glut periods but this is fairly limited. Prices for wild mushrooms and berries are determined by the international market, which in the case of wild mushrooms is dominated by production from Eastern Europe.

We interviewed the marketing businesses in Moray to obtain information on the financial and employment aspects of the wild product trade. The total payment to collectors in Moray was estimated at £25-40,000 per year. There are thought to be 10-20 mushroom/berry collectors who live in Moray (possibly constituting 4 FTEs). Some of the mushroom production from Moray is taken by collectors who reside in Highland and who market their mushrooms there. These collectors have no impact on the economy of Moray.

The marketing firms employ 3 FTEs from Moray. The sector is quite stable although there are year-to-year variations in output depending on the season. Output is unlikely to change. It is limited by suitable habitats and rather low returns for the effort involved.

3.9 Conclusions

Situation

The grower sector in Moray produced over 260,000t of timber in 2003/04 with direct employment of 55 FTEs. It also produces a wide range of environmental and social outputs (described in Chapter 6). Income, excluding FWPS incentives, is around £4.3m.

Prospects

The woodland area is expanding slowly (at c. 0.9% per year) but FC forecast a 40% increase in total timber output from the region in the next 20 years. This will increase earnings of the private forests, which are the source of most of the increased production, and maintain employment in the sector.

Future prospects for incomes in the sector are heavily dependent on (i) timber prices and (ii) grant aid for new planting, restocking and expenditure on public goods such as biodiversity and recreation. The apparent bottoming-out of timber prices and the introduction of SFGS are both positive indicators for future development although margins are tight. The rationalisation of FE operations is likely to slightly reduce employment in the public estate.

Any expansion of woodland area depends largely on new planting on farms. This will depend less on prices for timber than on the attractiveness of grant aid in the context of a reformed CAP. There is much uncertainty about the impact of single farm payments but it seems likely that this will be positive for forestry as land prices fall and farmers look for non-agricultural alternatives. Evidence from the challenge funded planting in Grampian indicates that planting on farms has a positive net impact on total employment although much of the effect does not come on stream until trees are harvested (CJC Consulting, 2004a).

4 Sawmills and timber processing

4.1 Introduction

Much of the timber output from forests in Moray is processed in Highland and, to a lesser extent, Aberdeenshire. Nine sawmills and processing plants were identified that accounted for almost all of the output. These were:

- James Jones and Sons Ltd (plants at Mosstodloch, Aboyne and Huntly)
- Tennants (Elgin) Ltd, Elgin
- Norbord Ltd, Inverness
- Tulloch Timber Ltd, Nairn
- BSW Sawmills, Boat of Garten
- Russwood Ltd, Newtonmore
- John Gordon and Sons (plants at Nairn and Carrbridge).

All these mills were surveyed and 100% responses received. The location of these plants and the type of timber they procure dictates timber marketing in Moray. Only two mills are located in Moray itself. Most are sawmills that purchase pallet wood and saw logs. Depending on the plant, output is in the form of construction timber, fencing, pallets/packaging or board. Norbord Ltd purchases mainly small roundwood for the production of oriented strand board. There is some export of small roundwood from Buckie.

Only one estate sawmill was identified in the grower survey and this was excluded from this analysis of processing because of its relatively small output.

4.2 Timber and wood purchases

Table 4.1 gives the total purchases of the mills in their 2003/04 accounting years. The purchases from Moray account for almost 300,000 tonnes. This is 14% higher than the grower estimate (see Table 3.4). Some discrepancy can be explained by sampling error amongst the growers and variation in the accounting years used by respondents in the surveys. Whilst the sawmills should be a more reliable source, because we received replies from 100% of those surveyed, some bias in the data is possible.

Table 4.1 Purchases of timber by primary processors (tonnes)

	Purchased from		
	Moray	Elsewhere in Scotland	Total
Small roundwood	123,000	365,317	488,317
Pallet wood	39,000	90,000	129,000
Saw logs	81,916	199,500	281,416
Other	56,000	251,200	307,200
Total	299,916	906,017	1,205,933

The amount of timber produced in Moray and processed by sawmills in Moray was estimated at 106,000t. With production in the 260-300,000t range, Moray is currently a surplus region for timber production. Around 60% of its output is processed outwith the region (mainly in Highland). If we exclude the 107,000t of small roundwood produced in Moray, since this mainly goes to specific outlets (Norbord or export), there is still an apparent surplus of 55-90,000t.

However, this is based on a narrow delineation of the market based on arbitrary regional boundaries. A number of plants are located near the Moray border (Nairn, Inverness and Strathspey) in order to draw timber from Moray and elsewhere in Highland and Aberdeenshire. Production from Moray only accounts for a third of their total timber purchases. Even so, with expectations of increasing timber output in Moray the local surplus will increase and there would appear to be scope for expansion in processing capacity. A significant degree of expansion is already taking place or is planned for 2005.

4.3 Income

Total turnover of the primary processors using Moray timber was estimated at £71m. As might be expected very little of the processed timber was sold to firms in Moray (4%). The main markets were in the Central Belt and Northern England.

Five of the respondents expected to increase turnover in 2005 and none expected it to fall. Overall, the mean increase expected was 12.6%. This reflected some additional investment in plant, and expectations of higher availability of timber in the north of Scotland, including Moray.

4.4 Expenditure

The primary processors made sizeable injections of expenditure into the Moray economy. These totalled £10.5m, including £1.62m in wages and salaries. (Table 4.2). Of these, payments for timber were slightly over £4m and payments to forestry contractors (excluding transport out of the plant) were £2.3m. In addition, there were payments of almost £1m to other suppliers of goods and services in Moray. The payments to growers and suppliers agree reasonably well with the estimates made separately from the responses from those businesses.

Table 4.2 Expenditure paid by primary processors to businesses and individuals in Moray (£)

Expenditure	Expenditure paid to businesses in Moray (£)
Timber	4,040,655
Direct labour/management	1,620,182
Contract harvesting and transport	3,938,209
Other contract	260,000
Repairs and maintenance	338,450
Purchase/lease payment for plant, machinery, vehicles	176,500
Overheads incl. office, insurance, power, administration, marketing, etc.	171,450
Total	10,545,446

4.5 Employment

The sawmills and board manufacturer are major employers within the forestry sector. In total, respondents indicated 452 direct FTE jobs, of which 97 were resident in Moray (Table 4.3). Also, we asked respondents to estimate the additional employment that they created through contractors who worked substantially at their plants. The estimate was for 176 FTEs in the forest sector (harvesting and transport), of which 56 lived in Moray. A further 25 employees in Moray were involved in repairs, maintenance and other contract activity.

Table 4.3 Employment in primary wood processing (FTEs)

Employment	Total	Of which, employees resident in Moray
Direct (own business labour, partners, directors)	452	97
Contract – Harvesting and transport	176	56
Contract – repairs and maintenance	14	5
Contract – Other	33	20

In terms of Moray residents, the processors account for 97 direct FTE jobs and 56 indirect jobs (both within the forestry sector) and 25 in other activities. Of these jobs 67 direct and 27 indirect (contracting) were employed by the plants located in Moray.

Because timber from Moray is processed outside the region it might be argued that some of the 452 direct jobs in processing could be attributed to timber produced in Moray. The direct employment in processing averages at 2,667 t of timber per FTE job (from Tables 4.1. 4.3). With 193,000 t of Moray timber processed outside the region the associated direct employment elsewhere is 72 FTEs. However, to be consistent and avoid double counting, this approach would require that the 97 jobs in Moray (Table 4.3) be reduced to account for the associated non-Moray timber element, including timber imported for processing in Moray. The net effect on direct jobs numbers is minimal.

4.6 Secondary processing

Secondary timber processing is not normally included in the forest sector as defined by FC, but allocated to manufacturing⁷. This reflects the difficulty of allocating manufacturing to primary sectors when a mix of inputs is used. In the input-output context this is taken into account by cross linkages between sectors.

There are three major manufacturers with plants in Moray producing timber products for the building and construction industry. One (James Jones and Sons Limited at Forres), produces timber I-joists used for structural support for flooring and flat roofs. The others produce roof trusses and timber frames (mainly house kits). It is not easy to identify the extent to which timber originating in Moray is used in these plants because the provenance of the dressed timber and board is not precisely known. The I-beam plant uses board from Norbord (Inverness) which does source small roundwood from Moray. The remaining timber used in I-beam, roof truss manufacture and house kits is imported. Some processors consider that it is not possible to obtain single-source supplies of local timber in sufficient volume at the specifications required for this type of manufacturing.

The total employment of local employees by these plants is quite significant and estimated to be 120. Expectations are for some increase in turnover in 2005. However, the connections with the rest of the Moray forestry sector are weak in terms of timber provenance. Nor is there a strong commercial advantage for the location in Moray. Nevertheless there is evidence that the choice of location has in some cases been influenced by a good quality workforce and links to other timber activity in the region.

All other secondary processors are small scale and mainly sole traders. The total population in Moray obtained from the Scottish Furniture Makers' Association and local sources was 10, but of these four were manufacturers using mainly laminated

⁷ Both primary and secondary processing are regarded as manufacturing in the SIC categorisation used by the Office for National Statistics (ONS).

board of unknown provenance. Only two of the remaining six responded to the postal survey but telephone interviews with non-respondents produced additional information. The group consisted mainly of small-scale manufacturers of furniture and bespoke joinery. One firm (Nor-Build) was also involved in ecological building, flooring and design products. Both hard and soft woods are used by these secondary processors. Local hardwood supplies were generally reported to be problematic, with no coherent supply chain for the limited hardwood stocks that exist. Some companies felt that there was scope for business expansion in the area, although in some cases supplies of European larch, Douglas fir and oak were not always easy to obtain. Furniture makers have to source wood from wherever it is available, often using agents to procure supplies, although one said that its use of local timber (albeit via sawmills located outside the area) was an important marketing factor. It is estimated that no more than 30t of timber originating in Moray was used in 2003-2004. This was mainly larch, pine and a variety of hardwoods. Total turnover is under £100,000 and direct employment in Moray, 7 FTEs.

4.6.1 Hardwood potential

The Scottish hardwood sector is very small. In a recent survey of the sector, John Clegg Consulting (2004) indicated that there are 28 main businesses in Scotland with a total full time employment of 51. Prospects for the sector appear reasonably buoyant with nearly 60% expecting turnover to increase in 2005 and only 8% expecting it to decline. 44% of businesses expected to increase their use of Scottish hardwoods in 2005. The main barriers to expansion did not seem to be wood supply although it was suggested that French hardwoods, available at very competitive prices, were constraining the use of Scottish hardwoods.

There is no competitive advantage for hardwood processing in Moray because it is not a significant source of supply or markets. There may be more scope for using pine and larch where local supplies are more predictable. Manufacturers based in Moray have located there mainly for personal reasons. This is a labour intensive activity in which timber costs do not typically account for more than 10-20% of turnover. Earnings tend to be low. Prospects are dependent on demand, which is likely to be determined by Scottish income levels and tastes for specific hardwood furnishings.

Despite the generally buoyant outlook described in the John Clegg Consulting (2004) study, prospects for expansion of hardwood and bespoke furniture manufacture in Moray depend mainly on initiatives in product design and marketing. There are excellent examples of timber products being used in house cladding, flooring and street decoration etc. but local demand appears to be limited.

4.7 Workforce and skills

There was a noted shortage of skilled staff in the timber processing sector, especially as regards skilled technical and maintenance engineers. For smaller companies there is difficulty in finding skilled workers for fine joinery and furniture making skills. These skills are extremely scarce in the region. Although larger companies can offer in-house training which avoids staff shortage problems, this requires a significant commitment, and for smaller businesses this option was not affordable in terms of time and risk. Some thought that there should be more done to encourage young people to see timber engineering as a serious option and smaller concerns found it potentially hard to respond to large orders because of lack of skilled joinery staff.

4.8 Future Developments

Existing plants

The primary processing sector is expected to increase turnover in 2005. Some firms are investing in additional equipment in order to increase throughput where the

current plant is at full capacity. This expansion is in preparation for an anticipated expansion in harvesting by private growers. A number of factors favour an increased volume being harvested in the immediate future. The SFGS grant aid is expected to encourage more thinning and re-stocking, timber prices may well have bottomed-out and FC forecasts indicate a growing volume of potentially available timber. This all points to a more favourable context for supplies than in recent years.

Invergordon plant

In the medium term, others sources of demand for wood output from Moray may develop. Proposals by Forscot for a £1bn mega-timber processing facility at Invergordon have been unveiled. HIE is undertaking an economic impact study on the proposal. The Invergordon plant would create a very major source of new demand for wood from the North of Scotland (including Moray), increasing the competition for available supplies.

Wood Fuel

A number of small scale ideas and proposals are currently at an early stage in Moray, and local wood chip systems are likely to be developed in time. Estates, in particular, are showing interest in using their own waste timber, and supplies to hotels and other commercial establishments could develop. Once the current ERDF-supported wood fuel programme finishes, however, MBSE will only be able to provide an environmental grant of 15% of the difference in cost between a business installing wood fuel rather than conventional heating technology.

There is also a proposal to build a community-owned 20MW combined heat and power plant at Tomintoul that would take 300,000t of green timber per year from a radius of 100 miles. Most of the supply is expected to come from Moray. Whilst some of the supply may be waste wood that is not currently marketed, the additional demand will increase the competition for supplies of small roundwood. It would certainly provide a market for small roundwood that is currently exported. The proposal is at an early stage and still requires planning permission, although a full business plan is being prepared.

A project managed by Highland Birchwoods for FC under the Northern Periphery Programme is in its early stages. This is investigating the scope to produce and use pellets from roundwood. Eventually, this could lead to pellet producing plants located in Moray.

MBSE and Moray Council are working to develop a biomass strategy which might lead to further developments.

4.9 Conclusions

Situation

Only around 35% of the output from forests in Moray is processed in the region. Even so, primary processors that buy Moray timber spend £10.5m in Moray and employ 97 direct and 56 indirect full time equivalent Moray residents.

Whilst there is considerable secondary timber manufacturing in Moray, much of the timber is imported from other regions. There are in some cases strong historical or other connections with the forest industry in Moray. A number of small-scale processors exist, generally specialising in distinctive and innovative product design. Some difficulties occur in sourcing hardwood locally.

Prospects

A substantial increase in timber output is forecast mainly from the private sector. Most local processors expect to increase throughput and some are investing in additional equipment. The two major proposals for wood-using plants, if built, would greatly increase demand for small roundwood. Details of the Invergordon proposals

are uncertain but there is likely to be increased competition for saw logs. These developments will be positive for the incomes of growers in Moray and probably beneficial for overall employment in Moray. Impacts on existing processors would not be entirely positive. Few details are, however, available for either project.

5 Forestry supply sector

5.1 Introduction

A database of first hand suppliers to the growers was established from FE records, the Forestry Contractors Association, HIE databases and the initial scoping interviews. This was supplemented with information on suppliers derived from questions in the grower and primary processing surveys. The database comprised forestry agents, nurseries, merchants and contractors of all types with significant forestry activity. Because of their diversity they were split into two groups:

- Agent/nurseries: comprising land agents, forest nurseries and merchants trading in timber. These provided services mainly to growers and, to a limited degree, to processors.
- Contractors: involved in ground preparation, fencing, planting, maintenance, harvesting, transport and related services. These services were mainly provided to growers although sawmills used harvesting and transport services.

These were businesses known to supply services to firms in Moray on a reasonably consistent basis. Some were sizeable businesses operating throughout the UK, whereas others were local sole traders. The database was not restricted to businesses located in Moray but included those with offices in Highland, Aberdeenshire, and in a few cases elsewhere in the UK.

A total of 105 businesses were surveyed using the same questionnaire. Table 5.1 gives the response rates and raising factors used. Whilst the agents and nurseries all responded, great difficulty was found in obtaining replies from contractors. The response rate was 38% but a number of these were found to be no longer active. There was evidence that larger contractors were more likely to reply than single operators and this may have biased the responses. To take account of this we raised the sample on the basis of estimated employment in the sector.

Table 5.1 Responses to the questionnaire

Group	Number in population	Sample size	Useable responses	Raising factor to population
Agents, merchants and nurseries	10	10	10	1
Contractors	105 (estimate)	95	16	2.5

Note 1 Telephone interviews established that 20 of the 95 contractors were no longer active.

5.2 Income

Table 5.2 gives the raised income data for suppliers. The group received £5.98m from businesses in Moray, with harvesting providing the main source of income (£3.0m), followed by sales of timber (£1.0m).

Not all this income was received from growers because contractors also supply services to processors, especially for harvesting and transport. Some firms also purchase timber and standing crop. The grower survey indicated that expenditure on contractors by growers was only £2.88m of this total (Table 3.5).

Table 5.2 Income of first hand suppliers surveyed (£)

Income	Income received from businesses in Moray (£)	% of total
Ground prep, roads	295,988	5.0
Planting, establishment, fencing, seed collection, maintenance, surveys	324,215	5.4
Harvesting	2,966,000	49.6
Nursery stock	462,196	7.7
Conservation/recreation	116,945	2.0
Transport of wood, timber and residues	285,000	4.8
Sales of timber, woodlands	1,007,131	16.8
Management, agent services	176,865	3.0
Other	344,913	5.8
Total	5,979,252	100.0

The income of the suppliers located in Moray is £8.6m (Table 5.3), although this figure is based on a small sample of only 16. Income from businesses in Moray is 42% of the total (£3.6m), and this indicates that more than half of the turnover of the suppliers based in Moray is from work outside the region. The most important sources of income are again, harvesting and timber sales, with nursery stock a significant contributor.

Table 5.3 Income of first hand suppliers located in Moray (£)

Income	Invoice value (net of VAT)	Income received from businesses in Moray	% of total
Ground prep, roads	173,988	145,988	4.0
Planting, establishment, fencing, seed collection, maintenance, surveys	386,200	260,915	7.2
Harvesting	1,580,000	1,276,000	35.0
Nursery stock	3,604,985	462,196	12.7
Conservation/recreation	71,000	41,945	1.2
Transport of wood, timber and residues	285,000	285,000	7.8
Sales of timber, woodlands	1,299,457	789,057	21.6
Management, agent services	413,200	172,865	4.7
Other	788,700	213,000	5.8
Total	8,602,530	3,646,966	100.0

5.3 Expenditure

Table 5.4 gives the expenditure breakdown all suppliers. £4.2m was spent on labour and secondary suppliers in Moray.

Table 5.4 Expenditure by suppliers to the forestry sector (£)

Expenditure	Total Expenditure (Ex VAT)	Paid to businesses in Moray
Direct costs – Nursery stock, fertiliser, tubes, fencing, repairs, fuel etc	1,319,364	630,229
Direct labour/management (excluding NI, and pensions)	2,883,661	1,513,781
Subcontractors (please describe)	15,557,036	1,081,656
Purchase of timber and standing crop	5,443,791	367,911
Purchase/lease payment for plant, machinery, vehicles	593,944	278,181
Overheads incl. premises, office, insurance, licences, power, administration, training etc	1,255,954	227,384
Other costs	262,155	117,155
Total	27,200,905	4,216,297

5.4 Employment

The survey indicated the level of forestry-related employment amongst the major first-hand suppliers. The 'agent/nursery' group had 103 FTEs resident in Moray (145 in total) (Table 5.5). Ninety of these jobs were in the three nurseries which are the major employers closely involved with forestry in Moray. The 'contractor' group had 68 FTE employees resident in Moray (200 in total). They were a diverse mixture varying from large transport businesses employing up to 30 staff to sole traders involved in planting or harvesting.

Table 5.5 Employment by first hand suppliers (employees resident in Moray, FTEs)

FTEs	Agents, nurseries, merchants	Contractors	Total
Direct employment	103	68	171
Subcontractors	14	30	44
Other	0	2	2

Taken together the suppliers accounted for 171 FTEs in Moray. Both groups used subcontractors (44 FTEs) but these were mainly providing more specialised services and were not considered as part of the forestry sector.

If the employment of suppliers (both groups) located in Moray is analysed, the number of FTE jobs is 145 plus 46 as subcontractors.

5.5 Workforce and skills

Respondents in the agent/nurseries group reported a shortage in forestry contract labour, especially ganger level foresters, trained harvesters, forwarders, skyline operators, and also professional contractors and managers. It was suggested that lack of government support makes it hard to make a living out of forestry and new graduates were moving to other sectors. One respondent commented that workers from eastern Europe will be used more often in the future resulting in a proportion of earnings going abroad. We did not explore the use of foreign workers in the

questionnaire. These were being used to a limited degree in nurseries for unskilled jobs because of a difficulty in obtaining suitable local labour. It was also convenient to use foreign workers and students for seasonal jobs. Contractors were looking for trained employees who would be more permanent and provide a pay back from training.

Amongst contractors, respondents noted a general decline in interest in outdoor manual labour with very few young people coming into the sector to offset those retiring. There were specific skills shortages in areas such as fencing and machine operating, with local accommodation problems and competition from other sectors also being cited as a disincentive for new recruits. Transport companies found a specific shortage of lorry drivers. The shortage of suitable employees in this sector was causing problems for some companies and more government support for training was seen as a solution. However, these issues were not universally reported and other businesses were expanding.

5.6 Trends

Amongst the agents/nurseries group there was no consistency in expectations for turnover in 2004/05 as compared with the previous year. Increased felling and restocking and more environmental schemes were seen as giving significant increases in individual business activity, whereas red-tape and regulations, lack of good manual workers, and increased mechanisation were all seen as negative factors for employment. However, both these trends were not thought to be likely to have a large impact overall. Timber prices and demand, as well as SFGS grants were seen as the critical elements to sustained development. One respondent commented that on the whole Moray was well provided with forest service businesses and was probably the most self-contained region within Scotland with respect to the forest industry. However this comment is at variance with the results of our survey, which showed significant cross border flows of timber and forestry activity.

Nurseries reported a sharp decline in new planting in recent years but a rising demand for restocking, with production switching to broadleaves.

The evidence on trends amongst contractors was quite mixed with, again, no consistent trends. Some businesses were coming out of timber contracting because of low margins. There was concern that increased fuel costs may also reduce the level of activity for the sector. On the supply side, reductions in planting on farmland because of uncertainty about agricultural support, and reduced thinnings due to low timber prices, were considered to have negative impacts. Others commented that although very small margins were 'harming the fabric of the forest industry network and experienced staff are being lost to other industries' Moray was in a better position to withstand these problems than other regions with less mature forest cover. Increased emphasis on environmental works was cited as benefiting some businesses, as well as technical improvements leading to an increased market share for others. A couple of respondents noted surprise that Moray had been chosen as the study area as it was thought to be well stocked with mixed forestry and presenting quite a stable situation.

5.7 Conclusions

Whilst the agents and nurseries willingly responded to the survey, it proved very difficult to obtain responses from the forestry contractors. This was despite follow up telephone calls and personal visits. In some cases respondents were not well organised and did not have ready access to financial information. Even so, there was a marked antipathy towards divulging financial information. Despite this we consider

that the response rate was adequate to give a reasonable aggregate picture of suppliers' activities.

Situation

First hand forestry suppliers are a diverse group of land agents, forest contractors, hauliers, merchants and nurseries. They provide goods and services mainly for growers, but some provide harvesting and transport services to the sawmills and processors. The contractors vary from highly capital-intensive businesses to sole traders mainly providing labour. Together they account for 171 FTEs resident in Moray. Suppliers in total spent £4.2m in Moray. Those located in Moray itself had a total estimated turnover of £8.6m. Around £5m of this was income derived from businesses located outside Moray. Many of suppliers reported difficulty in attracting both skilled and unskilled labour.

Prospects

There was no consistency in the responses regarding future trends in this sector. Whilst demand for harvesting and replanting is relatively secure given the expected increase in rates of harvesting, other contracting activity depends on the level of new planting and maintenance. Respondents' views varied considerably on the prospects for expansion.

6 Social, environmental and tourism benefits

6.1 Introduction

The forests and woodland in Moray produce a wide range of other outputs valued either by local residents and visitors, or by a much wider population in the case of biodiversity and carbon sequestration. In the survey of growers, respondents listed a variety of 'public goods' produced from their woodlands:

- ❑ Recreational activities (walking, leisure, horse riding, mountain biking etc.);
- ❑ Protected wildlife sites (SSSIs, SACs, SPAs);
- ❑ Benefits to landscape;
- ❑ Public access for recreation;
- ❑ Community woodlands;
- ❑ Contributions to tourism; and
- ❑ Educational use.

This chapter brings together the available data on the size of these benefits and their value to people and businesses in Moray and elsewhere.

6.2 Recreational benefits

Both FE and many private woodlands are used for recreational visits. The analysis of the number and value of these visits can be found in Annex II. The numbers of visits was estimated by FE staff and by private woodland owners responding to our survey. Detailed results for FE sites are given in Annex II Table 11.2. There were 709,000 visits with walking by far the main activity. 3.5% of visits were for biking or horse riding. 29% of visits were by tourists from outside Moray.

Similar information was derived for private sector woodlands in Moray. Visits were estimated at around 85,000 per year. In terms of activity, most of these comprise woodland walks (around 75,540 visits per year). The remainder comprise specialised activities: horse riding (3,115); mountain biking (4,560); educational (990); and other recreational visits (794).

6.2.1 Benefit estimates

A specific study of the recreational value to users of forests in Moray has not been undertaken. However, a number of studies have been undertaken on the value of recreational trips to forests and woodlands in Scotland, from which the recreational value of Moray forests can be inferred. This inference can be made in two ways: (i) by transferring a mean consumer surplus or mean willingness-to-pay (WTP) value from a similar forest (i.e. a forest with similar attributes in terms of size, tree species and age composition, and recreational facilities); or (ii) by transferring a benefit function from another forest study and estimating the recreational value of Moray forests based on their characteristics. Benefit functions specify WTP in terms of forest attributes (size, tree species, recreational opportunities, etc.).

The main studies that estimate the recreational values of FC woodlands are reviewed in Annex II, Section 11.1. The benefit equation estimated by Scarpa (2003) to calculate the aggregate value of woodland throughout Britain, was used to estimate the recreational value of the FC estate. A value of £0.90 was used to estimate the aggregate value of informal visits to forests in Moray. The total value of visits to FE woodlands was around £806,500 per year.

The corresponding value of visits to private woodlands was estimated to be £104,000 (see Annex II Table 11.3). In total, the aggregate recreational value of Moray forests is quite large, amounting to £910,500 per annum. 88.6% of this aggregate value is

accounted for by recreation in FC woodlands in Moray. At a 3.5% discount rate the annual value capitalizes to £26 million.

6.2.2 Health benefits

There is no doubt that the forest estate in Moray represents a significant resource for walking and other physical activity. It is well established that physical activity reduces risk factors for several major diseases. The Department of Health (2004) reviewed the evidence for the relationship between physical activity and health, against a background of generally declining levels of physical activity in the UK population. It concluded that adults that are physically active have 20-30% reduced risk of premature death, and up to 50% reduced risk of developing coronary heart disease, stroke, diabetes and cancers. The Scottish Executive has, as a major policy aim, the improvement of the health of the Scottish population, and greenspace facilities for taking exercise contribute to this.

In most valuation studies it is assumed that the WTP for recreation in woodlands includes the perceived health benefits to the respondent. However, this may not be the case and WTP values may be underestimated because of a lack of information on the gains to health experienced by respondents. It is clear that the woodland resource offers a major facility that will provide health benefits and contribute to the wider policy aims of the Executive.

6.3 Biodiversity benefits

The biodiversity benefits from Moray woodlands were assessed in two different ways. We undertook an ecological assessment and then examined the economics literature to investigate whether a benefit valuation was feasible.

6.3.1 Ecological assessment

The assessment of the contribution to biodiversity was facilitated by discussions with staff of FC, Scottish Natural Heritage (SNH) and RSPB, together with the responses to a survey of stakeholders, and limited on-site observations. SNH provided information on the five forest-related SSSIs in Moray (Quarrywood, Kellas Oakwood, Culbin Sands forest and Findhorn Bay, Lossie Forest and Culriach Wood). Some were also designated as SACs. Their importance is in terms of oak woodland, lichen rich habitats, coastal geomorphology and shingle habitats, and alder wood and floodplain forests on the Spey. The forests in Moray contribute to numerous HAPs and SAPs in the UKBAP.

In the Spey catchment management plan (River Spey, 2003) there were two conclusions relevant to this study.:

- Develop a vision for the contribution of woodlands to management of the catchment while promoting and supporting good woodland management practice.
- Consider the potential for floodplain and riparian woodlands to contribute towards flood control, river bank stabilization and assist with water quality management.

Annex III summarises the biodiversity impacts of forestry in Moray. The assessments depend mainly on how forests influence habitats, rather than direct observations on the species themselves. Each impact or output is specified, and a brief summary of each in Moray is given. The evaluations take two forms. The first gives a simple verdict up to the present; the second evaluates the predicted impacts from present policies and identifies opportunities that may or may not be realised under present policies.

The analysis shows that forestry has both negative and positive impacts on biodiversity and ecological processes. The positives take many forms. Properly sited, new forests reduce isolation of existing woodlands almost from the outset, and may

immediately protect nearby semi-natural woodland from grazing by sheep. Although wildlife diversity has often increased substantially during the initial stages of afforestation, the main gains have taken place as forests matured, became progressively more diverse as forest habitats, and as more forest species colonised. The gains have been increased by increasingly environmentally-conscious forest management. Furthermore, with the increasingly intensive use of farmland, the original afforestation has been viewed in a new light, environmentally, and the role of forests as protectors of remnants of precursor habitats from the impacts of farming has become more important.

Negative effects are less significant, and are associated particularly with the afforestation process through: (i) loss and fragmentation of semi-natural habitats, (ii) restriction of some ecological processes in some sites, and (iii) downstream impacts on water flow, water quality, silt load and thereby on fish populations in some catchments. These negatives can be, and in most cases have been, mitigated by suitable forest management.

6.3.2 Biodiversity benefit values

The survey of recreational visitors to Moray forests did not identify purpose of visit. Most visits would have been primarily to enjoy a walk through woodland; with or without the secondary pleasure of seeing the occasional wildlife species. A minor number of visits may have had as a primary purpose the observation of wildlife. Whatever the purpose of the visit, the values of these trips are captured in the estimates of recreational value documented in section 6.2 above. Hence biodiversity and wildlife *use* value is captured through recreational demand models of forest visits. However, many people are also willing to pay to preserve wildlife and biodiversity that they will not see. This may be for an existence motive (they want a certain quantity and diversity of wildlife to exist even if they have no intention of visiting forests to see it); or for a bequest motive (to ensure that the wildlife is available to future generations). Values for these motives, termed non-use biodiversity values, can only be captured through stated preference methods.

Biodiversity is one of the most difficult environmental goods for people to value. It is not traded in the market place, and people may not perceive how it may affect their lives. The *gross* biodiversity value of Moray forests was estimated from values derived from a number of different studies valuing different aspects of biodiversity in Scottish forests (see Annex II Section 12.2). It was particularly difficult to value the Scots pine element because while there is evidence about the value of native Caledonian pine there have been no valuation studies on plantation Scots Pine. The estimates were then raised to the level of the Scottish population. This gives a total biodiversity value of £5.39 million per year for Scottish households.

Table 6.1 documents the biodiversity value of Moray forests using values from Garrod and Willis (1997), Macmillan and Duff (1998) and Hanley *et al.* (2002). Annex III explains in detail the method used to estimate these values. The unit values for ancient and broadleaved woodland are based on Hanley *et al.* (2002). These values reflect the relative increase in people's values over remote coniferous commercial woodland with little biodiversity interest. The final column records aggregate values for Scottish households.

A conservative estimate of the biodiversity value of Moray forests would be to take the value aggregated over Scottish households. This gives a total biodiversity value of £5.39 million per year for FC and private sector woodland. The policy of the FCS is to re-structure spruce and pine forests, when they are felling and replanted, to create greater biodiversity value. The values in Table 6.1 reflect this policy. However, there is some uncertainty about whether private sector conifer forests in Moray are also being restructured to the same extent to enhance biodiversity value.

Table 6.1 Biodiversity values for Moray forests.

Forest type	Area (hectares) ¹	Unit value (£) per household per year per 12,000 ha	Biodiversity value: Scottish households £ millions
Ancient woodland	1869	0.90	0.324
Broadleaf	7363	0.61	0.864
Sitka spruce	12997	0.35	0.876
Scots pine	21063	0.47	1.906
Other conifers	21043	0.35	1.418
Total	64,335		5.388

¹ includes open land within forest boundaries since this forms an integral part of the forest ecosystem and biodiversity value of the forests.

6.4 Carbon sequestration benefits

Annex II section 11.3 estimates the quantities of carbon fixed in Moray woodlands and reviews the values (£ per t/C) that have been estimated in the literature. Table 6.2 presents the aggregate carbon sequestration benefits for Moray forests. These are capital values and range between £33.997 million and £102.873 million. A conservative estimate of the carbon sequestration value of Moray forests would be to take the lower quantities of tC per hectare and the lower social value of carbon of £7 per tonne, which suggests a capital value of £33.997 million.

Table 6.2 Carbon sequestration values for Moray forests

Species	hectares	tC per ha ^a	Carbon value (£ per tonne)	Carbon value range (£ per ha)
Sitka spruce	11,261	75 to 82-93	7 to 15	5.912 - 15.709
Broadleaves	6,380	200 to 379	7 to 15	8.932 – 36.270
Other conifer	36,483	75 to 82-93	7 to 15	19.153 – 50.894

^a see Table 11.6 for details of the calculations.

Annual values of carbon sequestration are an approximation of capitalised values because of initial changes in soil carbon, after use of wood, and other items that occur at specific points over the rotation. But over multiple rotations and assuming a steady state, the annual value for carbon sequestration is £1.189 million (assuming a social value of carbon at £7 per tonne).

6.5 Landscape benefits

The method adopted for deriving landscape benefits is described in Annex III. It was based on the comprehensive study of visual amenity benefits of forests in different landscapes undertaken by Garrod (2003). This study estimated that people would be willing to pay around £123 per household per year for views of conifers in a hilly/rolling landscape. This seems reasonable for Moray. At 3.5% it capitalises to £3,514. Since the average house price in Moray is currently £94,000, this represents 3.7% of the price of the house for a woodland view. This amount is consistent with HPM and other stated preference studies of the landscape value of woodland.

The number of households with a woodland view in Moray was estimated using GIS techniques to measure the distance of woodlands from centres of population. The derived landscape value of woodland in Moray was £2.90m per year (assuming only households within 0.5 km of a woodland benefit); or £3.42m per year (if all households within 1 km of a woodland benefit). The more conservative of these two

estimates of the landscape value of woodland should probably be adopted: viz £2.90m per year.

The actual landscape value of Moray woodland will be higher than £2.90 million per year to the extent that people derive landscape benefits of woodland whilst travelling e.g. along the A96 through Elgin, or along the A941 through Dufftown and Rothes, etc. In addition, since the value of £123 per household per year was for views of conifers in hilly/rolling country, the proximity of some properties to broadleaved urban fringe woodland will generate higher WTP amounts.

6.6 Tourism

There are no studies that directly measure the benefits to tourism of the forest resource in Moray. However, we can make some estimates of the economic impacts from data on visits to forests and the expenditure of tourists.

The number of visits from people living outside Moray to woodlands in Moray was estimated in Section 6.2 at 231,000 per year. This includes visits to both FC and private woodlands. We have no direct information about the trip decisions, their duration or the expenditures of these tourists.

The most comprehensive data on expenditures from forest-related tourism are in the study by Hill *et al.* (2003) for the Forestry Commission. Based on the UK Day Visits Survey and surveys of visitors to a sample of woodlands they estimate 19.1m tourist visits to Scottish woodlands with a total forest-related expenditure of £163.4m per year. If we assume that Moray is typical of Scotland as a whole then its 231,000 tourist visits would account for 1.2% of the Scottish total and £1.98m per year in expenditure.

The expenditure estimates in the Hill *et al.* study were based on trips from home or a holiday base and do not appear to allow for any accommodation element in the costs. Data from the study by Snedden Economics (2004) indicates average expenditures for tourists across all types of accommodation of £14.60 per day for day visitors and £56.79 per day for overnight visitors. Hence, the number of overnight stays that can be related to forest tourism is an important determinant of the total expenditures. There are no data on this aspect but it would seem appropriate to allocate a proportion of the accommodation costs as forest-related tourism. Without more detailed information it is not possible to give a precise estimate, but including an allowance for accommodation could increase the forest-related tourism expenditure to £2-2.5m per year (averaging £2.25m). There may be additional expenditures associated with tourists attracted by the afforested landscape typical of Moray and not accounted for in actual visits to woodlands. The Hill *et al.* study concludes that 'forests play an important role in attracting people to the countryside even where they don't visit forests specifically'. They concluded that 12-15% of tourist expenditure could be associated with forestry in the locations they studied. However, there was no information specific to Moray from which this landscape impact of forestry on tourism could be estimated.

In order to convert the tourist expenditures into impacts on income and employment we used estimates from previous studies. Slee *et al.* (1997) in their tourism in Badenoch and Strathspey estimated coefficients that account for direct, indirect and induced effects for both 'soft' (B and B, camping) and 'hard' (hotel) accommodation. Employment coefficients averaged 3.6 FTEs per £100,000 expenditure for soft accommodation and 2.8 for hard accommodation. Corresponding income coefficients were £29,677 and £21,771. Allowing for inflation since 1997, these are broadly consistent with the findings of the recent Snedden Economics study for HIE (2004), which estimated a rate of £41,000 of visitor spend per FTE. A more reasonable estimate for visitors to forests would be £35,000 per FTE, giving 64

FTEs, and £768,000 in income from employment (at £12,000 annual earnings per FTE).

6.6.1 Tourism development

Most of the recreational use of forests in Moray is by local residents. Tourists only accounted for 30% of the walking, 16% of biking and 3% of horse riding. There is scope for promoting forests for more active leisure tourism. Tourist expenditure could be increased through direct charging for specialist activities, or indirectly by providing activities that attract more tourists or persuade them to stay longer. This would benefit the Moray economy at a time new sources of income are a priority. We understand that some action is being taken to expand opportunities for biking and horse riding.

6.6.2 Sport

We did not estimate the total economic impacts associated with sport shooting in woodlands. The impact is thought to be quite small relative to those from forest operations and tourism. The grower survey took account of the small amount of direct income and employment associated with sporting use of woodlands. There would however, be some additional impacts from the expenditures of the shooters.

6.7 Community benefits from woodlands

Community involvement has been increasing rapidly in Scotland in the last 15-20 years through promotion and support from organisations such as Reforesting Scotland, and funding from the Forestry Commission in the form of the WGS Community Woodland Supplement, now replaced by the SFGS aid for 'Developing Community Involvement'. Community woodland purchase has also gathered momentum through the recently formed Community Woodlands Association, and financial support from organisations such as HIE's Community Land Unit and the Scottish Land Fund for feasibility studies, land purchase, and subsequent development. This is not primarily for woodland-related projects although these are included. These types of activities reveal that community woodlands can be a mechanism for enhancing community capital through the development of skills in publicity, fund-raising and negotiation.

6.7.1 Community ownership

The Forres area provides examples of the community initiating involvement in the management and purchase of woodlands. The catalyst for this action was the perceived threat of housing development on local and well-used woodlands.

In Muiry Woods (13 ha) the Muiry Wood Community Woodland Association set up co-management with Moray Council in 1999. In 2000, there was successful purchase of Muiry Wood (16 ha) from a private vendor, by the Forres Community Woodlands Trust (FCWT) to manage for community benefits. The usage of 10ha is amenity, public recreation (car parking, signposting and path improvements) and educational aims. On another 5 ha, educational and demonstration facilities for a range of different forestry systems is planned, as well as training sessions and demonstration of coppicing and permaculture (improvements of access and interpretation are also foreseen). There was a public consultation of the local population carried out by the community woodland groups in 2001. It is estimated that there are around 200 person visits per week, mainly for walking, by local residents, although some users travel 2-3 miles to use the woodland.

At Sanquhar woods a larger area of 47 ha was purchased by FCWT in 2002 with funding aid from Community Land Unit, SNH, Moray Council and private donations. The main usage is recreation with around 250 person visits per week estimated. The FCWT has recently won £20,000 from the Scottish Executive Biodiversity Action Grant Scheme for biodiversity enhancement. There are also active links with local

schools and regular usage by school groups, as well as development of a woodland arts programme that will include outdoor theatre and sculpture. There may be the opportunity to provide training in forestry skills. This initiative gathered pace over a short period of time in response to the need to act quickly in order to purchase the land, and the group has been heavily involved in bidding for funds, public awareness exercises and public consultation.

The benefits of these activities are mainly in terms of amenity and recreation for the inhabitants of Forres but extend to a wider group of users drawn in by the provision of educational and training opportunities. The formation of both the Forres trusts over a very short period of time, in the initial stages of the project, has undoubtedly enhanced the existing skills of those involved and the purchase at Sanquhar reflects the capabilities developed in the earlier stages of the project. The future challenge is to maintain local participation and motivation now that the initial threat of development has been countered.

6.7.2 Community involvement and management

There are several cases of formal community involvement in woodlands management and use. At Quarrelwoods, Elgin (FE and LA ownership, 64.8 ha), there is a high level of community involvement in activities such as hand-stocking and footpath maintenance, and also in terms of wider consultation and education. The woodlands are used by FC forest and coastal rangers for educational activities. In this case Moray Council and FC made efforts to involve the local community and there is now a very active community group, who engage in co-management with LA/FC. The community has successfully applied for EU funds for woodland amenity development, and despite the 'top-down' initiation of this community woodland, the successful fund-raising activities are evidence of enhanced community capability.

Cottage woods is a LA recreational woodland near Keith where the Council proposed co-management with the local community. There is now a high level of community involvement in co-management including hand-stocking and footpath maintenance.

Since the mid 1990s, Drummur Estate and the Drummur Community Association have been working together to develop the 4.5 ha of woodland near the village to enhance the environmental and amenity aspects of a 50-year-old commercial plantation area. Here, the estate owners are key players in the community group and have assisted in applications in 1997 for WGS funding to develop the area for the 200 strong community. The group is currently receiving SFGS for community involvement. Several other groups are linked into the community woodlands including the local schools and youth groups, the local Railway Association (creating rail access) and the Lochpark Rural Skills group who support people with disabilities (making signs and bird boxes). While the initiative has so far been steered by the estate owners, they are keen to see if the community want to take on greater management responsibility for the area, although establishing and maintaining ongoing commitment to woodland management by the community can be difficult.

The Crown Estate at **Glenlivet** has 3000 ha of commercial forest and 500 ha of semi-natural woodland and is another area in Moray that has high level of community consultation. The community in this case is the population of the estate, which numbers around 750. In addition to their responsibility as a Crown Estate to those living within the estate boundaries, there is also a commitment to integrated estate management and public involvement under the newly formed Cairngorms National Park requirements. The Estate has its own rangers and information centre at Tomintoul, and has been active in promoting public visits for many years.

These examples summarised in Table 6.3 demonstrate a variety of levels of community involvement with associated development of social capital. The extent of involvement depends mainly on individual community circumstances and motivations

rather than the precise form of ownership. In addition, there substantial community involvement in woodlands of a more informal nature. FE engages with communities at whatever level the community wishes. For example, work between FE and the Burghead community has delivered a range of benefits from a path network develop principally by the community as a measure to address teenage drinking.

Table 6.3 Community woodlands with a high level of community involvement

Type of involvement	Area (ha)	Relevant community population
Community ownership	77	8,967 (Forres)
High level of community involvement – LA ownership	102	34,287 (Elgin, Keith, Forres)
High level of community involvement – Private/Crown ownership	3,504	950 (Drummuir, Glenlivet)

6.8 Educational use of woodlands

There are three main providers of woodland educational facilities. Forest Enterprise provides facilities for visits from Moray primary and secondary schools (Table 6.4). The most widely used forest is Culbin but other sites serving Elgin, Fochabers, Keith and Buckie are also used. There are around 12 visits per annum from universities and other specialist groups from outside the region amounting to about 300 visitors each year.

Table 6.4 FE Educational forest visitor numbers (2004)

	No of Events	No of Visitors
What's On	23	1,107
Badger Watches	17	100
Educational Visits	32	1,049

In the private sector the survey indicated 990 visits to private woodlands. Two estates specifically encourage educational visits. The Crown Estate at Glenlivet focuses on primary and secondary schools, higher education institutions and specialist groups (Table 6.5). The levels of participation have been fairly constant in recent years.

Table 6.5 Educational visits at Glenlivet

	2002/2003	2003/2004
No. of visits	42	37
No. of school visits	27	Not known
No. of school participants	253	350
No. of Woodland Week participants	Not known	272
Total no. of participants	813	824

Seafeld Estates also encourages visits from local primary schools on its 3,000 ha of commercial forest and 100 ha of semi-natural woodland at Cullen. It is expanding this role by school visits and interpretative literature.

More generally the Forest Education Initiative organises activity-based experiences in local woods, mills and factories and visits to schools by foresters. They carry out

mini road-shows in the Grampian region e.g. touring wood turners visiting schools and woodland activity days. The Initiative specifically promotes a number of FC, LA and Crown estate woodlands in Moray.

6.9 Conclusions

The forests of Moray are a major environmental and social resource for the local population, the wider Scottish population and tourists. Recreational visits to woodlands number almost 900,000 annually. Whilst walking is by far the main activity, the forests are also used for biking and horse riding. The forests are used for a variety of community and educational activities. Six communities are involved in woodland management on woodlands they either own or manage in partnership with public or private owners. These mainly provide recreational opportunities but also contribute to community cohesion and a sense of ownership and involvement. FE and some estates activity promote and assist the use of woodlands as an educational resource, especially for local primary children. The estimated value to participants in recreation and other activities is just under £1m per year.

The biodiversity contribution of the forests is complex and not readily summarised. They provide habitats for important species including capercaillie, red squirrel, wildcat, and pine martin, Pinewood and sand dune habitats are important contributors in the UKBAP, and major oakwood, coastal and river valley sites are protected by SSSI designation. There are some negative effects (e.g. acidification on salmon fisheries) for which mitigation measures are now in place. A variety of sources were used to estimate the value of the non-use biodiversity value of Moray forests. The estimate was £5.39m per year for the Scottish population.

Landscape benefits were estimated at £2.90m per year to local residents. It was not possible to value the wider benefit of a wooded landscape for those travelling in Moray or for tourists' appreciation of landscape amenity. The annual value for carbon sequestration is £1.2 million, assuming a social value of carbon at £7 per tonne. This is global benefit.

Table 6.6 summarises the non-market benefits. They should be interpreted as indicative only because benefit estimates were not available for Moray itself and were transferred from other studies. The benefits total £10.39m per year, of which local residents benefit to the extent of over £3.8m per year.

Table 6.6 Non-Market benefit values of forests in Moray (£m)

Type of benefit	Benefit per year (£m)	Beneficiaries
Recreation	0.90	Mainly local, some tourists
Biodiversity	5.39	Scottish
Landscape	2.92	Local
Carbon sequestration	1.20	Global
Total	10.39	

Expenditure by tourists using forests was estimated at £2-2.5m per year and may be much higher. Using expenditure conversion factors from other studies suggests that tourism (visits to forests) supports 64 FTEs, and £768,000 in income from employment. There may be scope for increasing forestry's contribution to tourism by expanding the current leisure activity base.

7 Economic contribution of the forestry sector to the Moray economy

7.1 Employment in the forestry sector

7.1.1 Direct employment

The 2001 Population Census records the number of people directly employed in forestry and related activities (growers, suppliers) in Moray as 188. This would include part time employees. Our survey results indicate a figure of 226 FTE jobs (Table 7.1). This consists of 55 in the grower sector and 171 in the supply sector (the latter covering a wider range of activities than the Census forestry category). In addition there are an estimated 97 jobs in first stage processing that we include in the forest sector giving 323 in total. Jobs in secondary processing are excluded because they are not normally considered as part of the forest sector and their use of Moray timber was minimal.

Table 7.1 Forestry sector employment (FTEs)

FTEs	Residents in Moray employed by all firms	Employment by firms located in Moray
Processors (primary)	97	69
Growers	55	55
Forestry suppliers	171	145
Total	323	269

With regard to businesses located in Moray, their direct employment is 269, but not all of these staff are Moray residents.

Half of the jobs in forestry in Moray are in contracting. We can to some extent check on the consistency of the contractor employment by adding the estimates made by growers and processors (Tables 3.5 and 4.3). This accounts for 119 FTEs of the total of 171. The remainder can be accounted for by work associated with forests and woodlands outside Moray which were not included in the grower survey.

7.1.2 Scottish Forest Employment Survey

The Forestry Commission break down their national employment survey of forestry and primary wood processing by regions in Scotland (Forestry Commission, 2001). This is based on the old regional structure of local government, and Moray is included in Grampian. There were 1,411 FTEs recorded for Grampian. Based on the current woodland area of 169,780 ha in Grampian this suggests 1 FTE job per 120.3 ha. Using this ratio in Moray would indicate 535 jobs in the forestry sector.

This is higher than the figure of 323 estimated above. The 323 estimate is more reliable because it is based on a detailed local survey. The difference between the figures probably reflects the fact that the FC survey is based on the location of businesses, not the places of residence of employees (as in Table 7.1). Given the fact that a sizeable proportion of the services for woodlands in Moray come from outside the region it is not surprising that the FC figures are higher.

7.2 Labour costs and skills shortages in the forestry sector

There is a general shortage of skilled staff available for contracting and primary processing. This reflects low wage rates, difficult working conditions and a lack of career opportunities. It also reflects a tight labour market in Moray and opportunities

in other trades which are either better paid or provide more amenable working conditions.

There is no skill training in forest operations available in Moray and little in Inverness. It typically falls to the contractors to provide training. They cannot readily afford the costs and disruption associated with training when their ability to retain the staff is uncertain. This is not a problem unique to forestry.

The main concern for the sector is an ageing contractor population and a lack of recruitment, coupled with increase in costs associated with health and safety regulation. How this will affect the management of forests in Moray is not clear. It is likely to add to pressure on costs in an already difficult financial climate, encouraging lower cost methods of management. Processors are especially concerned with the implementation of the EU Working Time Directive and its impact on transport costs.

7.3 Incomes in the forestry sector

A narrow view of the forestry sector in Moray would consist of the growers and contractors located there. On this basis the income to the sector is estimated at £10.22m (Table 7.2). The contractors obtain slightly over half of their income from sources outside Moray (see Table 5.3). The forestry suppliers in Moray in the table below include supplies to primary processors.

Table 7.2 Income of forestry sector businesses located in Moray (£m)

	Firms located in Moray (£m)
Growers	3.81
Less payments to forestry suppliers located in Moray	2.19
Forestry suppliers in Moray	8.60
Total sector income	10.22

If we take a wider view of the sector and include payments by growers to forestry suppliers outside Moray the sector income increases to £10.99m

Management of forests in Moray also results in significant injections of expenditure into non-forestry suppliers (those not providing forestry contracting services) located in Moray and elsewhere. The growers spend £0.58m on non-forestry supplies, of which £0.40m is paid to suppliers in Moray (Table 3.6). Forestry suppliers spent £2.34 m on other supplies in Moray (Table 5.4), giving a total of £2.74m injected into other businesses in Moray as a further round of expenditure. This further round of spending gives an approximate first round indirect income multiplier of 1.28. However, this figure relies on respondents correctly identifying the geography of their payments, and this may not be very reliable.

7.4 Multiplier effects

From input-output (i-o) models of regional and national economies, three types of impact from a unit change in demand for a sector's output can be derived – direct, indirect and induced. The direct effects are those generated within the sector itself. The indirect are those in the rest of the economy and the induced are those that occur because of the spending of additional employees. The definitions of the Type I and Type II multipliers for employment are given below:

- Type I employment multiplier= Direct plus indirect employment)/Direct employment.
- Type II employment multiplier= Direct plus indirect + induced employment)/Direct

employment.

Multipliers derived from the 2001 Scottish i-o table (Scottish Executive, 2004) are given in Table 7.3 These are the normal demand-driven multipliers that are based on the backward (expenditure driven) linkages in the economy. The forestry sector is split into planting and harvesting in the i-o table and separate multipliers are calculated for each. The Type I multipliers are large for the harvesting sector but small for the planting sector. One reason for this is that harvesting output generates output from earlier stages in the production chain (although forestry is unique in the time lag between planting and harvesting, which makes application of multiplier analysis problematic). The Type II employment multipliers indicate that if direct employment in the harvesting sector increased by 1 FTE the indirect effects would add another 1.76 FTE and the induced effects a further 0.39 FTEs, making an additional 2.15 FTEs in all within the Scottish economy.

Table 7.3 Income and employment multipliers

	Income multipliers		Employment multipliers	
	Type I	Type II	Type I	Type II
Scottish 2001 table forestry planting	1.85	2.13	1.44	1.60
Scottish 2001 table forestry harvesting	2.80	3.21	2.76	3.15
Grampian forestry planting (Roberts <i>et al.</i> , 1999)		1.73		1.70
Grampian forestry harvesting (Roberts <i>et al.</i> , 1999)		2.99		2.10
Moray (GRIT estimates, this study)	1.06	1.35	1.12	1.58

Regional multipliers are smaller than those derived at national level because of greater leakage of the impacts. In the case of Moray they will not account for processing of timber and coproducts outside the region. Roberts *et al.* (1999) calculated Type II multipliers for Grampian and these are given in Table 7.3. They are in most cases smaller than the all-Scotland figures. For the harvesting sector the employment multiplier is 2.1, indicating that a 1 job increase in harvesting employment in Grampian will generate an additional 1.1 jobs elsewhere in the economy.

We estimated multipliers for Moray initially using the Generation of Regional Input-Output Tables (GRIT) technique (Jensen, 1990; Johns and Leat, 1987) which uses the national input-output table but adjusts for the regional share of employment. We used employment by sector data from the 2001 Population Census to achieve this. It is generally acknowledged that the smaller the region the less reliable the GRIT results are expected to be. The results are given in Table 7.3 for the forestry sector as a whole (planting and harvesting) in Moray. The i-o definition (National Statistics, 2004) is 'forestry, logging and related service activities'. It therefore excludes primary and secondary processing. A 1 job increase in forestry employment in Moray is associated with an additional 0.58 jobs through indirect and induced effects on the economy. Similarly for income, a £1 impact on income from forestry will produce a direct+ indirect effect of £1.06, and a total impact of £1.35.

The estimate of the (partial) indirect employment multiplier from our survey was 1.17 (Section 5.4). Taking into account other indirect effects would raise this to possibly 1.25. This is higher than the GRIT estimate of 1.06. The GRIT indirect multipliers are unrealistically low presumably because of imprecision due to the small size of Moray. Accordingly we use the survey-based estimate for first round indirect employment (1.25) and also assume an indirect income multiplier of 1.25. We then apply the

Scottish induced effects of 1.15 for income and 1.12 for employment to obtain Type II multipliers for Moray of 1.44 (income) and 1.40 (employment).

The effects of changes to the income or employment of the forestry sector are much smaller than those at regional or national level. This concurs with expectations for a small region and with the results of the survey of the sector which showed that much of the growers' expenditure on suppliers leaked out into the surrounding regions.

There would thus be beneficial knock-on effects elsewhere in the Scottish economy from an initial direct impact in Moray. We have not calculated the supply driven effects based on forward linkages (Roberts *et al.*, 1999) but with limited timber processing in Moray it is evident that part of the indirect and induced forward linkage impacts from a change in forestry output will be felt in Highland and elsewhere in Scotland.

7.4.1 Economic impacts of forestry and the forestry sector

The direct employment estimate was 323 FTE jobs for Moray residents (see Table 7.1, growers, suppliers and primary processing). An estimate of the total direct, indirect and induced employment can be obtained by applying multipliers to the forest sector business located in Moray. The direct employment is 200 (growers, suppliers, Table 7.1) and the employment multiplier is 1.4 giving a total of 280. The processing sector employs 69 and a Type II multiplier of 1.7 would be reasonable, giving a total employment of 397 by forestry firms located in Moray.

This approach is consistent with our actual observed employment of 323 FTEs, which does not take account of the associated induced employment.

The direct income of the forestry sector is estimated at £10.22m (Table 7.2) Applying the multiplier of 1.44 gives a total income of £14.8m (excluding processing), rising to £24.1 if primary processing is added.

When the economic impacts of tourism and fungi collection are added in, the total employment in Moray associated with forestry is around 468 FTEs, and the income is £26.3m. (Table 7.4). Secondary processing is not normally included as part of the forestry sector but we note that it accounts for over 100 FTEs jobs in Moray of which there are as estimated 7 FTEs in small scale hardwood and bespoke joinery businesses.

Table 7.4 Total economic impacts of forestry on the Moray economy

	Employment generated (FTEs)	Income (£m)
Timber and related activities	397	24.1
Forest related tourism	64	2.25
Other products (mainly fungi)	7 (direct)	Not estimated
Total	468	26.3

Note: these estimates exclude any impacts from forestry-related sport shooting or fishing

The employment estimates are those for which there is tangible evidence. They underestimate the total employment associated with forestry because firms that supply the sector as a minor part of their activity are under-represented. Furthermore, it has not been possible to account for the forest landscape element in tourism decisions, and this could increase the tourism employment figures considerably. A landscape lacking trees would much reduce the visual appeal of the area.

However, this effect would be balanced to an extent by the degree to which overnight stay expenditure by tourists who visit forests will not only have been generated by those visits.

7.5 Contribution to Forestry Commission, Scottish Executive and regional policies

7.5.1 Scottish Executive

The partnership agreement set out the plans and priorities of the Scottish Executive (2003). The agreement states that it will support the development of environmentally sustainable and competitive forestry. It specifically seeks to increase forestry and primary wood processing production over the next 15 years and to promote diversification in the use of forests and timber.

Contribution: The forests in Moray are amongst the most competitive in Scotland by virtue of their favoured soils and climate. Timber output is forecast to increase substantially and provide the supply for an expansion in wood processing. The forests provide a major recreational and environmental resource and the recent review of the public estate in Scotland will place more emphasis on the delivery of public goods from the estate.

Forestry also has a role to play in delivering on a number of other Executive policies. In relation to health, the Executive aims to increase and maintain the proportion of physically active people in Scotland (Scottish Executive, 2005b). It has set targets to achieve 50% of adults aged over 16 and 80% of all children aged 16 and under who meet the minimum recommended levels of physical activity by 2022.

In relation to social justice the Scottish Executive's (2005c) social justice and social inclusion agenda is committed to tackling poverty and disadvantage. One of numerous objectives is to increase the rate of improvement of the health status of people living in the most deprived communities.

FE staff and other woodland managers also engage with government and voluntary bodies in providing facilities and activities for socially excluded groups and for education. Whilst Moray is not extreme in terms of deprivation (Scottish Executive, 2005a) the public estate provides a resource for a number of communities with severe social problems.

7.5.2 Forestry Commission

The Scottish Forestry Strategy (Scottish Executive, 2000) outlines the strategic directions for Scotland's forests. These are:

- Maximising value;
- Creating a diverse forest resource;
- Making a positive contribution to environment;
- Enjoying trees, woods and forests; and
- Helping communities to benefit.

Contribution: The woodlands in Moray are emblematic in contributing strongly on all the strategic directions set by the FC. The larger estates and public forestry constitute a well-established and productive resource that also provides a wide range of highly valued environmental and recreational benefits. The active community woodland groups are evidence of strong interest in community engagement in woodland management, a development that the Commission is keen to encourage and where possible facilitate.

7.5.3 Regional policy

The Moray Forestry Strategy was formulated by the Moray Council in 2002 (Moray Council, 2003) with the aim of assisting the implementation of the Scottish Forestry Strategy by guiding and promoting sustainable forestry within Moray. The main policy instrument is strategic mapping of potential, preferred and sensitive areas for forestry, together with a map of opportunities for new woodlands. The preferred and potential areas amount to over 76,000 ha which, if planted, would more than double the existing woodland area. The regional policy supports forestry expansion. It highlights the regional interest in supporting timber production, and the role of woodlands in nature conservation (especially native woodlands), recreation, tourism, and the involvement of local communities.

Contribution: The existing estate is relatively stable in area and rapid expansion will only occur if agricultural land becomes available at an acceptable price for planting. The emphasis is thus on achieving regional objectives from the existing resource. The study has demonstrated the income and employment generated by the forest sector in Moray, and that it delivers strongly on the community and environmental agendas of the Council.

8 Conclusions

8.1 The Moray economy

Moray has a population of 86,940 (2001) and an economically active population of around 35,000 FTEs. In the 2001 Census, forestry and related services accounted for 188 jobs (excluding primary processing). The region's economy is facing major negative effects from the rundown of defence activity.

The review of the economy concluded that:

- Labour supply is tight, although average rates of earnings in the area have been consistently well below the Scottish average.
- Significant numbers of jobs are likely to be lost in the short to medium term in sectors dependent on the spending of the RAF bases and their military and civilian employees. For this and demographic reasons, a significant reduction in Moray's population is expected over the next 15 years.
- The area will depend on enhancing and promoting its landscape and other qualities to attract new businesses and residents to compensate for the rundown of the bases, and to increase its share of the north of Scotland's tourism.
- New development that creates employment is likely to attract good levels of public sector financial and other support to help cushion the area's economy from the impact of the job losses.

The forestry sector is likely to become increasingly dependent on migrant labour (especially from the new EU countries) for contract work.

8.2 Impacts of forestry on the Moray economy

Moray has 28% of its land area in forestry (64,335 ha) of which 36% is in public ownership, managed by Forest Enterprise Scotland. The total estate produces around 260,000t of timber per year and this is forecast to increase substantially during the next 20 years. The forest estate also provides a location for sport shooting and the collection of edible fungi.

The income forestry growers derived from forestry was £3.81m in 2003/04 (excluding grant aid) and direct employment 54.6 FTEs. The forest resource also supports economic activity in the forestry supply sector and in primary processing. Suppliers (agents, hauliers and forestry contractors) employed 68 FTEs in Moray and primary processors 97 FTEs. Taken together, the forest sector (growers, suppliers and primary processors) accounted for 323 FTE jobs in Moray and an income of £10.2m per year. When multipliers are applied to estimate the indirect and induced effects, the total regional income from timber increases to an estimated £26.3m.

Around 70% of the growers' forestry income was derived from sources outside Moray, a reflection of the fact that most of the timber processing takes place in Highland and elsewhere, with beneficial impacts on the Highland and wider Scottish economies. Moray appears to be in wood surplus but this has to be interpreted in terms of the wider market in the North of Scotland.

There is substantial secondary wood processing in Moray (mainly for housing and construction) but little of the timber used is sourced locally. There are a small number of hardwood and bespoke furniture businesses in Moray but again the linkage to the main forest sector is not strong.

Forest-related visits are an important generator of economic activity in the region. The total tourism employment from forest recreation was estimated at 64 FTEs, giving a total employment associated with the forest sector of 468 FTEs (1.3% of Moray's FTE employment) and a regional income of £26.3m. These are under-

estimates because we were unable to estimate the landscape element in tourism activity.

Growers, contractors and processors all reported difficulties in securing suitable labour and especially skilled labour. This is a major problem that reflects both low unemployment in Moray and the nature of forestry work which is unattractive to many employees.

8.3 Social and environmental benefits

The forests of Moray are a major environmental and social resource, especially for the local population, although also for tourists. Walking, together with horse riding and biking, account for almost 790,000 forest visits annually. The forests are also used for community and educational activities. The estimated value to participants in recreation and other activities is just under £1m per year.

Forests provide habitats for important species including capercaillie, red squirrel, wildcat, and pine martin, Pinewood and sand dune habitats are important contributors in the UKBAP and major oakwood, coastal and river valley sites are protected by SSSI designation. There are some negative effects (e.g. acidification on salmon fisheries). A variety of sources were used to estimate the value of the non-use biodiversity value of Moray forests. The estimate was £5.39m per year for the Scottish population but this may be an overestimate due to the limited valuation data available. Landscape benefits were estimated at £2.90m per year to local residents and the global carbon sequestration benefits were estimated, assuming a social value of carbon of £7 per tonne, at £1.2 million per year. Table 8.1 summarises the non-market benefit values.

Table 8.1 Non-Market benefit values of forests in Moray (£m)

Type of benefit	Benefit per year (£m)	Beneficiaries
Recreation	0.90	Mainly local, some tourists
Biodiversity	5.39	Scottish
Landscape	2.92	Local
Carbon sequestration	1.20	Global
Total	10.39	

Day trip and overnight expenditure by tourists using forests was estimated at £2.25m per year and may be much higher. Using expenditure conversion factors from other studies suggests that tourism supports 64 FTEs, and generates £768,000 in income from employment. There should be scope for increasing forestry's contribution to tourism by expanding the current leisure activity base.

8.4 Prospects

The economy in Moray is facing a major shock in relation to the rundown of defence facilities. This is unlikely to have a significant impact on the forest sector, but it will elicit public funding for investment to create new employment. The forest sector is a relatively stable one in terms of employment and incomes, and this is a valuable asset in the current context.

Prices for timber have been low in recent years, and this has depressed incomes, and there is as yet no clear evidence of a sustained price increase. However, the forecast increase in timber output provides the background for more buoyant prospects, especially for timber processing. This will also benefit harvesting and transport companies. A number of processors are planning to increase throughput. If one or both of two major proposals for wood processing in the north of Scotland are

taken forward there will be a major increase in demand for wood from Moray (especially small roundwood), with benefits to producers.

Prospects for an expansion in new planting are less certain. There is evidence that the SFGS grant aid is encouraging a more positive attitude to restocking on many estates. However, expansion of the forest area will mainly come from planting on farmland. The rate of expansion will be determined by any recovery in timber prices, grant aid levels and the impacts of the single farm payments under CAP reform.

The forest resource is widely used by local people for recreation, and there may be scope for extending its attraction for tourists with more opportunities for biking, horse riding and possibly nature tourism.

8.5 Recommendations for developing a transferable framework

Objectives and scope of studies

The study used a combination of detailed surveys and GRIT analysis. We consider that this remains the most cost effective route for deriving the total impacts of the forest sector on regional income and employment. However, the application of this approach to Moray was not straightforward for three reasons. First, the small size of Moray resulted in significant cross border movement in timber and services, making it difficult to identify the relevant population of contractor and processing businesses. Second, there were a small number of sawmills in the region, and this meant that it was imperative to obtain a near 100% response to the questionnaire. Finally, the GRIT multipliers proved unreliable at this scale. For these reasons we recommend that the Commission use larger, and ideally more self contained, areas for regional studies. This would reduce the border issues and allow a more reliable estimation of multipliers. A possible alternative, depending on the particular objectives of the study, would be to use localised case studies with the prior compliance of the key firms involved.

Business information

Little difficulty was experienced in establishing the population of growers, processors forest agents and nurseries. However the contractors were more problematic because of the geographic range of their activities and a reluctance to become involved in surveys. The population estimate and sample data are the best possible in the circumstances. In future it might be worth investigating IDBR as a source of business contact information. This is restricted to VAT registered and PAYE operating businesses and would therefore exclude the most problematic group – small contractors. IDBR could not therefore be the sole source of business information for regional studies, and experience has indicated that it may be less than totally reliable. FC has also experienced long time delays in obtaining IDBR data; hence to be useful, application would have to be made by the FC whilst contract specifications were being developed rather than after they were let.

Multipliers

GRIT provides a low cost method for deriving regional multipliers from the national input-output tables. Although it performed poorly in this study we still recommend that it be used in studies covering larger areas. Any other approach that attempts to estimate indirect impacts from local surveys (such as Local Multiplier 3, New Economic Foundation, 2005) requires much greater effort in data collection, and we doubt that this is either practical or justified. One of the problems with the forest sector is that it covers a diverse set of businesses whose purchases cannot readily be classified into business types. This contrasts with, for example, the tourism and recreation sector where expenditures can be classified fairly simply, and a further

round of expenditure evaluated which captures most of the multiplier effect. (e.g. Drew Associates, 2004).

Public goods and tourism

The methods used to calculate the public benefits from the social and environmental outputs are also well documented and could be transferred to other regions. The tourism impacts were derived using estimates of visitor numbers and expenditures, without undertaking detailed visitor surveys. The method is transferable but it relies on too many assumptions to be ideal. Much depends on how precise an estimate FC requires in any regional study. The research FC is now undertaking to obtain better information on the numbers and decision making of visitors to many of their woodlands should provide a better dataset for any future regional studies.

Landscape and environmental quality

One potentially important benefit from forestry not quantified in this study is the effect of landscape improvement and environmental quality on the attraction of people and businesses (other than tourists) to a region. In Moray, environmental quality could be a significant factor in the region's competition for new people and firms. This is a difficult area to research and studies of the effect of greenspace on the relocation of businesses have generally been inconclusive (CJC Consulting, 2005). However, in future regional studies it would be worth considering some survey work on recent in-migrants to assess the importance of woodlands in tourism and business decisions.

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10 Annex I Forestry Commission forecasts of timber output

10.1 Private sector

Table 10.1 Average annual volume for felling (m³ over bark)

Species	From	To	TDC 7-14	TDC14-16	TDC16-18	TDC18-40	Total
Conifers	2005	2005	62,323	23,302	22,363	104,866	212,855
	2006	2006	61,888	23,387	22,635	109,258	217,169
	2007	2007	58,985	23,677	23,435	116,331	222,428
	2008	2008	59,064	23,789	23,567	118,591	225,011
	2009	2009	68,568	29,386	29,118	134,038	261,110
	2010	2010	70,456	30,348	30,111	138,347	269,261
	2011	2011	74,016	31,679	31,367	141,111	278,173
	2012	2016	71,675	32,154	32,473	152,128	288,430
	2017	2021	69,657	33,640	36,859	180,954	321,110
	2022	2026	68,519	34,957	40,167	204,697	348,339
Broadleaves	2005	2005	553	337	489	4,263	5,643
	2006	2006	566	333	520	4,377	5,796
	2007	2007	566	333	520	4,377	5,796
	2008	2008	602	352	539	5,971	7,464
	2009	2009	567	334	520	4,408	5,829
	2010	2010	566	333	520	4,377	5,796
	2011	2011	1,224	756	1,125	8,064	11,168
	2012	2016	1,246	753	1,124	6,973	10,096
	2017	2021	1,176	609	896	4,378	7,058
	2022	2026	609	153	228	1,333	2,321

Note From 2005 to 2005 refers to the period 1st April 2004 to 31st March 2005
TDC is Diameter Class Grouping

10.2 Forest Enterprise

Table 10.2 Average annual volume for felling (m³ over bark)

Species	From	To	TDC 7-14	TDC14-16	TDC16-18	TDC18-40	Total
Conifers	2005	2005	65,693	19,209	16,043	49,171	150,115
	2006	2006	48,262	16,179	14,120	47,169	125,729
	2007	2007	33,147	11,370	10,246	38,879	93,642
	2008	2008	31,997	12,113	11,453	47,289	102,851
	2009	2009	75,425	28,091	26,941	102,081	232,539
	2010	2010	48,576	14,955	13,277	49,738	126,546
	2011	2011	36,977	15,159	15,440	60,791	128,367
	2012	2016	44,307	17,010	16,391	63,227	140,935
	2017	2021	38,901	15,692	15,685	65,887	136,166
	2022	2026	40,623	16,911	17,403	90,789	165,726
Broadleaves	2005	2005	0	0	0	0	0
	2006	2006	0	0	0	0	0
	2007	2007	0	0	0	0	0
	2008	2008	0	0	0	0	0
	2009	2009	0	0	0	0	0
	2010	2010	6	1	0	0	7
	2011	2011	0	0	0	0	0
	2012	2016	5	3	5	20	33
	2017	2021	1	0	0	0	1
	2022	2026	60	6	2	1	68

11 Annex II Social and environmental benefit values

11.1 Recreation benefits

A series of zonal travel-cost models (ZTCMs) of recreational trips to six Scottish forests, representing a range of forest and recreational types, was undertaken in the late 1980s. (Table 11.1) This study estimated a consumer surplus of around £2 per person per visit (in 1988 prices). Consumer surplus varied between individual forests from £1.34 to £3.31 per person per visit, depending upon the characteristics and location of each forest. There was also an enormous variation in the number of people, and the frequency of visits, to different forests (see Willis, 1991). Since both the recreational value per visit and the number of visits varies substantially between forests, this produces significantly different aggregate recreational values between forests and wide variations in recreational consumer surplus per hectare between forests:

Table 11.1 Consumer surplus per visit to different Scottish forests

Forest	Consumer surplus per visit (£)	Number of visits	Consumer surplus per hectare (£)
Aberfoyle	2.72	145,000	23
Buchan	2.26	84,000	27
Castle Douglas	2.41	32,000	13
Loch Awe	3.31	3,000	<1
Lorne	1.44	10,000	2
Newton Stewart	1.61	70,000	4

Source: Willis (1991).

Each of the above forests has differing arboricultural and recreational characteristics: *Loch Awe* has a large proportion of young trees, mainly spruce, high wind-throw hazard classes, and presence of forest cabin developments; Buchan is representative of a large number of forest districts in eastern Britain, with below average amount of older broadleaves but above average amount on non-spruce species; Aberfoyle has large areas of young conifer, mainly spruce, close to large population centre (Glasgow), with many recreational facilities provided; Newton Stewart is representative of forest districts with extensive ranges of young conifer, particularly spruce, high wind-throw class, and hence poorly roaded and non-thin common; whilst Lorne has large areas of young conifers but with significant amounts of older conifers and lower wind-throw classes; and Castle Douglas a high proportion of spruce, but with a greater range of age classes, and notable forest drives.

None of the above forests entirely replicates the characteristics of Moray forests in terms of arboricultural structure, recreational facilities, substitute sites, and distance from population centres. Thus rather than transfer a mean WTP recreational value from another forest, it is preferable to transfer a function and estimate the value of Moray forests on the basis of their characteristics.

A study by Hanley and Ruffell (1993) attempted to investigate the impact of forest and recreational attributes on WTP per visit using a hedonic travel-cost (HTC) model. Characteristics deemed important *a priori* to the number of visits and value per visit were percentage of forest in broadleaves, diversity of conifer species, height diversity, mean height, presence or absence of water features, proportion of forest as open space, provision of trails and other visitor facilities. Whilst the study derived a WTP value of £5 per household (or £2.19 per adult) per visit, unfortunately the HTC

model only found a significant relationship between visits and mean height and percentage of forest as open space.

The most comprehensive data set on recreational trips to Scottish forests is the EU-CAMAR data set. This data set is a sample of visitors, whose main purpose of their trip was a recreation trip to a forest. An analysis of this data set revealed that these visitors had a substantially higher economic surplus than previously estimated, with quite a variation across forest sites (£1.15 to £7). A better fit to the data was obtained when forest attributes were accounted for in the demand system through a hedonic travel cost (HTC) model of individual trips. From this model the expected benefit of each forest visit was estimated to vary between £2.25 to £3.70 (Scarpa, 2003). The EU-CAMAR data, with supplementary sample surveys of visitors to seven English and Welsh forests (Brenin, Dartmoor, Delamere, Epping, New Forest, Sherwood, and Thetford), formed the basis of the study by Scarpa (2003) of the recreational value of woodlands in Britain for the Forestry Commission social and environmental benefits of forests study.

The benefit equation estimated by Scarpa (2003) to calculate the aggregate value of woodland throughout Britain, was used to estimate the recreational value of Moray forests. Applying the characteristics of each of the Moray forests that attracted 'formal' visitors (i.e. visitors from >5 miles) produced consumer surplus values that ranged from 84p for Monaughty; £1.25 for Roseisle; £1.31 for Culbin; £1.89 for Deer Park; and £2.51 for Quarrelwood.

All of the above studies, including that by Scarpa (2003), tended to sample purposeful or formal trips to forests, usually at car parks where longer distance visitors would arrive. Casual visitors, such as local dog walkers, etc., were under-represented in these surveys because they accessed forests by a number of different routes rather than arriving by car at car park sites. Clearly a local dog walker who may make two trips to woodland every day is unlikely to pay £1 or £2 for every visit. Other studies have shown that dog walkers have a low consumer surplus on a marginal walk (around 4p to 30p), principally because of the number of such trips they make (i.e. it impacts on their budget constraint) and the availability of substitute sites (e.g. local street or parks) (see Willis and Garrod, 1991).

A study of the Community Woodland Supplement (CWS) (woodland within five miles of the edge of a village, town or city, where little other woodland was available for recreation) revealed that only a small part of the public benefit derived from physical (recreational) access to the woodland. Most residents were more interested in trees in their locality for reasons other than access. Thus, Crabtree *et al*, (2001) estimated that the mean use value per household (for households within 4 miles) of CWS woodland, varied from a lower bound estimate of £0.13 to an upper bound estimate of £0.56 per household per year. A somewhat higher value was derived in by Scarpa (2003) who estimated the use (recreational) value of round trip distances of less than 10 miles to woodland, to be £0.90. These trips were deemed to be local trips. This latter value of £0.90 was used to estimate the aggregate value of informal visits to forests in Moray.

Estimating recreational value on the basis of whether visits are formal or informal may underestimate the total value of recreation in Moray. A more accurate value of recreation can be obtained by recognising that different sub-sets of recreational users will have different values for forest recreation. The FC disaggregated the recreation data for Moray by activity type: walking, horse riding, biking, other recreational visits, and educational visits. Each of these categories was disaggregated into informal (i.e. by visitors originating within Moray district), and formal (i.e. by visitors originating outside Moray district) visits.

Unfortunately there is no information on WTP and consumer surplus values for specialised recreational activities in woodland in Great Britain. The Institute of Rural Sciences at the University of Aberystwyth is currently (2004-2005) estimating the value of specialist recreation in British forests for the Forestry Commission. However, we might assume that specialist recreational activities will be no less valuable than formal recreational visits to forests and woodland, and will probably be of higher value.

Benefit transfer function values were used to value formal walking visits (i.e. 84p for Monaughty; £1.25 for Roseisle; £1.31 for Culbin; £1.89 for Deer Park; and £2.51 for Quarrelwood), whilst informal walking visits by local residents were valued at £0.90. Specialist informal (local) recreation was valued at £1.71 (the average value estimated by Scarpa (2003) for purposeful recreational visits to forests; and specialist formal recreational visits were valued at £2.75). This value was derived by Scarpa (2003), based on the notion of a skewed distribution of WTP, from a model with a relatively good fit to his recreational data. Since formal specialist recreationalists travelled from outside Moray district, it may be assumed that they will be willing to pay more than local recreationalists.

Recording the number of visit and visitors (some visitors make more than one visit to a forest per year) is problematic: multiple access points to forests and low number of visitors per day to many forests render enumeration expensive. There are two ways of enumerating visitors: at the forest gate; or through a random sample survey of households, asking if household members had visited a forest or wood over a preceding time period. Few forests record visits consistently and accurately at the forest gate. On-site forest recreation surveys sample some days, and periods within these days, and extrapolate these numbers over the rest of the year. Such a method may over-estimate the number of visits; but, because they tend to be based on car park information, they are probably more likely to under-estimate visits – certainly of local informal visits where access is not by car. General household surveys have also been used to estimate visits to forests. A random sample of households is asked if they have visited a forest over a preceding time period. This method is thought to over-estimate the number of visitors to forests because of memory and other biases.

Table 11.2 presents the aggregate recreational values for FC forests in Moray, based upon the FC's estimates of visits to different forests, and the estimated values for each type of visit.

Table 11.2 Numbers of visits and consumer surplus values for FC Moray forests by activity

Forest	Walking: local visitors	Walking: other visitors	Specialist recreation: local visitors	Specialist recreation: other visitors	Total visits	Total value (£)
Culbin	55,400	29,800	3,300	1,500	90,000	98,666
Newtyle	4,400	-	1,100	-	5,500	5,841
Monaughty	43,300	10,800	1,350	550	56,000	51,863
Dallas	-	2,000	-	-	2,000	3,420
Roseisle	140,500	93,500	4,700	1,300	240,000	254,937
Quarrelwood	104,405	44,745	2,850	-	152,000	211,148
Lossie	13,300	-	1,700	-	15,000	14,877
Castle Hill	5,800	200	4,000	-	10,000	12,402
Tiendland	4,300	-	700	-	5,000	5,067
Elchies	9,300	200	500	-	10,000	9,567
Scootmore	1,000	-	-	-	1,000	900
Deer Park	60,200	20,000	3,400	400	84,000	98,894
Ben Aigan	3,300	1,400	2,100	200	7,000	9,505
Rosarie	400	-	500	100	1,000	1,490

Forest	Walking: local visitors	Walking: other visitors	Specialist recreation: local visitors	Specialist recreation: other visitors	Total visits	Total value (£)
Morinsh	1,500	500	-	-	2,000	2,205
Glenfiddich	1,000	-	-	-	1,000	900
Cairdswood	500	-	-	-	500	450
Aultmore	4,900	-	100	-	5,000	4,581
Maud/Carnoch	2,000	-	-	-	2,000	1,800
Ordiequish	20,000	-	-	-	20,000	18,000
Total	475,505	203,145	26,300	4,050	709,000	806,513

Similar information was derived for private woodlands. However, there is no information on the characteristics of private woodland in Moray that attract visitors similar to that available for FC forests. Hence it was not possible to use the benefit function transfer equation, and apply the characteristics of private forests to estimate a value for visits for which the main function was walking. Thus, the average value for a purposeful forest visit of £1.71 per visit derived by Scarpa (2003) was employed. The data on visits to private forests are not categorised by origin: local visits or those from outside Moray. Hence, the proportion is assumed to be the same as that for FC forests in Moray: 70% local visits, and 30% of visits from outside Moray, giving the number of local and longer distance visits for walkers documented in Table 6.2. The value of a local visit at £0.90 per visit was the same as that employed for FC forests. A similar procedure was adopted for specialist recreation: visits were disaggregated between those of local and non-local origin on the basis of the proportion of such visits to FC forests, and the same values per visit applied as for FC forests. The recreational values for private woodland in Moray are documented in Table 11.3.

Table 11.3 Consumer surplus values for private sector woodland visits in Moray

Activity	Number of visits	Value per visit (£)	Total value (£)
Walking: non-local visitors	22,662	1.71	38,752
Walking: local	52,878	0.90	47,590
Specialist recreation: non-local visitors	1258	2.75	3,460
Specialist recreation: local visitors	8202	1.71	14,025
Total	85,000		103,827

Tables 11.2 and 11.3 show that the aggregate recreational value of Moray forests is quite large, amounting to £910,340 per annum. 88.6% of this aggregate value is accounted for by recreation in FC woodlands in Moray. At a 3.5% discount rate the annual recreational value capitalizes to £26 million.

11.2 Biodiversity values

The *gross* biodiversity value of Moray forests can be estimated from values derived from a number of different studies valuing different aspects of biodiversity in Scottish forests. A study by Garrod and Willis (1997) estimated the biodiversity value of restructuring remote coniferous forests using a stated preference (contingent ranking) method. UK Biodiversity Steering Group (1995) estimated the restoration costs for Caledonian pine forest to be £776/ha (discounted at 6% over 100 years), although there was a large variance depending upon the particular site considered. However, the UK Biodiversity Steering Group value is the cost of restoring

Caledonian pine forest rather than the value the public derive from its restoration. Macmillan and Duff (1998) used a discrete choice contingent valuation question, to estimate the public's value of restoring two native pinewood forests in Affric and Strathspey in Scotland. Mean household WTP for those supporting a particular restoration plan ranged between £35 for Affric and £24 for Strathspey. The mean value for Strathspey was reduced when compensation for those who preferred the existing moorland landscape was included. However, this study was not exclusively concerned with non-use values for biodiversity in Caledonian native pinewoods, so that the results probably include some use, including landscape, value. The subsequent study by Hanley *et al.* (2002) attempted to generalise the biodiversity value of marginal changes in forests across all woodland types. Its specific objectives were to:

- Ascertain non-use biodiversity values for other types of forest, in addition to that for remote coniferous forest, and to
- Estimate the (marginal) biodiversity value of additions to these forests, in terms of extending their area.

The research was designed so that the results of the Garrod-Willis study could be used to estimate the biodiversity value of the remaining forest area in Britain, which has different biodiversity characteristics from remote coniferous forest. This was undertaken by the use of in-depth research on people's preferences for biodiversity and wildlife conservation in other types of forest.

The study by Garrod and Willis (1997) estimated the public's WTP for a number of forest management standards that could be adopted to improve levels of biodiversity in 300,000 hectares of remote upland coniferous forests, which the respondent would never visit. Biodiversity values were assessed in relation to different management standards for this type of forest: 'do nothing' (blanket commercial forestry); a 'basic' biodiversity management standard, that the FC was already moving towards; an 'enhanced' management standard, that would meet UK biodiversity obligations for managed forests, whilst still permitting some timber production; and a 'native woodland' standard, that would maximise biodiversity. The value for a marginal change, increasing biodiversity, in remote coniferous forests was £0.30 to £0.35 per household per year per 1% enhanced biodiversity management standard in these forests. A contingent valuation (CV) study produced similar results of £10-£11 per household per year for biodiversity for a 30% increase of the area of this forest type. The model adopted by was linear, and assumed each additional increment in enhanced biodiversity management of standard blanket commercial forests was valued equally. This may be a reasonable assumption up to the first 30% of blanket coniferous commercial forests restructured to meet an enhanced biodiversity standard (an axiom supported by the CV result). Indeed, the general consensus of the focus groups undertaken in conjunction with the Garrod & Willis (1997) study, was a desire by respondents to strike a balance between increasing biodiversity in commercial forests and the need to maintain profitable timber production. Thus it is likely that the value of marginal additions to the enhanced biodiversity in commercial forests, beyond 30% of the forest area, will decline. Indeed respondents did not wish to abandon commercial production *per se*, but rather diversify a proportion in the interests of biodiversity whilst maintaining commercial production in the remainder.

The subsequent study by Hanley *et al* (2002) was designed so that the results of the Garrod-Willis study could be used to estimate the biodiversity value of the remaining forest area in Britain, which has different biodiversity characteristics from remote coniferous forest. This was undertaken by the use of in-depth research on people's preferences for biodiversity and wildlife conservation in other types of forest. Hanley *et al* (2002) used a focus group based approach. In each group, participants had the chance to learn about biodiversity in forests before being asked to express their

preferences for biodiversity associated with different types of forest. Focus groups allow people more time to consider and discuss the various aspects of biodiversity in forests, compared with individual responses in a questionnaire survey; and more information can be provided to respondents. Tokens were used to allow respondents to express the direction and strength of their preference for different forest biodiversity regimes. The relative values as revealed by the “tokens” exercise, and as summarised in Table 11.4, can be taken to represent the relative merits and values for marginal increases in biodiversity in different types of woodland.

Table 11.4 Relative biodiversity values for different types of forest

Biodiversity forest type	Relative value for existing area	Relative value for an increase ⁺ of 12,000 ha.	Relative WTP values per household for an increase of 12,000 ha.	Absolute WTP values per household for an increase of 12,000 ha.
Upland Conifer Forest (control)	1.00	1.00	1.00	0.35
Lowland Conifer Forest	1.21	1.15	0.94	0.33
Lowland Ancient Semi-Natural Broadleaved Forest	2.11	2.31	3.23	1.13
Lowland New Broadleaved Native Forest	1.95	4.23	2.40	0.84
Upland Native Broadleaved Woods	2.32	3.31	2.57	0.90
Upland New Native Broadleaved Woods	1.95	3.15	1.74	0.61

⁺ Or in the case of ancient lowland and upland native broadleaved woodland to protect and regenerate these woodland types.

Table 11.5 documents the biodiversity value of Moray forests using values from Garrod and Willis (1997), Macmillan and Duff (1998) and Hanley *et al.* (2002). The unit values for ancient and broadleaved woodland are based on Hanley *et al.* (2002). These values reflect the relative increase in people’s values over remote coniferous commercial woodland with little biodiversity interest. The final column records aggregate values for Scottish households.

Table 11.5 Biodiversity values for Moray forests.

Forest type	Area (hectares) ¹	Unit value (£) per household per year per 12,000 ha	Biodiversity value: Scottish households £ millions
Ancient woodland	1869	0.90	0.324
Broadleaf	7363	0.61	0.864
Sitka spruce	12997	0.35	0.876
Scots pine	21063	0.47	1.906
Other conifers	21043	0.35	1.418
Total	64,335		5.388

¹ includes open land within forest boundaries since this forms an integral part of the forest ecosystem and biodiversity value of the forests.

Biodiversity values for Sitka spruce, Scots pine, and other conifers are more tentative; due to a lack of information about the exact structure of these forests in

Moray. The value for Sitka spruce is taken from Garrod and Willis (1997) and applies to a standard of forestry where the aim is to produce as much timber as possible (85% of the area comprising Sitka spruce) whilst meeting minimum standards for nature conservation (variation in age and size of forest blocks). The value for this basic biodiversity 'standard' assumes 1% of the area is left to regenerate naturally; 10% of area is left unplanted, creating open areas of grass, bog, heath, or rock; and 5% is replanted with native broadleaved woodland). This is assumed to be the basic biodiversity standard that this type of FE woodland has attained or is moving towards. A similar scenario was assumed for other conifer woodland. Both of these were applied to FE land; but not to private forest land on the grounds that less is known about private woodland and the fact that private woodland is likely to have a more stringent commercial goal. Values for Sitka spruce and other conifers apply to GB households.

A value for Scots pine could be taken from Macmillan and Duff (1998), who estimated the value for the restoration of native (Caledonian) pine forest in Strathspey (the area closest to Moray). However, there are few remnants of original Caledonian woodland in Scotland. Virtually all pine in Moray is non-native plantation woodland, which will have a much lower biodiversity value than native Caledonian pine forest. Hence applying the value of Macmillan and Duff (1998) value will grossly over-estimate the biodiversity value of the existing stock of Scots pine in Moray. Over-estimation of value would occur to the extent that Scots pine area is commercial forest rather than native Caledonian pine forest; and because the Macmillan-Duff value includes benefits other than those from pure biodiversity. Moreover, the Macmillan and Duff (1998) value assumes linearity in WTP for more areas of native Caledonian pine (which would over-estimate existing Scots pine woodland because of declining marginal utility). Thus, there is no accurate biodiversity value for Scots pine in upland areas. Scots pine is more valuable in biodiversity terms than Sitka spruce (35p per household), but may be less valuable than upland new native broadleaved woodland (60p per household). Thus, we assume for this study that it has a value mid-way between these at 47p per household per 12,000 ha.

The area of forest in Table 11.5 is taken from Table 3.1 in this report. This amounts to 54,123 ha (excluding the felled area): 47,744 ha of conifer and 6,380 ha of broadleaves. However, the afforested area of Moray also includes some open land and felled area; whilst the biodiversity values in Table 11.5 also encompass the value of open land as an integral part of the forest ecosystem. The afforested area in Moray is 64,335 ha. Thus the area of trees (broadleaves, Sitka, Scots pine, other pines, and ancient woodland) was factored up by 1.15412 [$=64,335/(54,123+1620$ ha ancient woodland)] to account for this open space.

FC and FE policy is to restructure forests, over time as trees are felled, from purely commercial forests concentrating on timber production, to forests maximising combined timber value and non-market benefits including biodiversity. The unit values per household in column 3 of Table 11.5 are based upon the relative values of restructuring forests to increase biodiversity. However, private forestry has little incentive to restructure forests to provide non-market benefits such as biodiversity benefits. Hence, we assume that Sitka spruce, Scots pine, and other conifers under private forestry do not embrace the relative biodiversity values in Table 11.5. Hence these hectares are excluded from the valuation.

A conservative estimate of the biodiversity value of Moray forests would be to take the value aggregated over Scottish households. This gives a total biodiversity value of £5.39 million per year for FC and private sector woodland. The policy of the FCS is to re-structure spruce and pine forests, when they are felling and replanted, to create greater biodiversity value. The values in Table 11.5 reflect this policy.

However, there is some uncertainty about whether private sector conifer forests in Moray are also being restructured to the same extent to enhance biodiversity value.

11.3 Carbon sequestration benefits

The anthropogenic emission of greenhouse gases (GHGs) increases the amount of carbon dioxide and other greenhouse gasses, such as methane, in the atmosphere. It is widely acknowledged that these GHGs contribute to global warming. Forestry contributes to reducing the amount of carbon in the atmosphere below what it would otherwise attain. The strategy for forestry in Scotland (National Office for Scotland, 2000), for example, suggests that Scotland's forests might absorb approximately 10% of annual CO₂ emissions attributable to Scotland, and that "the greatest sequestrations gains are likely to come from forests growing high quality timber (which will be put to long-lived end uses) on long rotations, in complex forest ecosystems with soils of low organic content" (NOS, 2000, page 26).

The accumulation of carbon in wood reflects timber increments, since the dry weight of wood comprises 50% carbon, and stem wood comprises the bulk of tree biomass (Broadmeadow and Matthews, 2003). The quantity of carbon captured and retained by the average forest in the UK (170 to 220tC ha⁻¹) is much higher than above ground carbon accumulation associated with other types of vegetation such as perennial grassland (5tC ha⁻¹) or heathland (10tC ha⁻¹).

Nevertheless, the process of estimating the value of this carbon sequestration is complex. Carbon sequestration depends upon timber yield (which varies between species, although there is little difference in carbon per m³ of wood between different tree species) over the rotation of the crop. Thinning during the rotation affects carbon sequestration, both in terms of timber yield and in terms of carbon release from tree litter on the ground.

The carbon content of the soil can change under trees compared to an alternative land-use. For example, soil drainage, either artificially or through trees using more water than grass or heath cover and lowering the water table, results in oxidation of peat and considerable quantities of carbon are lost to the atmosphere as CO₂. Thus planting trees on peat soil reduces the net amount of carbon sequestered in timber production. Non-peat soils generally sequester relatively low levels of carbon. It is assumed that forests in Moray are not planted on peat soils, since much of Moray has a sandy soil.

Carbon (petrol and diesel fuel) is also used in thinning, felling, and transport of the timber, at different stages of the rotation. In an analysis of carbon sequestration in Wales *et al.* (2000) found that woodland management had a substantial impact upon carbon storage in livewood.

Carbon storage in livewood is directly linked to timber volume, which can be derived from tree yield class. Brainard *et al.* (2003) used Sitka spruce, beech and oak as surrogates to represent the general categories of broadleaf and coniferous trees in GB. Data of the FC estate, and for private woodland through the National Woodland Inventory, was used to predict timber yields. Their model took into account changes in soil carbon content as a result of forestry, as well as carbon releases from machinery and log transport for felling operations in the UK during the year of felling. The inclusion in the models of carbon releases from harvesting machinery reduced total monetary values for carbon sequestered by between 0.5 and 3%. Finally the end product of the timber (paper, furniture, etc.) determines how long carbon remains 'locked-up' beyond the end of the rotation, or is released back into the atmosphere shortly after the end of the rotation.

This exercise to calculate the *net* amount of carbon sequestered through forests inevitably produces estimates that are subject to some uncertainty. However,

estimates of the physical amount of carbon locked up in forests is relatively accurate compared to the estimate of the social value of carbon. The uncertainty surrounding the social value of carbon is enormous.

This enormous uncertainty arises because the social cost of carbon is mainly calculated using a damage function framework: the effect on production, or preventative expenditure, or replacement cost, required to mitigate against increased flooding, rising sea levels, and changing climatic conditions, as a result of global warming attributable to carbon dioxide (CO₂) emissions. There is considerable uncertainty about the physical quantity of this damage, irrespective of the economic valuation of this damage to traded good and services. There is also considerable uncertainty about the value of non-market goods affected by climate change (e.g. with respect to biodiversity). Such economic damages are difficult to estimate especially over a long time scale. There is also disagreement on how such damages should be aggregated across regions with different levels of income; and the rate at which the value of future impacts should be discounted. Moreover, there is also uncertainty about how far adaptive responses (technological, ecological, and human) to climate change would mitigate these social costs.

Variations in these assumptions between different studies have produced a huge range of estimates of the social cost of carbon. These range from US\$7 to US\$197 t/C for the period 2001-2010. Nordhaus (1992) originally estimated the social cost of carbon (for 2001-2010) to be US\$7 t/C. Fankhauser (1994 and 1995) estimated the mean social cost of carbon for 2001-2010 to be US\$22 t/C [=£14.67 t/C (£1 = US1.5)]. Clarkson and Deyes (2002) suggest a much higher value for the social cost of carbon at £70 t/C. This is based upon higher estimates of physical impacts of carbon, a lower discount rate, equity weighting, and the value of (people's aversion to) risk and uncertainty. This high value is not supported by the price at which carbon permits are traded in the UK Emissions Trading Scheme. Whilst the price has varied since the scheme was launched from £3 to £12.50, probably due to the slow adjustment of market dynamics,⁹ permits were traded at £3 per t/C equivalent (ICAP, 2003; Willis *et al.*, 2003); and they still remain at a low price. Recently Canada decided to cap the carbon value at C\$15 (=US\$9.65); whilst Slovakia sold carbon allowances for US\$5 t/C. The Defra Climate Change Project Office (2005) was reporting a figure of \$3 to \$5 tonne CO₂ for carbon emissions trading, which is 82cents to \$1.36 t/carbon (1 tonne carbon = 3.67 tonnes of carbon dioxide).

Pearce (2003) in a review of studies estimating the social cost of carbon, argued that many studies of the social cost of carbon over-estimated damages because they were based upon models in which there was no adaptation to climate change. Thus Pearce (2003) argued that the 'base case' estimate of the social marginal cost of carbon is £2.66 to £6 t/C without equity weighting and using a constant discount rate. Applying the lowest equity weight¹⁰ ($\epsilon = 0.5$) to the highest discount rate ($i = 6\%$), and the highest equity weighting ($\epsilon = 1.5$) to the lowest discount rate ($i = 1\%$) produced a social cost of carbon estimate range of £2.40 to £15 per tonne. This range encapsulates two of the social cost of carbon values used in the study by Brainard *et al.* (2003): £6.67 per t/C and £14.67 per t/C, and these values probably represent the limits of carbon sequestration value.

Table 11.6 presents the aggregate carbon sequestration benefits for Moray forests. These are capital values and range between £33.997 million to £102.873 million. A conservative estimate of the carbon sequestration value of Moray forests would be to

⁹ Companies were slow in having their baselines verified, which delayed allocated allowances, causing an initial shortage of supply and price rise. Companies have now gone through their first reconciliation deadline, and this has led to a fall in demand for permits. Companies meeting their targets receive an 80% discount from the Climate Change Levy tax on business use of energy.

¹⁰ Where ϵ is the elasticity of the marginal utility of income (a measure of 'inequality aversion').

take the lower quantities of tC per hectare and the lower social value of carbon of £7 per tonne, which suggests a capital value of £33.997 million.

Table 11.6 Carbon sequestration values for Moray forests

Species	hectares	tC per ha ^a	Carbon value (£ per tonne)	Carbon value range (£ per ha)
Sitka spruce	11,261	75 to 82-93	7 to 15	5.912 - 15.709
Broadleaves	6,380	200 to 379	7 to 15	8.932 – 36.270
Other conifer	36,483	75 to 82-93	7 to 15	19.153 – 50.894

^a Sitka spruce tC quantities based upon Cannell and Dewar (1995) (75tC) and Brainard *et al* (2003) (82-93tC). Broadleaf tC quantities based upon Broadmeadow and Matthews (2003) (200tC) and Brainard *et al* (2003) (379tC). For other conifer, Sitka spruce carbon sequestration rates are assumed to apply.

Annual values of carbon sequestration are an approximation of capitalised values because of initial changes in soil carbon, after use of wood, and other items that occur at specific points over the rotation. But over multiple rotations and assuming a steady state, the annual value for carbon sequestration is £1.189 million (assuming a social value of carbon at £7 per tonne).

11.4 Landscape benefits

A number of studies have investigated people's preferences for trees and woodland in the landscape. These studies have employed a variety of methods, including hedonic price (HPM), standard gamble (SG), and stated preference (SP) techniques encompassing contingent valuation (CV) and choice experiment (CE). All have revealed a statistically significant relationship effect between landscape quality and people's WTP. The Forestry Commission has played an active role in this process in attempting to derive a monetary value for forest landscapes.

Forest valuation studies relating to landscape traits fall broadly into two categories:

- Characteristics of existing forests (Entec and Hanley, 1997).
- Woodland in the wider (usually agricultural) landscape (Willis and Garrod, 1992; Hanley *et al.*, 1998; Garrod, 2003).

The Entec-Hanley (1997) study investigated landscape improvements in British forests using expressed preferences: choice experiment and contingent valuation. The CE assessed WTP per household per year for forest shape; felling method; species mix in autumn, winter, and spring. This produced WTP values for (selective) felling: £12.89; (organic) shape: £13.90; and species: £11.36 (diverse mix of evergreen, broadleaf, and larch). WTP for the ideal forest landscape was inferred by summing these variables, and produced a value of £38.15 per household per year. The separate CV study indicated households would be willing to pay £29.16 per year to see enhancements in the appearance of British forests that resulted in the perception of an "ideal" forest emerging. There is no indication in this study as to how this result should be aggregated by the number of "ideal" forests, nor by forest improvements, nor by the number of households affected by the improvement. Neither does this study assess the value of restructuring forests with the more general landscape. The Entec-Hanley (1997) study is more concerned with people's WTP to improve the internal landscape management of a forest by the FC.

The scenic value of woodland, in a wider landscape context, has been investigated in a number of studies. Willis and Garrod (1992), used a HPM covering over 100,000 properties across the whole of Great Britain, to estimate the impact in the landscape of broadleaved trees; larch, Scots and Corsican pine, and mature sitka spruce, to house prices. Only broadleaved woodland and sitka spruce woodland was found to

have a statistically significant relationship to house prices. They found that a 1% increase in the relative proportion of broadleaved woodland in a FC forested area, in a given 1 km square, with all other independent variables held at their mean values, increased the selling price of a property by £42.81 (in 1988 prices). A similar increase in the proportion of Sitka spruce conifers reduced the selling price of a house by £141. If the 1% rise in the relative proportion of broadleaf cover had resulted in a similar reduction in the relative proportion of sitka spruce, then the selling price of the house increased by £181.81. This suggests that the landscape value of woodland depends on the relative species mix, as well as the number of properties in the 1 km square.

HPM studies of urban amenities have shown that broadleaf trees increase property values. Powe *et al* (1995) estimated an increase in property prices of £3441 or 3.2% (1992 prices) for properties within 500 meters of broadleaved woodland in Tyneside. The lack of a substantial number of HPM in different urban areas makes it difficult to generalize whether and how landscape values of trees differ between urban areas. *A priori* it might be expected that the impact of trees on property prices would be larger for an area such as Tyneside with relatively few urban and peri-urban deciduous woodlands, than for Moray with significant amounts of woodland.

The most comprehensive study to evaluate the visual amenity benefits of forests in different landscapes was that by Garrod (2003). This study adopted a stated preference CE approach. Landscape benefits of forests were evaluated with respect to three different landscapes (mountain, plateaux, and rolling hills) and two tree families (broadleaf and conifer). There was a majority (>50%) of respondent preferences for broadleaved trees (55%), small woods (57%), trees of various heights (75%), mix of trees and open spaces (83%), randomly spaced trees (77%), and trees on hills (49%). Unfortunately robust WTP estimates could not be estimated for a number of the landscape configurations in this study, due to a lack of statistically significant coefficient values. The study indicated that respondents suffered a loss of welfare associated with certain forests in particular landscapes (e.g. broadleaves in mountain landscapes). Of the two models used to analyse the data (the most preferred alternative (MPA), and the rank model) only broadleaves in the urban fringe provided positive and statistically significant benefits according to the MPA model. All other landscape benefits of forests (plateaux conifer, mountain conifer, rolling hill conifer, rolling hill broadleaf) were not statistically significant. The study estimated that urban fringe households were willing to pay £268.79p per year (2002 prices) for a woodland view from their home. More landscape configurations were statistically significant in the rank model; but estimated WTP in the rank model was much higher than in the MPA model (almost twice the value). However, the ranks model estimated that people would be willing to pay around £123 for views of conifers in a hilly/rolling landscape. Since Moray is dominated by conifers rather than broadleaves, this latter value was therefore adopted used to impute the landscape value of Moray woodland.

It was estimated using GIS that 57,341 people live within 0.5 km of woodland, whilst 67,633 people live within 1 km of woodland. The population of Moray was 86,940 at the 2001 Population Census, so a high proportion of people live near to woodland or are likely to have a view of woodland. The number of households recorded in Moray in the 2001 Census was 35,803, indicating that each household contained on average 2.43 people. This suggests that 23,597 households are located within 0.5 km of woodland and 27,833 within 1 km of woodland. It is not possible without an extremely time consuming application of GIS to determine whether all of these households have a view of woodland. But HPM studies have shown that properties within 500 metres of broadleaf woodland attract substantial house price premiums (see Powe *et al*, 1995), and broadleaved woodland is often planted in proximity to, or

within, urban areas. Thus it is not unreasonable to accept that households in close proximity to woodland, with or without views, will benefit from the woodland.

These estimates of household numbers and WTP per household (£123 per household per year) for a woodland view provide a landscape value of woodland in Moray of £2.90m per year (assuming only households within 0.5 km of a woodland benefit); or £3.42m per year (if all households within 1 km of a woodland benefit). The more conservative of these two estimates of the landscape value of woodland should probably be adopted: viz £2.90m per year.

The actual landscape value of Moray woodland will be higher than £2.902 million per year to the extent that people derive landscape benefits of woodland whilst travelling e.g. along the A96 through Elgin, or along the A941 through Dufftown and Rothes, etc. In addition, since the value of £123 per household per year was for views of conifers in hilly/rolling country, the proximity of some properties to broadleaved urban fringe woodland will generate higher WTP amounts.

A landscape value of £123 appears reasonable. At 3.5% it capitalises to £3,514. Since the average house price in Moray is currently £94,000, this represents 3.7% of the price of the house for a woodland view. This amount is consistent with HPM and other stated preference studies of the landscape value of woodland.

12 Annex III Biodiversity assessment

Table 12.1 Forests in Moray: summary of impacts on biodiversity.

Impact or output	Commentary and local detail	Evaluation	Potential
Afforestation replaces previous land use.	Loss and fragmentation of precursor habitats in unimproved farmland and moorland; modification of remnants as grass and dwarf-shrub rides. The rate of afforestation has been substantial in the past, but has now moderated.	Loss for semi-natural precursor habitats; gain if intensive agriculture is replaced.	Limited new afforestation.
Forests prevent land being used for intensive agriculture.	Considerable intensification of cropping on farmland has taken place since period of main afforestation. A significant, but unknown, proportion of plantation forests occupy land that would probably now be intensively farmed if it had not been afforested.	Forestry has mitigated agricultural impacts, but the extent of this is uncertain.	Limited well-sited afforestation can further mitigate agricultural impacts and build forest networks.
Afforestation modifies geomorphological processes.	Culbin Forest has stabilised dunes that were formerly mobile. Culriach Forest on the Spey floodplain replaced semi-natural communities and provided an incentive to arrest natural channel movement but natural processes have been resumed since plantation were removed from the floodplain.	Loss of natural process probably reflected in loss of specialist early-succession species.	Further problems not anticipated.
Lowers water tables through transpiration and drainage.	There must have been some drying of wet habitats in and close to forest, and this has probably reduced water table in former due slacks. Certainly, afforested peatlands have been dried out. Any effects would extend beyond the forest boundary. However, Moray's climate is relatively dry, plantations include minimal drainage, and even some coastal plantations suffer from waterlogging.	Loss, principally in upland mires.	Restoration of forest wetlands can reverse much of the damage.
Plantation forests develop as woodland habitats.	Most plantation forests in Moray have reached second and third rotations. Woodland species are usually well-established by the end of the first rotation, and continue to develop during subsequent rotations, and there is no reason to believe that Morey plantations depart from this general pattern.	Gain.	Continued gain.
Develop mature stands.	Moray plantations old enough to have developed into mature stands and some 26% of FCS stands have so far been earmarked for Continuous Cover treatments. Currently, some 22% (4396 ha) of all FCS conifer stands date from before 1950, together with a further 281 ha of broadleaves. This will add mature forest habitats to a region where such habitats were naturally widespread, but are now in short supply. Both group- and uniform shelterwood silvicultural systems have been adopted, and seed trees will be retained through subsequent rotations. However, progress in adapting stand structures to the new silvicultural system has been limited so far, and some commentators take the view that some stands have been over-thinned. FCS	Gain, but limited.	Substantial gains anticipated under current policies.

Impact or output	Commentary and local detail	Evaluation	Potential
	has also set aside 15% of stands to non-intervention, particularly within the riparian network.		
Provide substantial volumes of coarse woody debris in which decomposer species can be maintained.	Dead wood, both fallen and standing, is limited in timber-producing plantations, even though some is retained during most harvesting operations. There appears to be little provision for providing natural quantities of deadwood, even in a limited number of selected stands, though this should develop in non-intervention stands.	Limited gain	Further gains anticipated under current policies.
Context in which important sites can be protected.	Quarry Wood SSSI and Kellas Wood SSSI protected within forest. Relief from grazing; sheltered margins; wildlife populations buffered. Lower River Spey SSSI. Regeneration of alder woodland as plantations and exotic broadleaves are removed. Important SSSIs lie in private woodlands, such as Findhorn Glen and Darnaway Forest.	Gain.	Continued gain.
New semi-natural woodland develops within plantations.	Birch, beech and rowan commonly colonise plantation forests, and some are retained as fringes to planted compartments and as blocks of new native woodland. Scots pine has also been widely planted and is regenerating. In FCS forests, Scots pine dominates 40% of the stands, native broadleaves dominate a further 4.5%, and both figures are due to increase as non-native plantations on unsuitable ground are replaced.	Gain.	Continued gain as part of existing forest plans.
Develop new forest types.	Lichen-pine tundra woodland with a carpet of Cladonia and other lichens has developed in poorly-growing pine stands in Culbin forest	Gain.	Scope for high altitude scrub re-creation.
Habitat for important species.	Capercaillie, Red squirrel, Wildcat, Pine marten, Otter have colonised forests. Some characteristic native pinewood plants, such as Goodyera repens have also colonised.	Gain.	Further habitat maturing, diversification and linking through network should bring further gains.
Forest management usually creates habitat diversity.	As forests have become more mature, so the range of age-classes has widened. The large size of many forests allows large, and thus robust, populations of individual species to develop.	Gain.	
Open space habitats are maintained by management and shielded from agricultural impacts.	Ride grassland, heaths, wetlands, riparian habitats are maintained within a managed forest, where the forest shields them from lateral movement of fertilisers and herbicides, i.e., they remain free from the eutrophication effects of agriculture. Some heathland is being re-created on the margins for plantation forests, where it links well to heathland outside the forest fence. Likewise, there has been some wetland restoration within forests. However, there is considerably more scope for restoring wetlands within forests, especially in the uplands. Restoration of unwooded habitats in private woodland probably lags behind work in FCS properties.	Gain.	Considerable further gains are possible under present policies.

Impact or output	Commentary and local detail	Evaluation	Potential
Forests provide shelter for species that also use the land outside the forest boundary.	Forests diversify the fauna and flora of nearby farmland, but some of the species that use the forest are pests within farmland, e.g., deer.	Neutral; approximate balance between benefits and disadvantages.	
Protection for non-forest habitats.	The coastal forests probably provide additional protection for foreshore habitats and species by reducing disturbance	No change.	Continued protection
Downstream impacts on water quality.	Acidification of freshwaters with impacts on salmon and other fish. However, the Forestry Commission participates in Catchment Management Planning, and provides a basic standard safeguard through its Water Guidelines, which are also observed by private woodland owners.	Loss formerly, now substantially mitigated.	Complete mitigation anticipated.
Suitably placed forest land can shield watercourses from nutrient run-off from farmland.	Limited plantings have taken place with this in mind. However, whilst the need for nutrient buffering in agricultural land is recognised, little action has been taken to use trees as part of such buffers.	Small gains.	Large unrealised potential.
Downstream impacts on flow.	Some evidence that peak flows may increase due to accelerated run-off, combined with decreased low flows due to efficient drainage and transpiration. However, forest operations and drainage design are now aimed at stability of flow.	Loss but contribution due to forestry uncertain.	Some mitigation likely especially if riparian forests can be restored.
Downstream impacts on river structure.	Woody debris forms dams, which are said to act as barriers to migrant fish. However, debris dams enhance the energy base for aquatic food chains and diversify channel structure.	Gain, with alleged losses to commercial fishing.	River engineering requirements probably limit potential.
Forest boundaries potentially provide foci for biodiversity and species movement.	Forest boundaries are generally sharply defined. This may be inevitable at the border between forests and farmland, but there is unrealised potential for more gradual transitions in upland districts. In particular, forest-owning estates with high moorland have made little attempt to re-create high altitude scrub habitats.	Limited progress at forest boundaries.	Unrealised potential at boundaries with heath and moorland.
Networks of forest habitats provide resilient populations of wildlife species.	Moray has a substantial forest area, including extensive core forest areas that are reasonably well linked. There is, however, scope for improving the forest habitat network at medium scales, especially in association with protecting riparian habitats and watercourses from the impacts of farming.	Substantial gain.	Further improvement possible with targeted additions to forest area.