English Forestry Contribution to Rural Economies
Final Report

A report prepared by
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Consultants (PACEC)
on behalf of the Forestry Commission

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X1 Introduction

X1.1 This study has two primary and one secondary objectives

1. To assess the economic impact, in terms of gross output, net output and employment arising from forest establishment and management, and harvesting. This assessment includes both the direct economic impacts from these activities and indirect impacts arising from supplier linkages and induced consumption expenditure from income generated in these activities.
2. To determine the economic impact of downstream processing, including distribution and marketing of English produced timber, again capturing the direct, indirect and induced impacts. The input-output linkages are quantified for each stage, from the initial production to final consumption. Multipliers for each stage are estimated at the local and English level, capturing the direct, indirect and induced effects.
3. To examine the potential impact of five alternative scenarios:
   (a) Removal of the forestry sector in England.
   (b) A 50% increase in English timber harvesting.
   (c) Substitution of English timber for imported timber.
   (d) Removal of grant aid from English forestry.
   (e) A doubled labour productivity in forestry activities.

X1.2 This study investigates the linkages between all aspects of economic activity reliant on forestry production and processing in England. The output of this investigation is the quantification of forestry's contribution in terms of net output, gross output and employment to both the national and rural economies. Recreational activities have been excluded from this assessment and will be the object of another study.

X2 Methodology and survey approach

X2.1 Economic impacts are distinguished for England, local economies and rural areas. "Local" is here defined as 20 miles radius from the main place of work (the forest). The rest of England was split up between "rural" and "urban", where rural was defined as any settlements under 10,000 inhabitants.

X2.2 One novelty of this research project lies in the fact that economic linkages are assessed separately for each type of forestry activities, that is to say "**establishment**", "**maintenance**", and "**harvesting**". The economic impact and multiplier analysis was also carried out for **timber processing** which includes sawmilling, wood based panels, and pulp, paper and paperboard.

X2.3 The analysis was also undertaken for the forestry industry as a whole and for the following four forest types:

(a) **Productive High Forest:** Include conifer and broadleaf productive woodlands. Exclude coppice and other minority activities. Forests managed by FE are included into this category.

(b) **Traditional Estate:** Large privately owned farm and/or woodland consisting of a mixture of wood types. May have included a sawmill and a designated labour force.

(c) **Small Farm Woodland:** Woodland under 10 ha., or for which the owner receives or has received Farm Woodland Premium Supplement scheme. If greater than 10 ha include in Productive High Forest.

(d) **Community Forest:** Woodland for which the owner receives or has received Management Grant for Access or/and Community Woodland Supplement.

X2.4 Data to estimate the input-output linkages through the supply chain were collected through a company survey. Private owners and Forest Enterprise, management companies, contractors, and processing companies were sent a postal questionnaire and interviewed face-to-face. Data collection from their suppliers was undertaken by telephone.

X2.5 Key information gathered was primarily quantitative. The postal questionnaire focused on employment, financial details, activities, and breakdown of purchases. The follow-up questionnaire was used to obtain more qualitative information on timber sales and purchases, and business trends and future plans.

X3 Key findings from the multiplier and impact analysis

X3.1 A multiplier is a parameter expressing the ratio of the total impacts (employment, net output, gross output) to the direct impacts. For example,

with an employment multiplier of two for England, if there are 1,000 direct jobs in Industry A, the total effects (i.e. direct, indirect and induced) of Industry A on employment are 2,000 jobs. In the event of the creation of another 100 jobs in Industry A, the total effect on employment would be an additional 200 jobs in England.

X3.2 The total **gross output** generated by the forestry and processing industries in England amounts to £2,939 million, 37% of which is attributable directly to the forestry and processing activities (£1,085 million). The rest is indirect and induced. The total gross output multiplier is 2.71.

X3.3 Direct estimated forestry and processing **net output** amounts to £380 million. The net output multiplier is 2.63, meaning a total net output of £1,000 million.

X3.4 The total number of **jobs** (FTEs) supported by the forestry and processing activities in England is estimated to be 34,100, 84% more than the number of jobs attributable directly to the forestry and processing sectors (18,500). The total employment multiplier is 1.84.

X3.5 94% of the direct employment impact (equal to 17,500) falls within the local area as defined. The **local employment multiplier** (1.36), and the rural + local employment multiplier (1.43) are much lower than the total (i.e. England) employment multiplier (1.84).

X3.6 The estimated **employment multipliers for processing** are much greater than for forestry (respective multipliers of 2.49 and 1.40). The net output and gross output multipliers for processing are also much greater than those for forestry.

X3.7 Amongst forestry activities, **harvesting** accounts for a large proportion of direct jobs, 5,200 compared with 3,600 in maintenance and 2,200 in establishment. It also generates larger employment multiplier effects than the other two forestry activities with a multiplier of 1.49 compared with 1.29 for maintenance and 1.38 for establishment.

X3.8 Within the different **forest types**, productive and traditional estate forests account for the majority of jobs generated direct (respectively 4,600 and 3,400) compared with 1,800 and 1,200 in small farm and community woodlands. The employment multiplier effects are also greater in the former two. Moreover, the employment multiplier for **softwood** is significantly higher than for hardwood, 2.63 and 1.38 respectively.

X4 Timber impact simulations

X4.1 The importance of the forestry and processing industries is demonstrated through a series of simulations. These simulations are based on different assumptions which set a framework in which the economic significance of English forestry and downstream activities can be gauged. These assumptions are not necessarily representative of the foreseeable picture of the forestry and processing industries.

X4.2 The **removal of all forestry activities** would impact quite dramatically on the English economy since, besides the loss of direct employment, gross output and net output effects for forestry, some processing activities are partially dependent on the supply of domestic (i.e. English) timber. The total impacts of such a removal amount to 16,500 jobs lost, a decrease of £914 million in gross output and a total English net output diminished by £400 million.

X4.3 **A 50% increase in English timber harvesting** would add to the English economy another 3,900 jobs, a £270 million supplementary gross output and an extra £103 million net output.

X4.4 **Substituting English timber for imported timber** would also positively impact on the forestry and processing industries in the English economy. For a 20% substitution level, an additional 1,500 jobs would be created, an extra £108 million gross output generated, and an additional £41 million net output produced. The higher the substitution level, the higher the benefits.

X4.5 In order to measure **value to grant-aid**, its removal to private woodland owners and farmers was assumed and it would result in an immediate loss of 900 jobs in the establishment sector. The total effects on the wider economy

is much greater: 1,300 jobs lost, £59 million gross output lost, and a £28 million decline in net output. Longer-term effects of this removal would be very significant because of the impact on timber harvesting.

X4.6 Finally, **a doubled labour productivity in forestry activities** would result in some 5,500 jobs being lost in the sector, with another 2,100 jobs lost as a result of induced and indirect effects. This rise in labour productivity would also result in an increase in volume of timber harvested, leading to jobs creation (1,500 jobs for a 20% increase), to additional gross and net outputs.

1. INTRODUCTION

1.1. Objectives of the study

1.1.1. Public And Corporate Economic Consultants (PACEC) have been commissioned by the Forestry Commission to undertake a study investigating the linkages between all aspects of economic activity reliant on forestry production and processing in England. The aim of this study is to quantify forestry's contribution in terms of net output, gross output and employment to both the national and rural economies. Recreational activities have been excluded from this assessment and will be the object of another study.

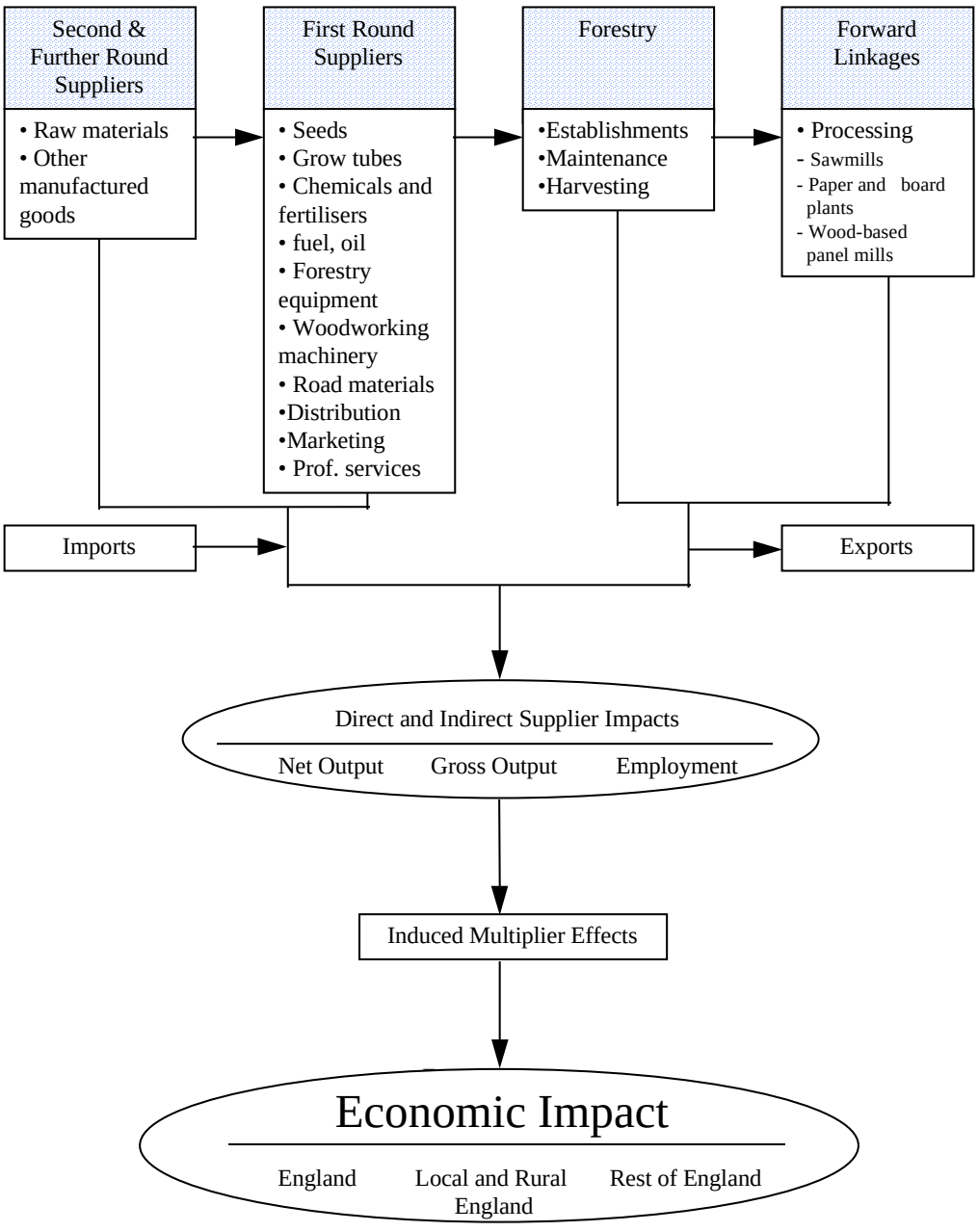
1.1.2. The study has two primary objectives and one secondary objective:

1. To assess the economic impact, in terms of gross output, net output and employment arising from forest establishment and management, and harvesting. This assessment includes both the direct economic impacts from these activities and indirect impacts arising from supplier linkages and induced consumption expenditure from income generated in these activities.
2. To determine the economic impact of downstream processing, including distribution and marketing of English produced timber, again capturing the direct, indirect and induced impacts. The input-output linkages are quantified for each stage, from the initial production to final consumption. Multipliers for each stage are estimated at the local and English level, capturing the direct and indirect effects.
3. To examine the potential impact of five alternative scenarios:
   (a) Removal of the forestry sector in England.
   (b) A 50% increase in English timber harvesting.
   (c) Substitution of English timber for imported timber.
   (d) Removal of grant aid from English forestry.
   (e) A doubled labour productivity in forestry activities.

1.2. Framework of the research

1.2.1. The overall framework within which the empirical research was undertaken is shown in Figure 1.1.

Figure 1.1 Outline framework for analysing the economic impact of forestry



Source: PACEC, 1999

1.2.2. The first row of Figure 1.1 shows backward and forward linkages in the supply chain of the forestry industry. Thus the forestry industry purchases from first round suppliers inputs which are directly relevant to forestry activities and these first round suppliers purchase their inputs from second round suppliers and so on. Thus column two in Figure 1.1. shows selected inputs into forestry and column one shows inputs into first round suppliers. In addition forward linkages of forestry outputs into processing, distribution and marketing are shown in column four. The bottom half of Figure 1.1 shows economic impacts derived from the spending of wages and profits from economic activity in forestry, suppliers and processing etc. The overall impacts are derived from combining the direct, indirect supplier impacts and spending impacts.

1.3. Structure of the report

1.3.1. The rest of the report is as follows: Chapter 2 sets up the context of the English forestry sector. Chapter 3 focuses on the approach and methodology used for the study. Chapter 4 examines the findings of the survey in terms of net output, gross output and employment broken down by forest types and activities for the forestry sector, highlights the results of the research for the downstream activities and concentrates on overall multiplier outcomes. Chapter 5 develops timber impact simulations. Finally, Chapter 6 draws conclusions from this study.

2. CONTEXT: THE ENGLISH FORESTRY SECTOR

2.1. Introduction

2.1.1. This chapter briefly presents the context for the study by describing developments in the forestry industry in England. It focuses on the different outputs of the industry, changes in employment and its main characteristics, and summarises the major governmental policies that are in place at the present moment.

2.2. The nature of the forestry industry in England

The structure of the industry

2.2.1. Since the end of First World War and after centuries of forest clearance, government policies have been encouraging new planting from both the public and the private sectors. The proportion of land under forestry has doubled in Great Britain within this century (see Table 2.1). However, this increase in forested land area has been uneven, with England witnessing a slower, though still significant, rise over the period. In 1998, forest represented 7.6% of English land area, amounting to some 990,000 hectares. The tree cover is expected to continue to grow for the two next decades (Forestry Commission, 1998).

Table 2.1 Land area under forestry, 1921 to 1998

	England	GB
1924	5.1%	5.3%
1947	5.8%	6.1%
1965	6.8%	7.7%
1980	7.3%	9.3%
1998	7.6%	10.7%

Source: Forestry Industry Council, 1998

2.2.2. Forest ownership in Britain is divided between the Forestry Commission (which manages most State woodlands) and "private owners". In England, the

majority (i.e. 77.9% in 1998) of woodlands is owned by the private sector (See Table 2.2.). The private sector encompasses a wide spectrum of ownership from farmers, small woodland owners, integrated farms, Local Authorities, voluntary organisations to larger estates and investors. If 22.1% of total woodlands are owned and managed by the state, this proportion, however, tends to diminish in favour of private ownership. Just looking at high forest and coppice between 1978 and 1998, area owned by the private sector grew by 42.9% while state-owned forest area decreased by 18.9%. This changing ownership pattern is likely to be reflected into the ownership of the other woodlands as well, although no figures are available.

Table 2.2 Land area under forest, England (thousand hectares), 1978 and 1998

	High Forest and Coppice		Other	Total
	Conifer	Broadleaves incl. Coppice	woodlands*	
March 1978				
Forestry Commission	209	40	2	251
Private woodlands	195	283	171	641
Total	404	323	173	900
March 1998				
Forestry Commission	167	35	17	219
Private woodlands	216	467	88	771
Total	383	502	105	990

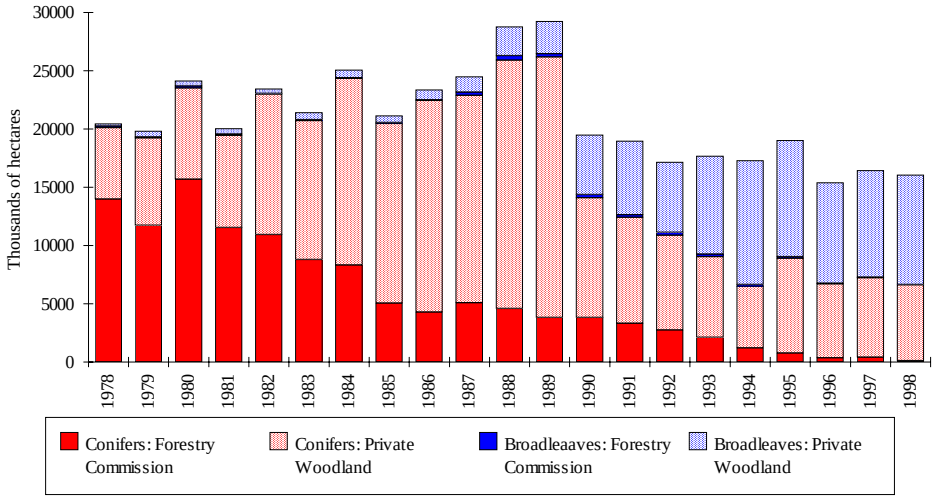
* Woodlands not primarily managed for timber

Source: Forestry Commission, 1999

2.2.3. Figure 2.1 shows that total new planting (excluding restocking) in England decreased by 21.5% between 1978 and 1998. However, both the rates and composition of new planting have varied by ownership in the two decades since 1978. Planting of Forestry Commission has been decreasing steadily since the early 1980's, while new planting by private owners has been growing driven by tax concessions and planting grants. There has been a steady decline in conifer planting over the last 10 years, both as a result of reduced Forest Enterprise new planting and because of declining land availability (Forestry Commission Annual Report and Accounts, 1995/6). New planting is today also more evenly split between broadleaves and conifers. Rates of new

planting have also varied with political and economic circumstances, for example there was a particularly sharp decline in planting by private owners in the decline of the late 1980s. Also, 1988 saw forestry withdraw from income tax net.

Figure 2.1 New planting* of conifers and broadleaves in GB, by the Forestry Commission and private owners, 1978-1998**



* excluding restocking,
** grant aided only,
Source: Forestry Industry Council, 1998

Table 2.3 Total area of woodlands, 1998 (thousands hectares)

	High Forest			Total	Other	Total
	Conifers	Broadleaves	Coppice	productive		
England	383	483	19	885	105	990
Wales	167	67	1	234	13	247
Scotland	989	120	0	1,109	93	1,202
GB	1,539	670	20	2,229	211	2,439

Source: Forestry Commission, Facts and Figures, 1998

2.2.4. English woodlands accounts for 40% of the British total and broadleaved forests are more predominant than in Scotland and Wales (see Table 2.3). 56% of all English high forests are broadleaves, partly due to the English inheritance and climate. 93% of these broadleaved forests were in private ownership in 1998 (See Table 2.2). Coniferous forests represented 38.7% of forest area in England in 1998. It is noteworthy that woodlands not primarily

managed for timber, i.e. recreational woodlands, conservation and amenities (classified as Other in Tables 2.2 and 2.3) represented 10% of English forest area in 1998.

Employment supported forestry and processing activities

2.2.5. Woodlands may be managed for timber, though it may not be the only purpose. Therefore, forestry is an important economic sector. Results from the latest employment survey by the Forestry Commission (1993-94) show that total direct employment in forestry and primary wood processing accounted for 34,820 in Great Britain, 55.7% of them being in England (See Table 2.4.). Though the English forest land area is not as large as in Scotland, the country remains the major employment centre for forestry and primary wood processing. This could be explained by the atomised nature of ownership itself in England, and a lower productivity per hectare, in contrast to the larger estates in Scotland and the consequent economies of scale in timber production.

2.2.6. The main employers in England are the private estate owners, followed by the wood processing companies (sawmills, pulp and paper mills, board panel plants). Employment by the Forestry Commission must be considered carefully since research and administrative employment is included in the figures presented in Tables 2.4 and 2.5. Finally, timber harvesting companies employed 11% of the total English forest- and wood-related workforce while forest management companies played only a minor role as far as employment is concerned (See Table2.4.).

Table 2.4 Employment in forestry and primary wood processing in England, Scotland and Wales, 1993-94

	England	Wales	Scotland	GB
Forestry Commission*	2,570	1,270	2,810	6,650
Private Estate Owners	7,525	1,100	2,125	10,750
Forest Management Cos	735	125	1,050	1,910
Timber Harvesting Cos	2,135	515	1,645	4,295
Wood Processing Cos	6,445	1,740	3,030	11,215
Total	19,410	4,750	10,660	34,820

*All of Forestry Commission
Source: Forestry Commission Employment Survey, 1995

Table 2.5 Employment in forestry and primary wood processing in England, Scotland and Wales, 1993-94, %s

	England	Wales	Scotland	GB
Forestry Commission*	13	27	26	19
Private Estate Owners	39	23	20	31
Forest Management Cos	4	3	10	6
Timber Harvesting Cos	11	11	15	12
Wood Processing Cos	33	36	29	32
Total	100	100	100	100
Employment per country	55.74	13.64	30.61	100

*All of Forestry Commission
Source: Forestry Commission Employment Survey, 1995

2.2.7. Turning now to the employment distribution by activity (See Table 2.6.), the single most important activity is processing which accounts for 39% of employment. The activities of forest maintenance, and harvesting and extraction are also significant providers of employment accounting for 22% of total employment.

Table 2.6 Employment by activity in forestry and timber processing, 1993-94

	England	% of total English forestry and processing employment	GB
Forest nurseries	380	2	580
Establishment	1,790	9	2,770
Maintenance	2,530	13	3,725
Harvesting / extraction	4,220	22	9,290
Road construction	285	1	630
Other forest	1,200	6	1,735
Forest total	10,405	-	18,730
Haulage of timber	325	2	985
Processing	7,555	39	12,315
Other non-forest	1,125	6	2,790
Non-forest total	9,005	-	16,090
Total	19,410	100	34,820

Source: Forestry Commission, Forest Employment Survey 1993-94

2.2.8. Evidence on employment trends in the forestry sector is provided by Forestry Commission surveys. Table 2.7 shows that over the period from 1988/9 to 1993/4 total employment in the sector declined by about 8%, however there are important differences in the behaviour of employment across the different types of companies making up the sector. Employment in wood processing industries increased by 12% (+700 jobs) and by comparison the numbers employed by private estate owners decreased by 30% (-3,200 jobs). When analysed by activity harvesting together with processing shows a loss of 12% (-1,600 jobs) and establishment / maintenance shows an increase of 24% (+900 jobs).

Table 2.7 Employment change in forestry and timber processing in England, 1988/89 to 1993/94

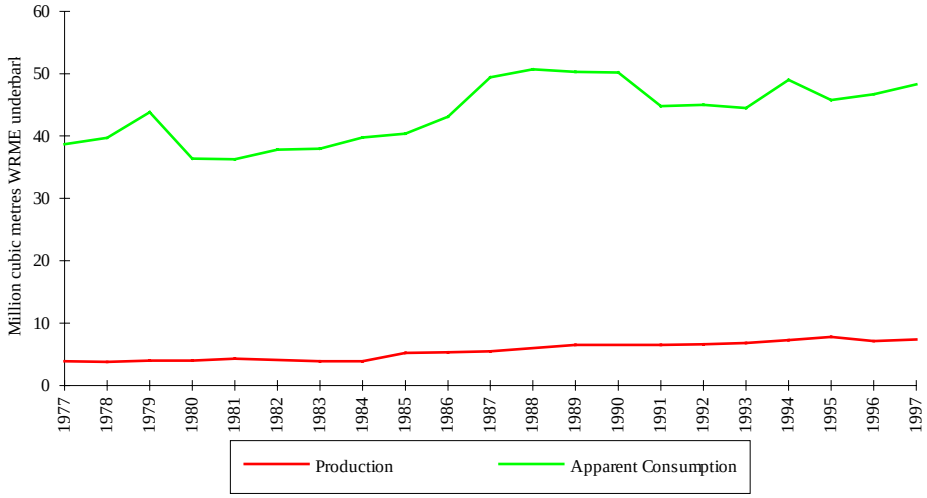
By Sector	1988/89	% share of Employment 1988/89	1993/94	% share of Employment 1993/94
Forestry Commission	2.7 (100)	13%	2.6 (93)	13%
Private Estate Owners	10.7 (100)	51%	7.5 (70)	39%
Forest Management Cos	0.7 (100)	3%	0.7 (100)	4%
Timber Harvesting Cos	1.2 (100)	6%	2.1 (175)	11%
Wood Processing industries.	5.7 (100)	27%	6.4 (112)	33%
Total	21 (100)	100%	19.4 (92)	100%
By Activity				
Establishment/Maintenance	3.8 (100)	18%	4.7 (124)	24%
Other Forest	1.0 (100)	5%	1.5 (150)	8%
Harvesting/Processing	13.7 (100)	65%	12.1 (88)	62%
Office	2.5 (100)	12%	1.1 (44)	6%
Total	21.0 (100)	100%	19.4 (92)	100%

Source: Forestry Commission, PACEC

The demand and supply of timber

2.2.9. Traditionally the United Kingdom has satisfied its demand for timber largely through imports and Figure 2.3 shows the relative importance of imports and exports of wood and wood products. Some timber is exported but it is relatively small by comparison with consumption. Nevertheless, UK production has grown more rapidly in percentage terms than consumption since the mid-1980s, as shown in Figure 2.2. British based processing has grown significantly by virtue of a domestic capacity investments programme averaging £100 million a year since 1980. Given the modest growth of exports it is apparent that the UK is slowly becoming relatively less dependent on imports for wood and wood products.

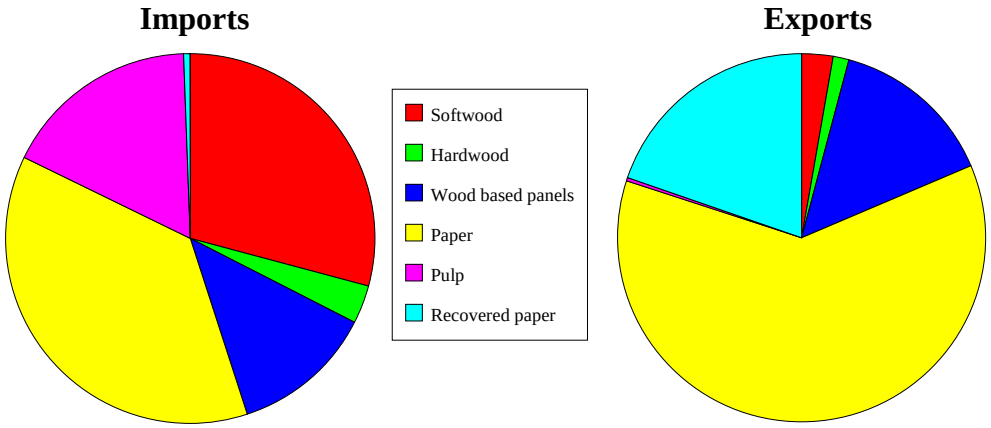
Figure 2.2 Production and apparent consumption of wood and wood products in the UK, 1977/97



Source: UK Overseas Trade Statistics and conversion factors

2.2.10. The composition of imports and exports of wood and wood products is shown in Figure 2.3. Pulp and paper, as well as softwood, account for a significant proportion of imports. On the export side paper is the dominant product. Figure 2.4 shows the volume of imports and exports of wood and wood products and its evolution over time. Imports volume outweighs exports volume as can be gauged by the difference shown in Figure 2.4. An other pattern is that during the 1990's, imports tended to grow at a slightly faster pace that exports.

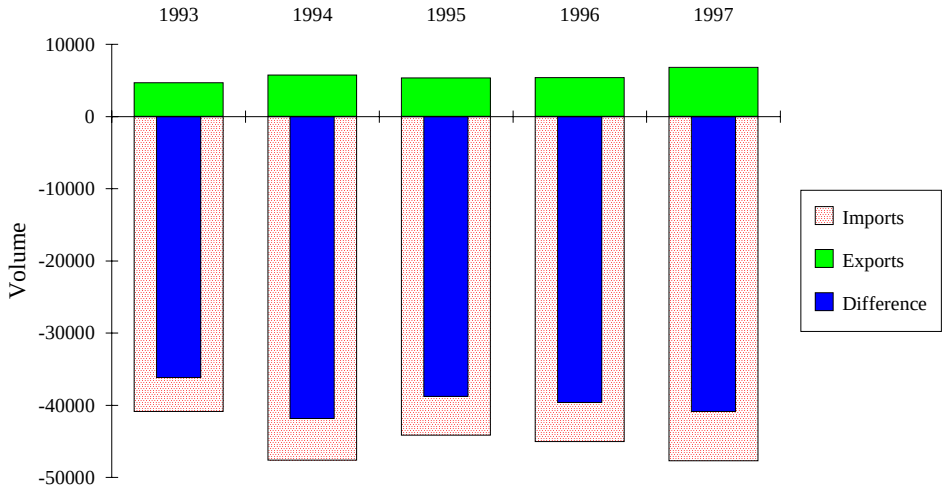
Figure 2.3 Breakdown of exported and imported wood and wood products from and to the UK by volume, 1997



Volume: Thousand cubic metres WRME underbark

Source: UK Overseas Trade Statistics and conversion factors

Figure 2.4 Balance of exported and imported wood and wood products from and to the UK, 1993-1997



Volume: Thousand cubic metres WRME underbark

Source: UK Overseas Trade Statistics and conversion factors

2.3. Governmental policies: Incentives to new planting and existing forest management

2.3.1. Forest and woodlands offer multiple benefits to the community. Besides the environmental and social benefits, they help meet our growing demand for

wood. They also provide jobs and economic benefits. The State, through the Forestry Commission, the Government department responsible for forestry in Great Britain, has therefore continuously encouraged new planting and forest management since 1919. Support to forestry has been continuous, but policy objectives have changed over that time, the emphasis being more and more on the social and environmental considerations. At the present time, the Government offers two national grant schemes, both of which are part funded by the European Community. The Woodland Grant Scheme (WGS) offers grants towards the costs of establishing and maintaining woodlands, and the Farm Woodland Premium Scheme (FWPS) offers annual payments to compensate for agricultural income forgone. These schemes are described below.

Woodland Grant Scheme (WGS)

2.3.2. After a period during which economic interests dominated, a new WGS was set up in 1988 (when forestry was taken out of the income tax net), trying to combine the traditionally opposing interests of conservation and commerce in forests and this grew to the present aim of sustainable forestry development. The major objective of this scheme is now to encourage the creation and development of multi-purpose forestry. Its aims are:

- to encourage the creation of new woodlands and forests to
  - increase the production of wood;
  - improve the landscape;
  - provide new habitats for wildlife;
  - offer opportunities for recreation and sport;
- to encourage good management of forests and woodlands, including their well timed regeneration, particularly looking after the needs of ancient and semi-natural woodlands;
- to provide jobs and improve the economy of rural areas and other areas with few other sources of economy activity;
- to provide a use for land instead of agriculture.

Farm Woodland Premium Scheme (FWPS)

2.3.3. The FWPS is open to farmers who run an agricultural business that includes the land to be converted to woodland. This premium can supplement the Woodland Grant, the same standards applying. In July 1995 a new EC Council regulation came into force which allows farmers to count arable entered into the WGS and the FWPS towards their set-aside obligations. This new regulation, part of the Common Agricultural Policy Reform, has its rationale in the recognition of surplus agricultural production and is a way of encouraging new planting on improved agricultural land.

2.3.4. These two schemes favour the development of multi-purpose forests and woodlands, where economic interests go hand in hand with environmental and social considerations. This change in priority in forestry policy has had severe implications for the type, nature and location of current planting in England. Broadleaves forests have been more strongly promoted, as have been community forests, based near towns and cities, in order to make them more easily accessible to most people. Recreational and environmental activities in the forests have been developed, besides to more traditional forestry activities.

2.4. Devolution and its implication for English forestry

2.4.1. Following the recent devolution wave that has changed the political picture of Britain and its countries, the Government policies on forestry are now set up and implemented at the country level. The England Forestry Strategy (EFS) set up an integrated approach focusing on four areas of priority:

1. Rural development: woodlands for timber to strengthen local economies;
2. Economic regeneration: woodlands to re-clothe industrial dereliction;
3. Recreation, access and tourism; and
4. Environment and conservation.

2.4.2. The Government's approach to sustainable forestry is underpinned by the 1998 UK Forestry Standard. The aim of the EFS is to promote benefits for the society in social, environmental and economic terms. (For further details,

please see "England Forestry Strategy, A New Focus for England's Woodlands").

3. EMPIRICAL METHODOLOGY AND SURVEY APPROACH

3.1. Introduction

3.1.1. The programme of empirical work for determining the economic impact of forestry in England involved four inter-related stages of research. The four stages are:

Stage 1 Defining the measures of economic impact, the geographical areas to be used in the analysis, the forestry activities to be distinguished and the types of woodland.

Stage 2 Identifying the relevant data sources for establishing the sampling frame, selecting the sample and estimating relevant "population" totals for purposes of "grossing up" sample based estimates of specific impact measures.

Stage 3 Undertaking a survey of forestry establishments, suppliers and timber processors.

Stage 4 Estimation of economic impact and multipliers.

This chapter presents information relating to Stages 1, 2 and 3 and the analysis of economic impacts and multipliers (Stage 4) is presented in Chapter 4.

3.2. Stage 1: Definitions and measures

Measures of impact

3.2.1. Three main measures are used to assess the economic impact of forestry:

(a) Gross Output: The gross output of the forestry sector is calculated from staff costs plus purchases, plus pre-tax profits. Staff costs include wages, salaries, overtime, bonuses, commission, employers NI

and pension contributions, and directors' remuneration. Pre-tax profits excludes directors remuneration.

(b) Net Output: This is the contribution of forestry to GDP. The GDP of forestry is calculated by the addition of staff costs and pre-tax profits.

(c) Employment: All employment figures is measured in full time equivalents (FTEs). Employment includes directors, proprietors and the self employed and is measured at the place of work.

Geography

3.2.2. An important objective of the research is to assess the economic impact and size of multipliers at different spatial levels of economic activity and in particular to distinguish local and national impacts. This raises the difficult question of defining what is meant by a "local" area. One approach is to define a functional local economic area in terms of travel-to-work patterns to capture a high proportion of the local employment impact of forestry activity. Although this clearly has some merits it suffers from the problem that survey respondents find it difficult to relate to the concept when completing the questionnaire. A second issue concerns the distinction between rural and urban areas for which impact assessments are required where again a number of possible distinguishing criteria could be used. The geographical definitions used here are:

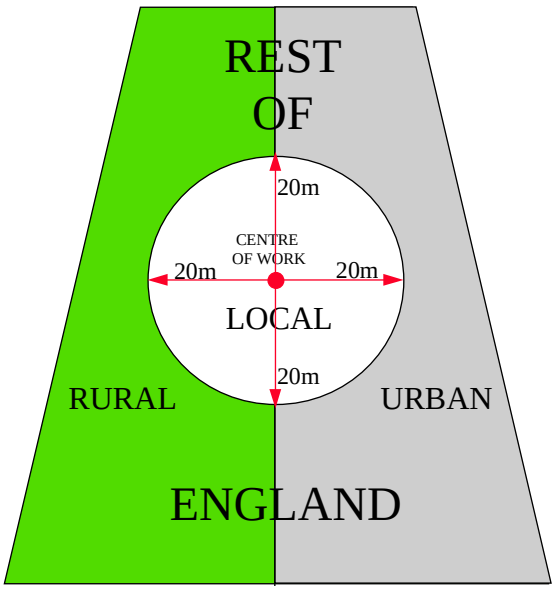
(a) Local: Local is defined as the 20 miles radius from the centre of the forest / plant / sawmill**.**

(b) Rural/Urban: Where possible, it will be attempted to provide this distinction. "Rest of England" is divided into two categories: "rural" and "urban". "Rural" is defined as a town or city with a population of less than 50,000. In contrast, "Urban" is a city / town of more than 50,000 people.

(c) National: Total England, ie rural plus urban England

The geographical delineation of the areas selected for impact analysis is shown in Figure 2.1 below. Local may be either rural or urban, or both, and non-local areas are divided between rural and urban.

Figure 2.1 Split-up between Local, and Rest of England Urban / Rural



Source: PACEC, 1999

Activities

3.2.3. Previous research (e.g. McGregor and McNicoll, 1992) focused very much on establishing the economic impact of forestry as a whole and a novel aspect of the current research was to assess the impact of forestry by selected forestry activities. Thus the economic impact and multiplier analysis is carried out not only for the **forestry sector** as a whole but also separately for each of the following activities:

(a) **Establishment:** Year 0-10 Includes nurseries and replanting

(b) **Maintenance:** Year 10 - maturity

(c) **Harvesting:** Includes thinning

It should be recognised that the sectors shown may include an associated forest management element, a marketing element, distribution costs and road construction.

3.2.4. The economic impact and multiplier analysis is also carried out for **timber processing** (including the processing of imported and Scottish and Welsh timber). The management, marketing, haulage and distribution involved in these activities is included within each category. The analysis is undertaken for the three sectors which comprise timber processing:

(a) **Sawmilling** SIC (1992) 20.1

(b) **Pulp, paper and paperboard** SIC (1992) 21.1

(c) **Wood based panels** (particle board and fibreboard) SIC (1992) 20.2

Forest types

3.2.5. Four forest types are identified:

(a) **Productive High Forest**: Include conifer and broadleaf productive woodlands. Exclude coppice and other minority activities. Forests managed by FE are included into this category.

(b) **Traditional Estate**: Large privately owned farm and/or woodland consisting of a mixture of wood types. May have included a sawmill and a designated labour force. Include sporting activities undertaken on the estate.

(c) **Small Farm Woodland**: Woodland under 10Ha., or woodland for which the owner receives or has received Farm Woodland Premium Supplement. If greater than 10Ha, then included in Productive High Forest.

(d) **Community Forest**: Woodland for which the owner receives or has received Management Grant for Access or/and Community Woodland Supplement.

3.2.6. The analysis is carried out for the whole of the forestry industry for each of the above types of forest. However, where possible a breakdown by activity is also applied (establishment, maintenance and harvesting). The processing sector is categorised by type of processing activity where possible (sawmilling; pulp, paper and paperboard; wood based panels), and by either softwood or hardwood.

3.3. Stage 2: Data sources, the sampling frame and grossing up

Sampling frame

3.3.1. There are several data sources that can be used to establish a reasonably comprehensive population of firms, other organisations and individuals which make up the forestry industry, and to provide the sampling frame from which

the company sample may be selected. The main categories for which such data are available include:

(a) Private owners and the Forestry Commission and their employees *(Only FE employees taken into account, excluding Forest Holiday and Forest Units).*

(b) Management companies who are contracted by some owners to manage forests.

(c) Sub-contractors: both companies and self-employed who are contracted by owners and management companies to undertake establishment, maintenance, harvesting, forest management, road maintenance, and/or haulage. Additionally sub contractors may be involved in more than one activity and may undertake some sawmilling. It may be that an individual may operate both as a self employed individual working directly for one owner and via a sub contractor for another and in selecting the sample care was taken to avoid double entry into the sampling frame.

(d) Processing companies: Sawmills, Paper mills and Panels and board plants that process English and foreign timber, including from the rest of the UK.

Grossing up and the population data for forestry activities

3.3.2. To gross up the sample base estimates of economic impacts for different geographical areas, forestry activities and types of forest, it is necessary to have independent estimates of the total economic activity associated with forestry and timber processing. The most reliable measure for this purpose is employment, and specifically the estimates provided by the Forestry Commission. Employment data are given for the key categories of establishment, maintenance, harvesting and processing but it is necessary to allocate employment data given for other forestry activities namely: nurseries; construction; other forest; haulage; processing; and other non-forest (including mainly office related employees) These are allocated using the following rules:

- Nursery jobs are allocated to establishment.
- Haulage jobs are allocated to harvesting.
- Other forest jobs are divided into two categories:
  (a) Jobs which cannot be broken down by activities but are related to them are allocated, pro-rata, to establishment, maintenance, and harvesting.

(b) Jobs related to recreational activities, wildlife conservation and environmental work are excluded from calculations and analyses. However, for sampling purposes, as they cannot be computed, they are allocated pro-rata to the three forestry activities in the tables below.

- Construction jobs are allocated, pro-rata, to establishment, maintenance and harvesting.
- Other non-forest jobs are allocated, pro-rata, to establishment, maintenance, harvesting and processing.

The FC, in its employment survey (1993/94), divides employment into direct employees and contractors and within these two categories into FC, other owners, management, harvesting and processing companies. They have been modified as follows:

- Within the FC, only Forest Enterprise employment (except Forest Holidays) is taken into account.
- FE, owner, management company and processing company categories include direct employment only (excluding contractors).
- The contractor category includes all contractor employment and all direct harvesting company employment.

3.3.3. Employment data for England by type of company (FE, Owner, Management, Harvesting, processing) by type of activity (Establishment, Maintenance, Harvesting, Processing) from the 1988/89 and 1993/94 surveys was obtained from the Forestry Yearbook.

Table 2.1 Employment by forestry activity for England, 1988/89

Activity	Total	FE	Own	ManCo	Harv	Proc
Establishment	3,022	482	1,749	136	656	0
Maintenance	1,153	182	841	21	109	0
Harvesting	6,571	686	2,117	43	3,725	0
Processing	7,623	0	1,723	0	230	5,670
Total	18,370	1,350	6,430	200	4,720	5,670

Source: Forestry Commission, PACEC

Table 2.2 Employment by forestry activity for England, 1993/94

Activity	Total	FE	Own	ManCo	Harv	Proc
Establishment	2,364	221	1,077	113	953	0
Maintenance	2,745	250	1,647	53	795	0
Harvesting	4,830	404	903	30	3,493	0
Processing	7,921	0	1,077	15	384	6,445
Total	17,860	875	4,705	210	5,625	6,445

Source: Forestry Commission, PACEC

3.3.4. Employment data for England by type of company by type of activity is estimated for 1997/98 by using arithmetic progression for those cells in which employment rose between 88/89 and 93/94, and geometric progression for those cells in which it fell.

Table 2.3 Employment by forestry activity for England, 1997/98

Activity	Total	FE	Own	ManCo	Harv	Proc
Establishment	2,095	130	866	98	1,001	0
Maintenance	3,686	303	2,278	78	1,028	0
Harvesting	4,614	288	605	22	3,699	0
Processing	8,210	0	716	28	401	7,065
Total	18,605	721	4,464	225	6,129	7,065

Source: Forestry Commission, PACEC

3.3.5. Annual employment survey data for England for 89/93/97 from NOMIS was used to check whether this was reasonable. During this period there was great volatility in the NOMIS data (5700 - 4200 - 6200), and there was no evidence to cause us to change the estimates based on the Forestry Commission data (18400 - 17900 -18600).

Sample selection

3.3.6. The target sample for forestry and its distribution across different types of organisations is shown in Table 2.4. Data were collected for the year 1997/98.

Table 3.4 Overall target sample for forestry and timber processing

Activity	Proportion of non-FE			Sample	
	Contacts	Employment	Average	Total	Face to face
FE				**11**	4
Owners	55%	30%	42%	**67**	19
Management cos	5%	1%	3%	**5**	2
Contractors	28%	33%	30%	**48**	14
Processor cos	13%	36%	25%	**39**	11
Total	100%	100%	100%	**170**	50

Source: PACEC, 1999

3.3.7. The detailed target sample for forestry and timber processing is shown in Table 2.5. The survey data are for the accounting year nearest to 1997/98.

Table 3.5 Target sample for timber processing

Activity	Establishments	Sample
Sawmill	72	21
Pulp / paper	44	13
Panels	5	5
Total	118	39

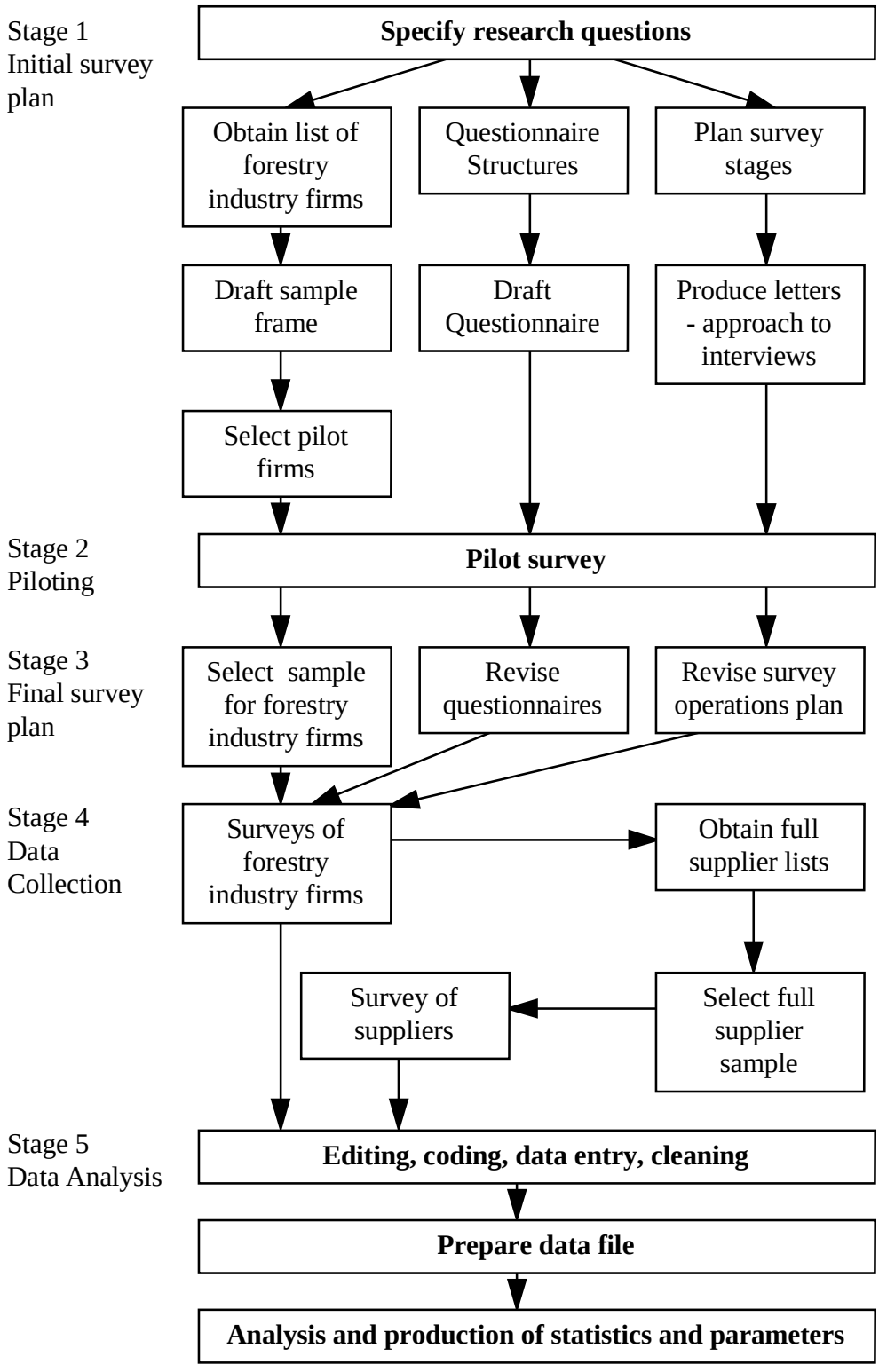
Source: PACEC, 1999

3.4. Stage 3: The survey approach and information required

Survey approach

3.4.1. The survey programme involved a combination of face-to-face interviews and postal questionnaires for both the forestry production sector and the forestry processing sector. In addition a number of telephone interviews were undertaken where questionnaires had not been fully completed or where there were important data entries requiring clarification or explanation. Telephone interviews were also used for the survey of suppliers. The full details of the survey process are shown in Figure 2.2 below.

Figure 2.2 The Survey Process



Source: PACEC, 1999

Key information required

3.4.2. The sample survey is concerned with establishing a data base that will permit the estimation of direct and indirect economic impacts and multipliers for forestry and timber processing as a whole, for a range of different forestry activities and forest types described above and for different geographical areas. The information is primarily quantitative and relates to both inputs and outputs of the different organisations interviewed. Table 2.6 shows the information to be obtained from the forestry and processing survey. All information obtained (i.e. employment, sales, labour costs, profits and purchases) were sought by activity and forest / wood type. Information related to recreational, conservation and environmental activities (except Forest Holidays for FE) were captured through the questionnaires but will be excluded for calculations and analyses.

Additionally, purchases will be split by industrial classification and commodity, following the commodity classification used in the input-output tables. They will also be split by area (local, rural England, urban England, rest of UK, overseas). The names of suppliers are obtained from the questionnaire to forestry and processing organisations in order to compile the database of suppliers.

Table 3.6 Information required from forestry and processing survey

	Activity	Forest / wood type[1]	Industry	Area	Names
Employment (FTE)	✓	✓		✓	
Sales	✓	✓			
Labour costs	✓	✓			
Profits	✓	✓			
Purchases	✓	✓	✓	✓	✓

1 Forestry only

Source: PACEC, 1999

Supplier survey

3.4.3. Table 2.7 shows the breakdown of information required from suppliers. Five types of information are required such that the survey results correspond to the standard input-output classifications by industry category. Purchases are required by industry and by area to derive indirect supplier impacts.

Table 3.7 Information required from the supplier survey

	All	Industry	Area
Employment (FTE)	✓		
Sales	✓		
Labour costs	✓		
Profits	✓		
Purchases	✓	✓	✓

Source: PACEC, 1999

The postal questionnaire is primarily concerned with obtaining quantitative information and focuses on:

(a) Employment, and place of residence of employees.

(b) Financial details including sales, grants, change in the value of stocks, staff costs, purchases (capital expenditure and operating costs), and pre-tax profits.

(c) Activities: employment, purchases and sales by activity, and employment by forest or wood type.

(d) Purchases: costs, and geographical origin of main inputs by "local area", rural England, urban England, Wales, Scotland and rest of the World.

(e) Suppliers contact list.

A follow-up questionnaire was also used to obtain more qualitative information relating to:

(a) Timber sales and purchases: geographical origins and destinations, competition with foreign timber, substitution of foreign timber for British timber, and recycled paper purchases.

(b) Business trends and future plans.

4. IMPACT ASSESSMENT AND MULTIPLIERS

4.1. Introduction

4.1.1. This chapter has two main objectives. Firstly it is concerned with estimating the direct, and indirect and induced economic activity supported by the forestry and timber processing activity in England for the sector as a whole and for different forestry activities, geographical areas and forest types. Estimates are presented for the economic impact in terms of employment, gross output and net output. To achieve such a comprehensive assessment involved the development of a set of input-output relationships for the sector and the different component activities identified in the earlier chapters. Figure 4.1 illustrates the structure and main outputs of the chapter.

4.1.2. The survey provided the basic data for much of this analysis. The survey was carried out in different parts of England and included the majority of Forest Enterprise Districts and service units, forestry companies and contractors in each of the main forest regions, and 515 were either sent a questionnaire or interviewed face-to-face (the respondents to this main survey were followed, and their main suppliers contacted, both by telephone). The achieved sample on which the analysis is based is shown in Table 4.1. The number of organisations responding to the survey was 118, of which only 103 questionnaires were usable, reflecting a 23% response rate. These 103 organisations for which the questionnaire was usable covered the full range of forestry and processing activities and forest types and as can be seen from Table 4.1 many organisations were engaged in more than one activity (thus the total of organisations for activities exceeds the total number of respondents). The majority of the major companies responded to the survey and in addition the large majority of the Forest Enterprise Districts also cooperated fully in the enquiry. As a result of this, a relatively high coverage of forest activities was achieved. In addition, the survey included a sample of very small operators, mainly self-employed.

Table 4.1 Sample size by activity, area and type of forest

Sub-sector	No. of companies*
Activity	
Establishment	62
Maintenance	67
Harvesting	69
Total Forestry	91
Sawmilling	21
Pulp, paper and Board	3
Total Processing	24
Grand total	103
Forest type	
Productive high forest	51
Traditional estate	49
Small farm woodland	27
Community Woodland	12
Hardwood	21
Softwood	14

* Many companies are involved in more than one activity.
Source: PACEC, 1999

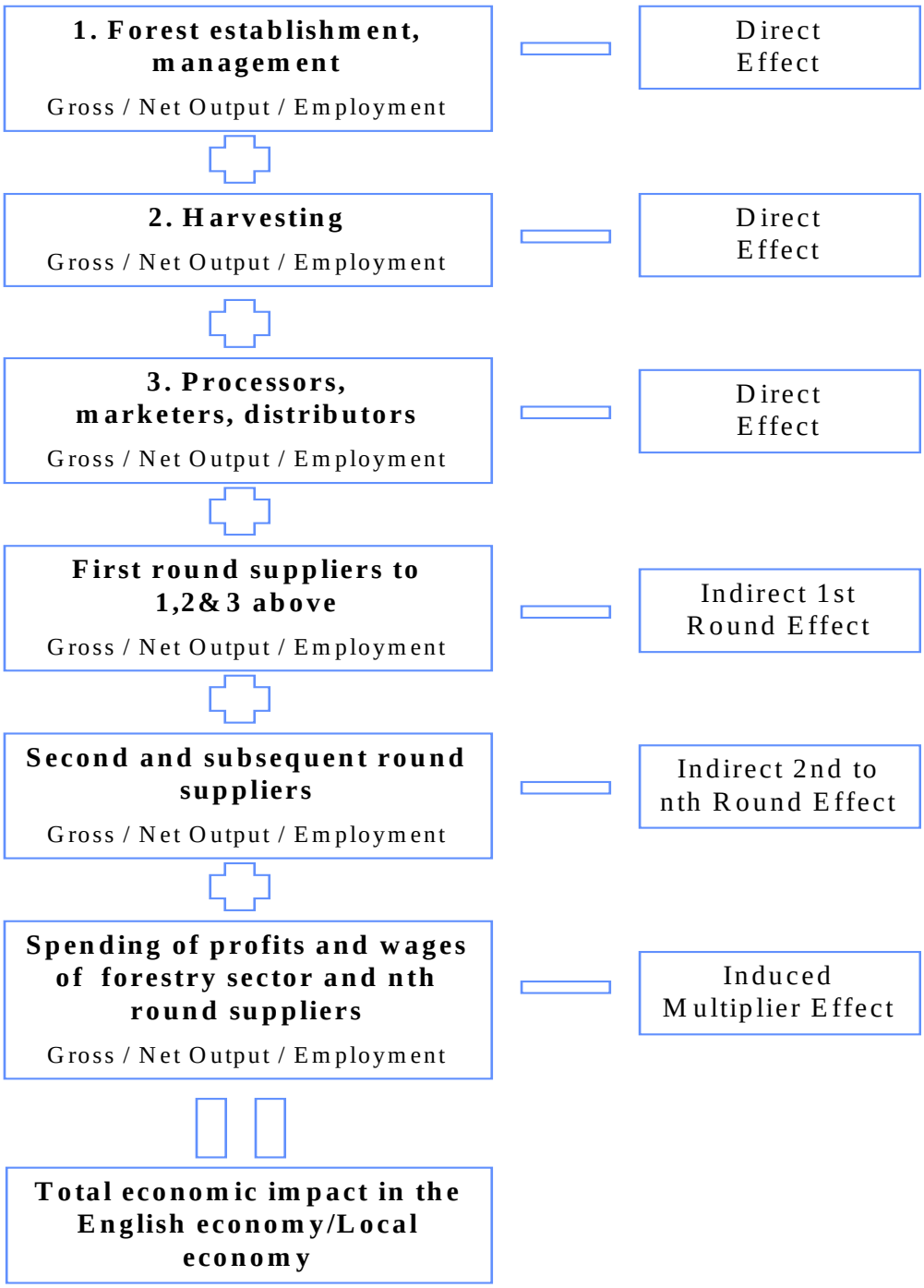
The sample breakdown in terms of the type of organisation is shown in Table 4.2.

Table 4.2 Sample by category of organisations

Organisation	%
Forest Enterprise	12
Forest Enterprise unit	5
Woodland owner	34
Management company	1
Subcontractor	31
Processing agent / co	17
Total	100

Source: PACEC, 1999

Figure 4.1 Sources of economic impact



Source: PACEC, 1999

4.2. Estimates of gross output, employment and net output, and associated multipliers

4.2.1. This section presents the key results emerging from the analysis of the data derived from the survey of organisations in the forestry sector and their suppliers.

Direct effects

4.2.2. All the estimates of employment, gross output and net output are based on the weighted main survey results of all processors, owners, contractors, managing agents and Forestry Enterprise (districts and units):

(a) Direct employment impact is equal to the weighted survey *full time equivalent employment*

(b) Direct gross output impact is equal to the weighted survey *sales + change in value of stock (excluding purchases within the forestry industry)*

(c) Direct net output is equal to the weighted survey *Staff costs + profit.*

4.2.3. In addition, employment data from the FC Employment Survey for the years 1988/89 and 1993/94 was used to estimate **direct** employment in the forestry and processing sector for the year 1997/98 using the method outlined in Chapter 2 above.

First round indirect effects

4.2.4. **Indirect** gross output, employment and net output effects arise firstly from supplier linkages outside the forestry industry. These are estimated using the proportion of suppliers turnover accounted for by forestry purchases converted into employment, gross output and net output.

4.2.5. First round supplier effects are based on the weighted main survey results, and the supplier survey. The total amount purchased from different first round suppliers is estimated using the weighted survey purchases (NB: This excludes purchases from forestry sub-contractors which have been included in the direct

effect, and it also excludes all purchases outside England). This is equal to the first round gross output.

Table 4.3 The structure of goods and services purchased by the forestry/timber processing sector

Sector	Total (£m)	%
Machinery, metal goods	162	25%
Electricity, gas, water	108	17%
Chemicals and fertilisers	62	10%
Other materials	162	25%
Construction	6	1%
Transport	72	11%
Other services	73	11%
FE Engineering services	6	1%
Total	651	100%

Source: PACEC, 1999

4.2.6. The number of staff per £m of turnover is derived from the supplier survey. This is used with the first round gross output impact above to generate the first round employment impact.

Table 4.4 Number of employees per £m turnover in distribution and manufacturing

	Staff per £m turnover	
Sector	Distributor	Manufacturer
Machinery, metal goods,	8	6
Electricity, gas, water,	9	N/A
Chemicals and fertilisers	14	10
Other materials	13	7
Construction	21	N/A
Transport	16	N/A
Other services	10	N/A
FE Engineering services	11	N/A

Source: PACEC Survey, 1999

4.2.7. The staff costs and profit per £m of turnover are derived from the supplier survey. This is used with the first round gross output impact above to generate the first round net output impact.

Table 4.5 Staff costs and profits per (£k) turnover for distributors and manufacturers

	Staff costs + profit (£) per turnover (£k)	
Sector	Distributor	Manufacturer
Machinery, metal goods,	510	470
Electricity, gas, water,	560	N/A
Chemicals and fertilisers	570	290
Other materials	430	400
Construction	620	N/A
Transport	600	N/A
Other services	540	N/A
FE Engineering services	240	N/A

Source: PACEC Survey, 1999

Induced effects and indirect 2nd to nth round effects

4.2.8. Induced gross output, net output and employment effects arise from the spending of wage income and distributed profits arising in the forestry / processing sector and supplier industries.

4.2.9. The proportion of wage income and distributed profits which are actually spent is calculated using appropriate estimates of saving, tax and import propensities. The conventional parameters were used: income tax propensity of 20%, marginal import propensity of 30% and savings propensity of 10%. This yields a spend of 50% of earnings. (0.8*0.7*0.9)

4.2.10. The first round induced gross output effect arising from direct activity and first round indirect activity is equal to 50% of the wage income and distributed profits, estimated using the weighted main and supplier survey results.

4.2.11. Second round indirect gross output was estimated from the difference between first round gross output and first round net output, taking into account imports.

4.2.12. National Accounts data is used to estimate the gross output multiplier associated with the induced and 2nd-nth round indirect effects. National Accounts data was also used to estimate the ratio of gross output to net output and the ratio of gross output to employment for these induced and indirect effects. The total gross output, employment and net output effects are equal to the sum of the direct, first round indirect and all induced and 2nd-nth round indirect effects.

Economic Impact Estimates for England

4.2.13. Table 4.6 presents the gross output, employment and net output impacts for England. The total number of jobs (FTEs) supported by the forestry and processing sector is estimated to be 34,100, 84% more than the number of jobs directly attributable to forestry and processing activities i.e. an employment multiplier of 1.84. The greater part (81%) of the indirect employment impacts derive from the supplier chain (12,700 jobs) with the remaining jobs being generated by expenditure from wages and distributed profits. The total net output (GDP) supported by forestry is estimated to be £1.0 billion of which £380 million is generated directly by forestry and processing activity. Total gross output generated is estimated at some £2.9 billion.

Table 4.6 Estimated gross output, employment and net output impact of the Forestry and Processing sector of England, 1997/98

	Gross Output	Jobs	Net Output
	£m	FTE000	£m
Direct impact	1,085	18.5	380
Indirect	1,496	12.7	554
Induced	358	2.9	66
Total impact	2,939	34.1	1,000
Total multiplier	2.71	1.84	2.63

Source: PACEC, 1999

Estimates by geographical area

4.2.14. Estimates of the local impacts, defined as the impacts falling within a 20 miles radius of the centre of the forest are shown in Table 4.7. The evidence from

the survey suggests that 94% (equal to 17,500 jobs) of the direct employment impact falls within the local area as defined. Purchases in the local area and in the local and rural combined are estimated from the weighted survey using weighted survey results. The local jobs impact per £m turnover in the local area is estimated from the supplier survey as is the local+rural impact. These impacts/turnover ratios are then used with the purchase estimates to produce the first round indirect employment effects. Owing to the limited number of suppliers located within the local area and the limited expenditure from wages and profits in the local area, the local employment multiplier is estimated at 1.36, very much lower than that for England as a whole (i.e. 1.84). The first round induced gross output effects in the local area is estimated from the weighted survey using 50% of staff costs together with the geographic distribution of employment. First round employment effects of spending are estimated on the assumption that the employment: gross output ratio is the same as in first round purchases. The ratio of first round induced to direct employment effects is used (via the sum of a geometric progression) to estimate the total induced multiplier.

Table 4.7 Estimates of the employment, gross output and net output effect by area for the whole of England

	Direct Effect			Multipliers			Total Effect		
	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output
	£m	FTE000	£m				£m	FTE000	£m
All Activity	1,085	18.5	380	2.71	1.84	2.63	2,939	34.1	1,000
Local+Rural	1,085	18.2	377	1.82	1.43	1.78	1,975	26.0	672
Local	1,085	17.5	358	1.71	1.36	1.66	1,853	23.8	596
Rural	0	0.8	18	-	-	-	122	2.2	76
Urban	0	0.2	4	-	-	-	965	8.1	330

Source: PACEC, 1999

Estimates by activity

4.2.15. The final set of economic impact estimates relate to the different forestry activities and woodland types identified in Chapter 2. The first broad distinction presented in Table 4.8 is between forestry activities as such and timber processing. Although forestry activities account for more direct jobs

than processing (11,100 jobs and 7,500 jobs respectively) the employment multiplier (supplier+induced) for processing (2.49) is much greater than for forestry (1.40). The net output and gross output multipliers for processing are also greater than those for forestry.

Table 4.8 Estimates of the employment, gross output and net output effect for forestry and processing for the whole of England

	Direct Effect			Multipliers			Total Effect		
	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output
	£m	FTE000	£m				£m	FTE000	£m
All Activity	1,085	18.5	380	2.71	1.84	2.63	2,939	34.1	1,000
Forestry	325	11.0	198	2.56	1.40	1.82	833	15.3	360
Process	760	7.5	182	2.77	2.49	3.51	2,106	18.8	640

Source: PACEC, 1999

4.2.16. Within the different forestry activities harvesting accounts for the majority of direct jobs: 5,200 compared with 3,600 in maintenance and 2,200 in establishment, as shown in Table 4.9 below. Harvesting also generates somewhat larger employment multiplier effects than the other two forestry activities with a multiplier of 1.49 compared with 1.29 for maintenance and 1.38 for establishment. Including direct and indirect effects harvesting accounts for an estimated 7,700 jobs, maintenance for 4,600 and establishment for 3,000 jobs.

Table 4.9 Estimates of the employment, gross output and net output effect by forestry activity for the whole of England

	Direct Effect			Multipliers			Total Effect		
	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output
	£m	FTE000	£m				£m	FTE000	£m
Forestry	325	11.0	198	2.56	1.40	1.82	833	15.3	360
Establish	44	2.2	36	3.16	1.38	1.83	138	3.0	66
Maintain	39	3.6	53	4.06	1.29	1.67	156	4.6	88
Harvest	243	5.2	109	2.22	1.49	1.89	540	7.7	206

Source: PACEC, 1999

Estimates by wood type

4.2.17. The analysis by woodland type presented in Table 4.10 shows that productive and traditional estate woodlands account for the majority (7,900) of jobs generated compared with 3,000 jobs in small farms and community woodlands. The employment multiplier effects in the former two types of forest are also greater than those for small farms and community woodlands. Community forests generate very little income (as recreational and environmental incomes are excluded for the purpose of this research study), which explains relatively high gross output and net output multipliers.

Table 4.10 Estimates of the employment, gross output and net output effect by forest type for the whole of England

	Direct Effect			Multipliers			Total Effect		
	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output
	£m	FTE000	£m				£m	FTE000	£m
Forestry	325	11.0	198	2.56	1.40	1.82	833	15.3	360
Productive	169	4.6	81	2.48	1.48	1.97	419	6.8	159
Trad estate	98	3.3	66	2.56	1.39	1.76	251	4.7	116
Small Farm	51	1.8	34	2.40	1.34	1.68	123	2.4	57
Community	7	1.2	17	5.85	1.23	1.60	41	1.5	28

Source: PACEC, 1999

4.2.18. Softwood processing generates 6,700 direct jobs, representing 89% of all direct jobs in processing. Moreover the employment multiplier for softwood as shown in Table 4.11 is significantly higher than for hardwood, 2.63 and 1.38 respectively.

Table 4.11 Estimates of the employment, gross output and net output effect by wood type for the whole of England

	Direct Effect			Multipliers			Total Effect		
	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output	Gross Output	Jobs	Net Output
	£m	FTE000	£m				£m	FTE000	£m
Processing	760	7.5	182	2.77	2.49	3.51	2,106	18.8	640
Softwood	729	6.7	163	2.80	2.63	3.72	2,037	17.6	608
Hardwood	31	0.8	19	2.21	1.38	1.64	69	1.2	31
Sawmill	133	3.4	74	2.13	1.38	1.66	284	4.7	123
Pulp	626	4.1	108	2.91	3.40	4.77	1,822	14.1	517

Source: PACEC, 1999

5. TIMBER IMPACT SIMULATIONS

5.1. Introduction

5.1.1. This chapter seeks to demonstrate the importance of the forestry and processing industries through a series of simulations. These simulations are based on different assumptions which set a framework in which the economic significance of English forestry and downstream activities can be gauged. This appraisal is made through five simulations:

- the removal of the forestry sector in England
- a 50% increase in English timber harvesting
- the substitution of English timber for imported timber
- the removal of grant-aid to English forestry
- the doubling of labour productivity in the forestry sector.

5.2. Removal of the forestry sector in England

5.2.1. Government's policies have been encouraging the development of the forestry activities through incentives to new planting and forest management. Forest coverage has increased in England, which has revitalised the forestry economic sector. In this first simulation, forestry as an economic sector is entirely suppressed in England. The activities of establishment, maintenance and harvesting are therefore removed. This entire suppression of forestry activities would impact on other economic sectors through inputs purchases and income spending. The effects would then be direct, and indirect and induced. This simulation, although setting up unrealistic assumptions (the total disappearance of the forestry sector is very unlikely), has the advantage that it clearly indicates the real importance of the forestry sector to the English economy.

5.2.2. The removal of the forestry industry in England may also impact on downstream activities, as some timber processing activities may be totally or partially dependent on English timber production. However, the first

assumption here, or **assumption 1** is that **the processing industry is not at all affected** by the disappearance of the English timber production sector owing to substitution of domestically grown timber by imports. In other words, the dependency ratio of the processing industry to the English forestry sector is zero. As a result, employment, gross output and net output in the processing sectors would remain untouched, while those in the forestry industry would completely disappear. Table 5.1 shows the impacts on employment, gross output and net output of the removal of all types of forestry. The total number of jobs lost through this removal would be 15,300, 72% of which are directly accounted for by forestry, the remaining being indirect and induced jobs created through inputs linkages and incomes spending. The decrease in gross output would be £833m, of which 39% would directly be derived from forestry activities. Net outputs losses would amount to £360m, of which £198m is direct and £162m indirect and induced.

Table 5.1 Impact of the removal of the Forestry of England, Assumption 1

	Gross Output	Jobs	Net Output
	£m	FTE000	£m
Impact of the removal of forestry			
Direct effects	-325	-11.0	-198
Indirect and induced effects	-508	-4.3	-162
Total effects	-833	-15.3	-360
Total impact of the removal of forestry by activity			
Establishment	-138	-3.0	-66
Maintenance	-156	-4.6	-88
Harvesting	-540	-7.7	-206

Source: PACEC, 1999

5.2.3. In the case where downstream processing industries are dependent on English timber production and would not exist in the absence of domestic production, the impact of the removal of the forestry sector, shown in Table 5.1, would be an underestimate of the removal of forestry. Thus **under Assumption 2** the simulation is repeated by imposing certain levels of critical supply dependence on the downstream users of English timber. The 1998 sawmill survey asked larger mills (each producing over 5000 m3 sawnwood, and in total responsible for 87% of softwood logs sawn) about their sources of logs. For mills in

England, 47% of logs came from England, 28% from Wales, 24% from Scotland and 1% from overseas. Hardwood mills and other smaller mils might be expected to process a larger proportion of local logs, but the volumes are relatively small, so they are unlikely to raise English logs as a proportion of English throughput much above 50%. But this only indicates the current trading patterns, not the extend of dependency on English logs. Mills, particularly those close to the Scottish and Welsh borders, could switch to using logs from Scotland or Wales, considered as foreign countries in the context of the study. In the long-run however, outsourcing logs could prove uneconomic and leads to mills closures. The dependency ratios for the UK as a whole used in the McGregor and McNicoll (1989) study were 21.6% for sawmilling and 2% for pulp and paper. These dependency ratios represent the percentage of activity in each downstream activity assumed to be reliant on domestic forestry as a source of timber, or, in other words, for financial, regulatory or technical reasons, unable to import timber for processing. The greater these dependency ratios, the larger the impacts, and vice versa. A 12.5% dependency ratio was assumed for the English timber and wood processing products industry (sawmilling and wood panels industry), considering the proportion of softwood and hardwood produced and consumed in England, as well as the geographical position of the main sawmills. The 2% dependency ratio for paper and pulp industry suggested by McGregor and McNicoll in their UK study was adopted for the English industry. Looking at trading patterns in 1997, the English pulp and paper industry used 41% of English small roundwood and residues, and imported the remaining 59% from Wales and Scotland. There is, however, enough roundwood from Scotland to meet the current consumption of England and Wales, so it appears that the English processors are only little dependent on English supplies. Again, a longer-term effect could be the deplacement of pulp and paper mills closer to the source. The scope of the impacts of the removal of the forestry industry on the processing industry depends on the dependency ratios that apply.

Table 5.2 illustrates the impacts of the removal of English timber production on the English economy. Direct, and indirect and induced effects for forestry are presented in the second row, while those for processing are in the third row. Finally, the total effects in the forestry and processing industries are shown in the last row. Total losses in employment, gross output and net

output would amount respectively for 16,500 jobs, £914 million, and £400 million.

Table 5.2 Impact of the removal of the Forestry of England, Assumption 2

	Gross Output £m	Jobs FTE000	Net Output £m
Additional impact on the Forestry industry			
Direct effects	-325	-11.0	-198
Indirect and induced effects	-508	-4.3	-162
Total effects	-833	-15.3	-360
Additional impact on the Processing industry			
Direct effects	-29	-0.5	-11
Indirect and induced effects	-52	-0.7	-29
Total effects	-81	-1.2	-40
Additional impact on the Forestry and processing industries			
Direct effects	-354	-11.5	-209
Indirect and induced effects	-560	-5.0	-191
Total effects	-914	-16.5	-400

Source: PACEC, 1999

5.3. A 50% increase in English timber harvesting

5.3.1. Although double that in 1918, England is one of the least wooded countries in Europe (Forestry Industry Council, 1998). New planting is encouraged by grant-aid, and timber harvesting is forecast to grow substantially over the next 20 years. The next simulation investigates the economic impacts of a 50% increase in English timber production on the wider English economy.

5.3.2. It is assumed that productivity ratios, broadleaves/conifers ratio, and the volume/value ratio remain unchanged. A 50% increase in English timber harvesting would lead then to a 50% increase in harvesting activities. Establishment (new planting and restocking) and maintenance activities would not be affected by this increase in timber harvesting. The direct, and indirect and induced effects of this change are summarised in Table 5.3. below. Another 3,900 jobs would be created, 2,600 being in the forestry industry. An

additional £270 million gross output is added and the English net output would be boosted by £103 million. The economic weight of the forestry industry would increase significantly by the doubling of the value/volume of timber harvesting.

Table 5.3 Impact of a 50% increase in English timber harvesting

	Gross Output £m	Jobs FTE000	Net Output £m
Additional impacts on forestry			
Direct effect	+122	+2.6	+55
Indirect and induced effects	+148	+1.3	+49
Total effects	+270	+3.9	+103
Impacts on forestry			
Direct effect	447	13.6	253
Indirect and induced effects	656	5.6	211
Total effects	1,103	19.2	463

Source: PACEC, 1999

5.3.3. As developed above, a 50% increase in English timber harvesting would impact on the English forestry industry and the wider economy through induced and indirect effects. This increase might also impact on the processing industry. The economic effects on the downstream sectors (i.e. sawmilling, board panels, and pulp & paper) would depend on whether processing output is demand or supply driven and two scenarios can be produced. The first scenario is developed under the assumption that timber and wood products output is demand driven: **Assumption 1**. Therefore a 50% increase in English timber harvesting would have no effect on the volume/value of timber processed by English downstream industries. A proportion of this additional harvested timber might substitute for imported timber or be exported. For the purpose of this simulation, the whole value of English timber harvesting would be processed by English downstream industries, export volumes and values remain constant. Direct, and indirect and induced effects on jobs, gross output and net output in the processing industry would remain unchanged under assumption 1. The only additional impacts deriving from a 50% increase in timber harvesting would be those described in Table 5.3. above. Table 5.4. summarises the total and direct

effects derived from the forestry and processing industries on the wider economy.

Table 5.4 Impact of a 50% increase in English timber harvesting, Assumption 1

	Gross Output £m	Jobs FTE000	Net Output £m
Impact on Forestry			
Total effects on forestry	1,103	19.2	463
Impact on Forestry and Processing			
Additional effects	0	0	0
Total effects *(Unchanged)*	2,939	34.1	1,000
Impact on Forestry and Processing			
Direct effects	1,207	21.1	435
Indirect and induced effects	2,002	16.9	669
Total effects	3,209	38.0	1,103

Source: PACEC, 1999

5.3.4. By contrast, the second scenario assumes that timber and wood products output is supply driven: **Assumption 2**. If import levels and export/production ratio do not change, the additional volume of timber processed would equal to the additional volume of English timber produced. The volume of timber processed would then increase. Table 5.5. summarises the total and direct effects derived from the processing industry, and the total impacts derived from the forestry and processing industries on the wider economy. An extra 6,200 jobs would be created, total employment effects then amounting to 40,300. Net output would be boosted by £186 million, and gross output would increase by £548 million.

Table 5.5 Impact of a 50% increase in England timber harvesting on the forestry and processing industry, Assumption 2

	Gross Output	Jobs	Net Output
	£m	FTE000	£m
Impact on forestry			
Total effects	1,103	19.2	463
Impact on processing			
Direct effects	861	8.5	206
Indirect and induced effects	1,523	12.6	517
Total effects	2,384	21.1	723
Impact on forestry and processing			
Direct effects	1,307	22.1	458
Indirect and induced effects	2,180	18.2	728
Total effect	3,487	40.3	1,186
Additional effects on forestry and processing			
Direct effects	+222	+3.6	+78
Indirect and induced effects	+326	+2.6	+108
Total effects	+548	+6.2	+186

Source: PACEC, 1999

5.4. Substitution of English timber for imported timber

5.4.1. As outlined in Chapter 2, the proportion of domestic timber and wood products production has increased over the last decade, but remains largely insufficient to meet consumption demand. England's wood processing industry is highly reliant on imports (The Forestry Industry Council, 1998). Indeed, England's wood processing industry is supplied by 94% with foreign timber and timber-related products, the remaining 6% being English. In the previous simulation, we researched the effects of an increase of timber harvesting, and assumed that this additional domestic timber supply was absorbed by the processing industry, import levels remaining stable. In this simulation, the approach is different in the sense that the starting point is a change in timber consumption patterns from the processing industry leading to a higher demand for domestic timber. Consequently, timber harvesting increases to meet this additional demand. This simulation could arise from a fall in the value of sterling against foreign currencies. The aim therefore is to

estimate the economic impact of the substitution of domestic (i.e. English) timber for imported timber.

5.4.2. Two scenarios are considered regarding the substitution of English timber for imported timber: firstly, a 10% substitution level is envisaged, and secondly a 20% substitution level is assumed. With a 10% substitution level, England's wood processing industry would be supplied by 6.6% with English timber and timber-related products (instead of the 6% originally). The volume / value of timber processed is assumed to stay the same, and effects linked to the processing activities not to change. However, changes in the source of timber inputs will affect the English forestry industry. Table 5.6 shows the economic direct, and indirect and induced effects that different levels of substitution of domestic timber for foreign timber would have in the wider economy. A 10% substitution level would lead to the creation of 800 jobs in the English economy, 58% being in the forestry and processing industries. Gross output would increase by £54 million, and an extra £21 million net output would be produced. The higher the substitution level, the greater the effects on the domestic economy. A 20% substitution level would generate an additional 1,500 jobs, an extra £108 million gross output and a further £41 million net output.

Table 5.6 Impact of substituting English timber for imported timber

	Gross Output	Jobs	Net Output
	£m	FTE000	£m
10% SUBSTITUTION LEVEL			
Total effects on forestry	887	16.1	381
Direct effects	349	11.5	209
Indirect and induced effects	538	4.6	172
Total effects on forestry and processing	2,993	34.9	1,021
Direct effects	1,109	19.0	391
Indirect and induced effects	1,884	15.9	630
Additional effects on forestry and processing	+54	+0.8	+21
Direct effects	+24	+0.5	+11
Indirect and induced effects	+30	+0.3	+10
20% SUBSTITUTION LEVEL			
Total effects on forestry	941	16.8	401
Direct effects	374	12.5	220
Indirect and induced effects	567	4.3	181
Total effects on forestry and processing	3,047	35.6	1,041
Direct effects	1,134	20.0	402
Indirect and induced effects	1,913	15.6	639
Additional effects on forestry and processing	+108	+1.5	+41
Direct effects	+49	+1.0	+22
Indirect and induced effects	+59	+0.5	+19

Source: PACEC, 1999

5.5. The effects of removing grant-aid to English forestry

5.5.1. Forest new planting is subsidised through grant-aid packages made available to woodland owners and farmers under environmental conditions. The major grant schemes (WGS and FWPS) are presented in Chapter 2. Although the impacts of grant-aid on levels of new planting by private woodland owners is difficult to evaluate, it could be argued that its removal would significantly reduce the area of woodlands planted, and therefore have negative economic effects on the forestry sector and on the wider economy. This simulation

estimates the magnitude of effects following the removal of grant-aid under the assumption that the area of new planting and associated establishment by private owners supported by the grant-aid schemes would reduce by 90%. Planting by private owners not in receipt of any grant would remain unchanged. What would happen in the case of community forests is uncertain. It can be argued that new planting for this forest type depends relatively heavily on grants, notably on the Community Woodland Supplement scheme or that it stands apart from other forest types since being more reliant on voluntary sector's strategies. Little comprehensive information and statistics on community forests are made available at the present stage, and this forest type is therefore treated as the others in private ownership. Planting by Forest Enterprise would not be affected by this measure as it does not receive grants. A 90% reduction in the area of grant-aided private woodlands planted (new planting only) in the base year of the study, 1997/1998, is equivalent to 3,700 hectares in England (Forestry Commission, 1998). It is also assumed that in the first year of the removal of grant-aid packages, the level of restocking would not (or only to a very small extend) be affected.

5.5.2. Table 5.7 shows the impacts the suppression of grant-aid would have during the first year, when only establishment is affected, and maintenance, harvesting and processing stay at the same levels than before the suppression of the planting grants. It is estimated that 900 direct jobs would be lost in establishment, that total gross output would decrease by £59 million and net output by £28 million in the English economy.

Table 5.7 Impact of the removal of grant-aid to English forestry

	Gross Output £m	Jobs FTE000	Net Output £m
Additional impacts on forestry and processing (- : losses)			
Direct effects	-19	-0.9	-15
Indirect and induced effects	-40	-0.4	-13
Total effects	-59	-1.3	-28
Impacts on forestry			
Direct effects	306	10.1	183
Indirect and induced effects	478	4.0	150
Total effects	784	14.1	333
Impacts on forestry and processing			
Direct effects	1,066	17.6	365
Indirect and induced effects	1,814	15.2	607
Total effects	2,880	32.8	972

Source: PACEC, 1999

5.5.3. Having looked at the impacts of the suppression of grant-aid during the first year, the dynamic effects of this measure also need to be investigated. In the long term, harvesting activities will also be affected. The average age of felling for the main commercial tree species grown in Great Britain is 57 years (age of felling for each species weighted by forest area) (Forestry Industry Council, 1998). Looking at the impacts at time of felling, the scale of timber harvesting would be reduced by the total area that was planted. Though forecasts are difficult in such a long period, maintenance and harvesting activities would unquestionably be negatively affected. Owing to the dependency of some processing activities on the supply of domestic timber, the processing industry would also suffer from the impacts of the suppression of grant-aid.

5.6. The impact of a doubling of labour productivity in the forestry sector

5.6.1. The final simulation relates to the impact of an increase in labour productivity in the forestry sector on the economy. Productivity would double for each forestry activity: establishment, maintenance and harvesting. This increase in productivity would directly impact on the number of jobs in the industry.

Gross output would remain the same, so would net output, assuming that productivity gains would be passed on profits. As shown in Table 5.8, the doubling of labour productivity would lead to a reduction of 7,600 jobs in the English economy, nothing being changed otherwise. However, positive effects created through productivity gains are not taken into account in this simulation.

Table 5.8 Impact of a doubling of labour productivity in the forestry sector

	Gross Output £m	Jobs FTE000	Net Output £m
Impact on forestry and processing			
Direct effects	1,085	13.0	380
Indirect and induced effects	1,854	13.5	620
Total effects	2,939	26.5	1,000
Additional impact on forestry and processing (or losses)			
Direct effects	0	-5.5	0
Indirect and induced effects	0	-2.1	0
Total effects	0	-7.6	0

Source: PACEC, 1999

5.6.2. A doubling of labour productivity, if not passed onto wages, would considerably boost profits. This increased profitability ratio would probably act as an incentive for timber producers to increase the volume harvested in the first place, and subsequently to increase the volume of new planting. The assumption here is that the volume of timber harvested would increase by 20%, nothing being changed otherwise. Therefore, in addition to those impacts presented in Table 5.8, gross output, net output and employment would respectively increase by £49m, £22m and 1,000 jobs in the harvesting sector, as shown in Table 5.9. The cumulative impacts of the doubling of labour productivity and the 20% increase in volume harvested are shown in the lower part of Table 5.9.

Table 5.9 Impact of a doubling of labour productivity in the forestry sector and a 20% increase in volume of timber harvested

	Gross Output £m	Jobs FTE000	Net Output £m
Additional impact on harvesting (20% increase in volume)			
Direct effects	+49	+1.0	+22
Indirect and induced effects	+59	+0.5	+19
Total effects	+108	+1.5	+41
Cumulative additional impact on forestry and processing (or losses)			
Direct effects	+49	-4.5	+22
Indirect and induced effects	+59	-1.6	+19
Total effects	+108	-6.1	+41
Cumulative impact on forestry and processing			
Direct effects	1,134	14.0	402
Indirect and induced effects	1,913	14.0	639
Total effects	3,047	28.0	1,041

Source: PACEC, 1999

6. CONCLUSION

6.1. The analysis presented in this report shows that forestry, through its purchases of labour, materials and manufactured goods and services, through its upstream links with timber processing and through the spending of income generated in these activities, makes a vitally important contribution to the economy, particularly the rural economy of England. Directly and indirectly forestry activity in England is shown to support some 34,100 jobs in the country, to generate gross output of just over £2.93 billion and GDP of £1.0 billion.

6.2. Not surprisingly the contribution to rural economic development from forestry activity is very significant although local economic impacts (estimated at 17,500 jobs) falling within 20 miles of forestry activity are primarily associated with activity directly linked to establishment, maintenance and harvesting of forests. The local multiplier, covering all indirect and induced effects is estimated at 1.36, reflecting the substantial "leakages" of economic activity from the local area. Notwithstanding this, the indirect supplier effects and processing effects support an additional 7,800 jobs in the wider rural economy of the country and an estimated 7,900 jobs are supported in the more urbanised parts of the country.

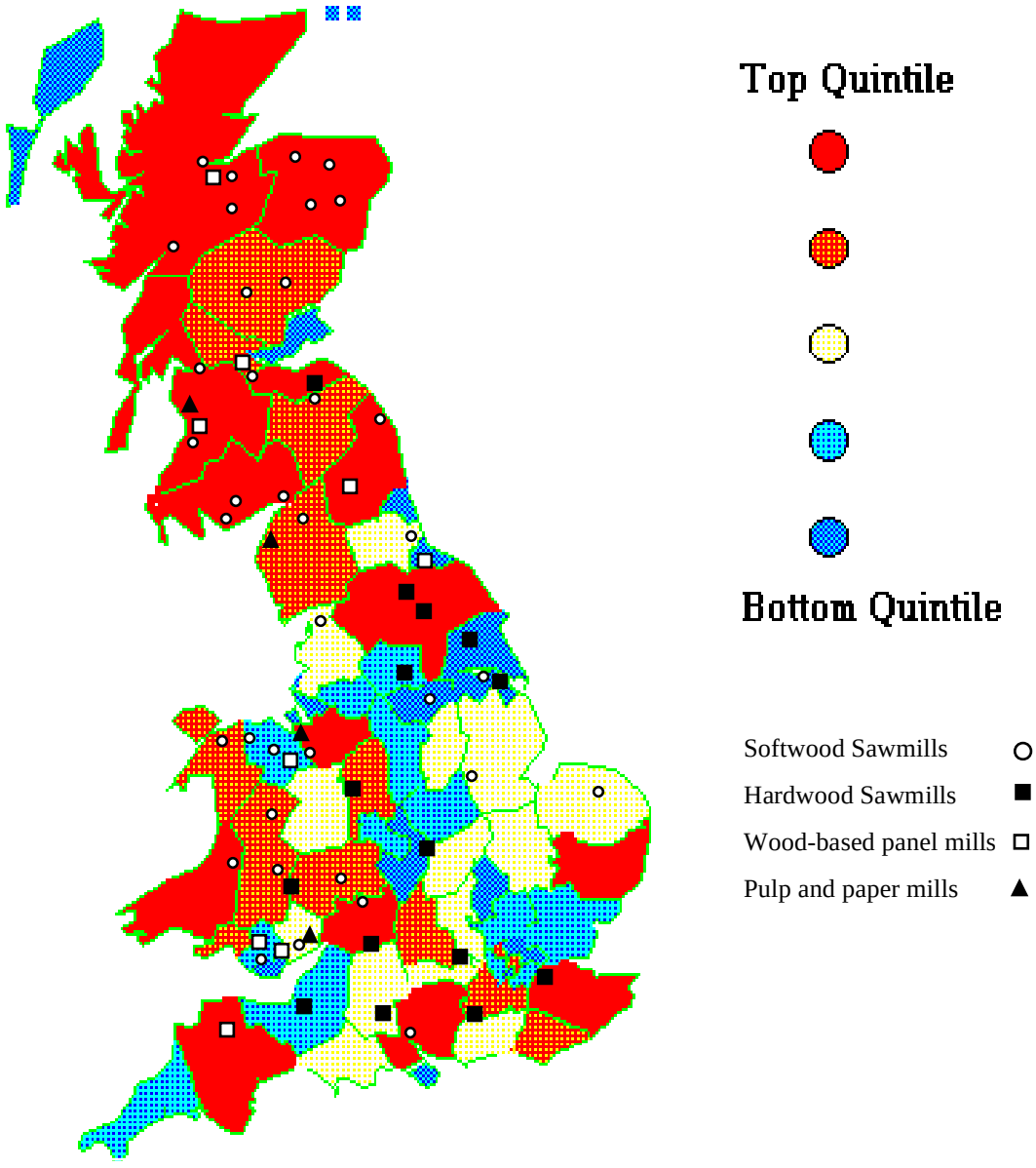
6.3. An innovative aspect of the study is the attempt to estimate multipliers for different types of forestry activity. An important conclusion here is the substantial variability of forestry activity multipliers and the relatively high multipliers associated with downstream timber processing. Within forestry activity per se, the differences in employment multipliers were less marked but were significant for net output and gross output. This suggests that dis-aggregation by activity does improve our understanding of the contribution of forestry to economic activity by comparison with the normal practice of treating forestry activity as an homogenous whole.

6.4. The economic impacts and multipliers are also shown to vary by type of woodland. Employment multipliers are relatively low in small farms and community woodlands by comparison with other types of forest.

6.5. The significance of the forestry and processing industries in the wider English economy is assessed through a series of simulations. These simulations show the positive impacts an increase in timber harvesting, together with the substitution of domestic timber from imported timber would have on the wider English economy. A 50% increase in English timber harvesting would add to the English economy an additional 6,200 jobs, a £548 million supplementary gross output and an extra £186 million net output. For a 20% substitution level, an additional 1,500 jobs would be created, an extra £108 million gross output generated, and an additional £41 million net output produced. The higher the substitution level, the higher the benefits.

6.6. Increase in timber harvesting has been made possible by a larger forest cover in England, new planting being highly subsidised. Removing grant-aid to private woodland owners and farmers would directly result in an immediate loss of 900 jobs in the establishment sector. The total effects on the wider economy is much greater: 1,300 jobs lost, £59 million gross output missing, and a decline in net output of £28 million. Longer-term effects of this removal would be very significant because affecting the volumes of timber harvesting.

APPENDIX A: FORESTRY EMPLOYMENT 1998 AND MAJOR FOREST PROCESSING MILLS WHICH USE DOMESTIC TIMBER IN THE GB CONTEXT



Source: Nomis 1998, Forestry Industry Council, PACEC LEPS

APPENDIX B: GLOSSARY

APF	Association of Professional Foresters
EC	European Commission
EFS	England Forestry Strategy
FC	Forestry Commission
FCA	Forestry Contracting Association
FE	Forest Enterprise
FTE	Full Time Equivalent
FWPS	Farm Woodland Premium Scheme
GDP	Gross Domestic Product
TGA	Timber Growers Association
WGS	Woodland Grant Scheme
WRME	Wood Raw Material Equivalent

APPENDIX C: REFERENCES

Countryside Commission, various publications

Financial Times Survey (07/12/1998), World Pulp and Paper

Forestry Commission (1994), Forest Employment Survey 1993-94, Employment in Forestry and Primary Wood Processing

Forestry Commission (1998), Grants: Woodland Grant Scheme, Farm Woodland Premium Scheme

Forestry Commission (1998), A New Focus for English Forestry

Forestry Commission (1998), Forestry Briefing

Forestry Commission (1997), Annual Market Report for 1997 with Prospects for 1998

Forestry Commission Statistics Department (1997), Sawmill Survey 1996

Forestry Commission, Annual Report and Accounts 1995-96

Forestry Commission (1974), Forest Products in the United Kingdom Economy, Forestry Commission Bulletin

Forest Enterprise (1998) Annual Report and Accounts 1997-98

Forestry Industry Council, The Forestry Industry Year-Book, 1996 and 1998

Forest Research (1998), The National Inventory of Woodland and Trees

Jaakko Poyry (1998), The Future Development Prospects for British Grown Softwood

McGregor P.G. and McNicoll I.H. (1989), The Impact of Forestry on Output and Employment in the UK and its Member Countries, Fraser of Allander Institute

MLURI, John Clegg & Co, University of Aberdeen (1999), Scottish Forestry: An input-output analysis

National Small Woods Association (1998), Woodland Initiatives Register, *Forestry Commission*

Snowdon P.J. and Slee R.W. (1998), An Appraisal of Community Based Action in Forest Management, *Scottish Forestry*, 52-2&3, pp146-156

APPENDIX D: MAIN QUESTIONNAIRE TO FORESTRY AND PROCESSING AGENTS

APPENDIX E: FOLLOWING QUESTIONNAIRE TO FORESTRY AND PROCESSING AGENTS

APPENDIX F: QUESTIONNAIRE TO SUPPLIERS