

ISBN 0-905442-30-X

COUNTY LEITRIM RESOURCE SURVEY

Part111A

Forestry

Economics, Employment and Development Proposals

Published by An Foras Taluntais
19 Sandymount Avenue, Dublin 4.
1978

Price £2.00

CONTENTS

Foreword

Preface

Chapter

1. Introduction - <i>M. Bulfin</i>	1
2. State Forestry in Ireland - <i>Si. Bulfin</i>	3
3. Forestry in Leitrim - <i>Si. Bulfin</i>	9
4. Economics of Forest Production in Leitrim <i>B. C. Hickey and Si. Bulfin</i>	13
5. Employment in Forestry - <i>M. Bulfin</i>	33
6. Processing of Current Plantations - <i>M. Bulfin</i>	37
7. Drumlin Afforestation Project - <i>M. Bulfin</i>	45
8. Private Forestry - <i>A/. Bulfin and B. C. Hickey</i>	51
Summary and Recommendations	59
References	62

FOREWORD

For many years it has been recognised that some of the worst features of western decline are represented in County Leitrim. Controversy has surrounded the county with regard to the possible means by which this continuing decline could be halted and reversed. Farming in the county is beset by many problems arising from natural, technical, economic and social forces.

The natural limitations of the county are those imposed mainly by a combination of heavy, poorly drained soils and a relatively wet climate. This dictates a predominantly grassland farming system which encounters serious problems such as poaching by grazing animals, short grazing season, the necessity for the conservation of large amounts of winter fodder, and poor trafficability for farm machinery. This latter problem is accentuated by the presence of many steep slopes associated with the predominantly drumlin topography.

It is not surprising, therefore, to find serious sociological problems associated with these conditions. Farm -size is small, off-farm employment is scarce, and the resulting outmigration has brought about a population structure dominated by the old and very young. This represents a very serious obstacle to economic development.

Against this background the Council of An Foras Taluntais decided in 1971 that the overall agricultural situation in Leitrim should be examined. It was realised that much of the information already available was related to situations of the past and was irrelevant in terms of future demands created by E.E.C. requirements. It was also realised that the positive way to progress is through identifying the resources available and, using those, to develop systems based on modern technology and innovation. Having completed an inventory of Leitrim's resources, recommendations could then be made with regard to alternative land-use systems. The objective is to bring about an overall improvement in the welfare of the people of the county, and of the drumlin belt as a whole, to which the results should equally well apply.

The conduct of such a comprehensive resource survey presented a formidable task, demanding the collective efforts of people in a wide variety of disciplines and from a number of organisations. The experience gained on methodology and organisation in the course of two previous resource surveys, West Cork and West Donegal, was of great value. It is hoped that the report of the present survey will go further than the other two in making an economic assessment, from the basic output potential data, of the major alternative land uses, namely, grassland and forestry.

It is a pleasure to be associated with the highly merited acknowledgments given to those within An Foras Taluntais and those outside who co-operated in this survey. Finally, may I commend the efforts of the Working Party who embarked on and completed this task with such dedication and enthusiasm.

T. Walsh,
Director.

PREFACE

The findings of the Leitrim Resource Survey are published in five parts:

- Part I Soils, Grazing Capacity, and Forestry Potential
- Part II Some Aspects of Production — Drainage, Machinery Use, Grass Production and Utilisation, Farm Systems, Animal Health, Fisheries
- Part III Demography, Sociology and Economics
- Part III A Forestry; Economics, Employment and Development Proposals
- Part IV A Programme for Development.

The background and objectives of the study are outlined in the introduction to Part I which deals mainly with the physical resources and their influence on grass production and forestry potential within the county. Part II deals with various aspects of agricultural production. It concentrates on major problems such as land drainage, machinery use on drumlin slopes, grassland production and utilisation, poaching, feed conservation, animal health and fisheries.

Part III concentrates on the demographic structure and social attitudes of the population, together with an analysis of the economics of agriculture. This Section, Part III A, deals with the potential role that a forest industry could play in diversifying land use in the region.

For their assistance in the work reported here, grateful acknowledgment is due to the officers of the Forest and Wildlife Service, to Mr. T. McEvoy; Dr. G. Gallagher and Mr. J. Dillon who co-authored Chapter 7, Part 1; Mr. T. Purcell, and especially Mr. N. Morris, who compiled the data on which the economic calculations in this section are based.

Our thanks are due to the members of the Forest and Wildlife Service in the Leitrim area and also to those private landowners, especially Mr. O'Rahilly, who allowed access to their plantations.

Grateful acknowledgment is also due to Mr. L. Gallagher of the Institute for Industrial Research and Standards and to Mr. F. Jackson, Managing Director of Munster Chipboard for advice on the processing side of the forest industry.

Our thanks are also due to Mr. J. O'Mahony of North Connaught Farmers Co-op and Mr. F. O'Rourke for their interest in the development of a scheme for private forestry.

We also wish to thank all the local organisations and their officers who have co-operated with discussions and advice, especially Mr. J. Martin of the Leitrim County Development Team, and the members of the North Leitrim Development Federation.

The contributions of Messrs. A. Comey and T. Radford for technical assistance and Ms Lena Foley for executive assistance is acknowledged.

Finally our thanks are due to Dr. E. Culleton for editing this Report.

M. J. Gardiner,
Project Leader
An Foras Taluntais, 1978.

Members of the Project Team

Project Leader: Dr M. J. Gardiner, B.Agr.Sc, M.S., *Head*, National Soil Survey Department.

Mr M. Bulfin, B.Agr.Sc, (Forestry), M.E.S., National Soil Survey Department.

Mr P. Broughan, B.Agr.Sc, Agricultural Liaison Department.

Dr D. Collins, M.Agr.Sc., Animal Management Department.

Mr J. Curry, M.A., Rural Sociology Department.

Dr M. Drennan, B.Agr.Sc, M.S., Animal Management Department.

Mr M. Fleming, M.Sc, (Dairying), Dairying Microbiology Department.

Mr L. Grubb, B.A., Hill and Marginal Land Department.

Dr I). Harrington, B.Sc, M.E.S., *Head*, Statistics Department.

Mr B. Hickey, B.Agr.Sc, B.Comm., Farm Management Department.

Mr J. Mulqueen, B.Agr.Sc, M.S., *Head*, Hill and Marginal Land Department.

Dr D. Poole, M.Sc, M.R.C.V.S., *Head*, Field Investigations Department.

Miss M. Prendiville, M.Agr.Sc, Vegetable Crops Department.

Mr B. Stronach, B.A., Game Research Unit.

Mr M. Walsh, B.A., M.Sc, National Soil Survey Department.

Mr E. Pitts, B.Comm. acted as Secretary to the Project Team.

Dr P. Ryan, Deputy Director, acted as Advisor to the Project Team.

INTRODUCTION

M. Bulfin

"The formulation and development of forest policy measures should not be considered in isolation but as part of general land use policy and in harmony with and a contribution to other national and Community policies" (1)

" . . . there are in the Community a large number of agricultural holdings where agriculture is practiced on land which is not suitable or no longer required for this purpose but which is very suitable for forestry" (2)

" . . . forestry is thus an essential complement to the measures already taken to improve agrarian structures and especially to Directive No. 72/160/EEC" (2)

The EEC policy statement and the two extracts from the Draft Directive on forestry above indicate the line of thinking on forestry within the EEC Commission. Such statements are based on the realisation that forestry plays a major role in land use within the Community. Some 20% of all Community land is under forest. Despite this the Community still imports half its total wood requirements at a cost of 10,000 million units of account per annum (1).

In Ireland, native forests were wiped out centuries ago, and no tradition of continuous forestry exists. State forestry, which has had to concentrate on the poorest of mountain and bog land, now accounts for about 5% of the land area of the country. Private afforestation is almost non-existent, due to lack of awareness of forestry, poor timber prices in the past and little encouragement from State sources.

Vet on many areas of poor land, forestry may be the only viable land use system. Over much of the exposed western peats and the high mountain areas, land that is marginal for agriculture is also marginal for forestry. This is not the case with the wet mineral lowland soils. These soils associated with drumlin topography — amounting to 6.8% of the country — while presenting major difficulties for agriculture, have proved to have high yield potential in forestry. The question must therefore be reviewed as to whether forestry can offer a viable alternative land-use system on these soils.

No matter how much agricultural development takes place, the wet drumlin region will remain a difficult area to farm. The wet soils, which respond but poorly to drainage, combined with steep slopes, restrict animal movement and impede mechanisation. These inherent drawbacks of the soil are further complicated by poor farm structure and an ageing population. Even if the demographic problems are solved and farm structure improved the farmer in Leitrim will remain at a disadvantage compared to his more fortunate counterpart on better soils. Thus, in the foreseeable future farming in Leitrim will continue to be more difficult than in other areas. For these reasons, the potential of forestry must be carefully examined.

The difficulties which face the agricultural sector can be contrasted with the

potential of a forest enterprise. The wet mineral drumlin soils can grow Sitka spruce faster than anywhere else in Europe. The maximum potential growth rate of Sitka on these soils is not yet known — it seems to be somewhere above the 30M³ per ha per annum level. However, the growth rates as given in Part I indicate that these soils are capable of producing Sitka spruce at well above the national average rate. The Scandinavian countries, from which we import much of our softwood timber, have average growth rates less than a quarter of those in Leitrim (3,4). Thus if the EEC policy of transferring land marginal for agriculture but suitable for forestry is to be followed the possible contribution of forestry to rural welfare must be examined.

Because many people are unfamiliar with both the current status and future potential of the forest industry, this Section has been compiled to give, not only a detailed analysis of forestry in Leitrim, but also a broad outline of the forest enterprise as it operates in Ireland. Three aspects of forestry, representing its chief contributions to the welfare of a region or country, are dealt with in detail, namely, economics, employment content and the prospects of private forestry.

Since a change in land use, particularly a change to forestry, is a major economic undertaking, the economics of such a transfer have been intensively studied. Secondly, the potential of the total forestry sector to provide employment is of vital importance especially in areas where declining rural population threatens the whole infrastructure of a region. Therefore, details of current employment and projections of future employment are given. Finally because the drumlin areas offer prospects of economic success for private forestry this aspect of forestry is examined. In particular, a method of overcoming the chief drawback of a private landowner transferring his land to forestry, namely the lack of income in the early years, is proposed.

By looking at all sections which make up a forest industry, including planting, harvesting and processing, a more comprehensive view of the impact of forestry on a region is gained. Such a regional approach to forestry becomes more realistic as the volume production from current plantations builds up. In countries where the timber industry is highly developed, the processing plants are located close to the source of supply and this is the pattern which should emerge in Ireland — again reinforcing a regional approach to the location of future processing plants (5).

STATE FORESTRY IN IRELAND

M. Bulfin

Introduction

Details of the high potential for timber production are given in Part 1 of this report. These very high levels of production can only be achieved on a few areas of similar wet mineral lowland soils elsewhere in Ireland. Because of this potential and because forestry offers good future employment prospects, afforestation must be seriously considered as an alternative land use enterprise. This chapter gives some basic information about forestry, its current position nationally, as well as its contribution to local development.

Forestry in Ireland is now very much a state enterprise - active private afforestation is on a very small scale. Because forestry is a state enterprise it operates on a national scale with administration centrally located in Dublin and planning based on national targets. A regional afforestation programme - whether for economic or social purposes - has never really been adopted in Ireland. Despite the recommendations of the Cameron report in the 1950's the movement of State forestry into the twelve western counties was as much an enforced move due to the lack of land for acquisition in the better areas as to greater emphasis of a social nature in forestry (6). The afforestation programme of the past 50 years has touched most parts of the country, but the bulk of planting has been confined mostly to the poorer areas of land.

Awareness of forestry

The forest industry in Ireland, which now employs some 3,000 people on the land in State forests, and a similar number in private industrial enterprise, seems to make a minimal impact on the rural community's awareness. Because the country was almost bare of forests during the 19th and early 20th centuries there has been little tradition of forestry in the Irish countryside. The land tenure system was such that forestry as a long term enterprise, was out of the question. The scattered nature and remote location of most State forests tends to dilute the impact of forestry on any one region. There has been no heavy regional concentration of forestry. County Wicklow, with 15% of its area devoted to forestry, is the most intensively afforested county. If the impact of Bord na Mona on the Midlands is looked at then it is possible to see what the impact of an intensive regional forest industry in the Drumlin area might be.

Awareness of forestry is also hampered because the State is the major afforestation agency in the country. In 1903 a Forestry Branch was set up in the Department of Agriculture and Technical Instruction and this marked the beginning of State forestry in Ireland. Unlike most European countries where private forestry is dominant - (60% of EEC forests are privately owned and a further 20% community owned) - almost 95% of current afforestation is being carried out by State enterprise. In 1974 the total productive woodland area in State hands was some 3.8% of the

total land area of the Republic (total land holding including unproductive areas amounted to 5.0% of total area) (7). This may be compared with other agricultural countries in the EEC all of which have large areas under forest - West Germany (29%), Italy and France (20%) and Holland, which is one of the world's most densely populated countries, has 8% of its land under forest. However, Britain and Ireland are the only EEC countries with major afforestation programmes in progress. In most of the other member States, new planting barely replaces forest areas lost to urban and industrial development (8).

Acquisition Policy

Acquisition policies adopted in the early days of the State persist today. The Irish Government in the annual report of the Minister for Lands for the year 1925-26 stated that "the Department did not desire to acquire for afforestation, land fit for agricultural purposes which might be capable of being used for new holdings or enlarging existing ones. With a view, therefore, to preventing such land being acquired for afforestation, they have fixed a maximum price at such a figure as to render its sale to the Department for this purpose an uneconomic action (7). This policy was acted upon by the Forest Service and became the criterion by which land acquisition for forestry was judged by the agricultural sector of the community. The maximum price policy continued in the Forest Service until 1969. While the maximum price itself gradually moved upwards, it was always such that its original purpose was maintained.

Forestry tended to be seen as the land use of last resort and not as a productive enterprise capable of producing raw material for industrial processing. The effect of the maximum price policy was to confine afforestation to the poorest soils in the country. The Forest Service in the past few decades has made determined efforts to overcome the disabilities of climate and soil in the areas where it had to operate. They have become particularly successful at establishing crops on wet climatic peat. This success has led them to plant increasing areas of blanket peat in the West, and at high elevations in the East and South of the country, in order to meet their planting target of 10,000 hectares (25,000 acres) per year. While attitudes towards land acquisition within the newly retitled Forest and Wildlife Service have changed, with the lifting of the maximum price policy, attitudes at local level in agriculture have remained unchanged. Local opposition to State acquisition of land for afforestation in some parts of the country is still very evident.

Plantation Forestry

Plantation forestry is the type of system used by the Forest and Wildlife Service in Ireland. It offers to the forester a relatively simplified management system with maximum flexibility and control. Because records of all operations are kept, a useful body of knowledge is built up over a relatively short period. Plantation forestry is not a purely mechanical operation. As far as possible the forester adopts an ecological approach to his task by suiting tree species to the site.

Many European countries have inherited natural woodlands, and the silvicultural management system operated is one of felling and regenerating tree species which are both indigenous to their country and which regenerate naturally and easily on clear felled land. No large areas of natural woodland exist in Ireland, thus, afforestation means planting bare land.

Unfortunately, almost all of the native trees in Ireland are hardwoods and would require very long rotations. Therefore, coniferous species must be used as these are normally faster growing. The Forest Service initially used European conifers and

more recently has switched to conifers native to the north-west coast of America. It has been found that foreign tree species, especially conifers from North America, are higher producers of timber than native or European species (3).

Sitka spruce is now the favoured tree on most of the lands acquired by the Forest and Wildlife Service, while any well drained soils are planted with Douglas Fir, or larches. Contorta pine is reserved for the poorest sites, particularly at high elevations and on the western peats. Sitka spruce is the species which gives the highest production under Leitrim conditions and was used as the basis for potential production forecasts for this survey.

Forest management

The management of the State forests is in the hands of trained, skilled, professional land managers. The management section of the Forest and Wildlife Service controls the day-to-day operations in the forest and ensures that forest lands are operated as efficiently as possible. The expertise of State foresters is also available to assist private forestry. It is arguable that new policies or new methods can be implemented with greater speed and efficiency in a unified forest management system such as the Forest and Wildlife Service, than by the more diverse fragmented agricultural sector with its multitude of individual owners. This possibly applies to poor land areas in particular where agricultural management of small farms is often very difficult.

Forest Employment

Forestry is a source of rural employment. Forestry operations require mostly an unskilled and semi-skilled labour force which is the type of employment most needed and most available in rural areas. Forest work and farming have much in common because both are based on outdoor manual work. The transition from farming work to forestry is easy for most of the rural work force. Forestry is one of the few industries which can offer employment to the unskilled and semi-skilled rural worker in his own area.

Improved management and incentive bonus schemes, allied to increased mechanisation, has brought a decline in the level of forest employment - reflecting a similar pattern to that in agriculture. This decline in the forest work force cannot continue indefinitely as the number of workers necessary to maintain a forest increases substantially when trees reach thinning and felling age. As the planting programme has been greater than 8,096 ha (20,000 acres) annually since the 1950's, labour requirements will begin to increase as large areas are now reaching first thinning stage. The Forest and Wildlife Service has also moved into the area of amenity development - an area which will require a considerable amount of labour in preparing the forests for public access.

While rural employment in State Forestry has been decreasing, employment in the private industrial sector (thinning, clear felling, extraction and transportation) has been increasing. Increasing amounts of home produced timber coming on the market means increasing employment in harvesting operations, all of which are carried out by private firms. All this home-produced raw material is being absorbed by the processing industry, which has expanded its capacity and its work-force to handle the extra material. Because the Forest and Wildlife Service does not carry out felling or extraction operations, or deliver to the pulp mills, the employment generated by these operations does not appear in their reports. Nonetheless, extraction and transport are an integral part of forest operations and contribute to rural employment.

Thus, with a forest at full production, for every one man employed in planting and maintenance there would be at least two others employed in felling and extraction, with up to five more employed in the processing industries (Table 13).

On the management side there are around 1,000 people employed by the State, with perhaps 50 to 60% of these jobs in rural areas. Assisting foresters in the management side there is a considerable back-up service of research workers, computer operators, engineers, wildlife specialists, economists and accountants.

Forestry: Indirect Effects On The Economy

The indirect effects of forestry on the economy are harder to evaluate but nonetheless important. Indirect effects include inter-industry demand that is created directly by the forestry sector as well as the multiplier effect of forest industries on the entire economy. Forestry in other countries has always been considered a propulsive sector of the economy, investment in forestry also inducing an impetus in other branches of the economy (9, 10). Forest industries have a very strong forward linkage—a good starting point for industrial growth. In the home-grown timber industry at the moment there are some 4,000 people (between management and field operatives) employed in the State forests and another 3,000 to 4,000 working in extraction, transport, processing and manufacturing. As our current home production of raw material is but one sixth of our total consumption of timber products there is obvious room for expansion both of home production and employment (11).

Contribution To Amenity

Forestry also adds to certain areas by enhancing the landscape. The opening of forest lands to the public has provided an extra dimension to the recreation facilities of the countryside. While rural dwellers might question the amenity value of forestry, the use that is made of the forest by urban dwellers and foreign visitors leaves one in no doubt that forests have a high recreational value (12). The current emphasis of the Service on the wildlife and amenity aspects of forestry shows an astute awareness of these facts. Increased amenity value means increased tourist income in an area (Lough Key Forest Park near Boyle, County Roscommon is a good example - between June 1973 and December 1974 there were 325,000 visitors).

Diversification Of Regional Land Use

An afforestation programme means increased diversity in a region. This diversification of rural land-use, particularly if there is a definite policy to this effect, can provide some counterbalance to the economic problems in the agricultural sector. It was noticeable that during the recent agricultural recession of 1974 - 75 it was the farmers on the poorest soil areas - those lands in most contention for forestry - who fared worst. If the small farmer owned his own woodlot, as is commonly the case in Scandinavian countries, then he would be able to compensate for his reduced income from agricultural sources by increasing output from the woodlot (13). Employment from state forests could also be a source of employment for part-time farmers.

Forestry has many direct or indirect benefits some of which are external to forest economics and some to all market appraisal and, therefore, difficult to evaluate. Thus a distinction must be made - or at least attempted - between a financial appraisal (in terms of monetary returns in the short run or to special groups) and a total benefit appraisal (in terms of both short and long term returns to all the people affected) (9). Gifford Pinchot the founder of forest management in the United States, propounded the ideal that natural resources, such as forests, should be managed for the "greatest good to the greatest number for the longest time" (14). This principle

has led American forestry out of its exploitive phase into one of long-term management with renewal of felled areas to provide a varied mixture of benefits. While our forests are more limited in their uses than their American counterparts, they are capable, however, of providing a number of ancillary benefits, while at the same time fulfilling their principal role of raw material production.

The Xatwnal Forest

The present capital value of State forests is estimated to be between £300 to £400 million. This forest estate has been built up gradually over the past fifty years. In 1972-73 State expenditure by the Forest and Wildlife Services amounted to some £7.73 million of which some £5.44 million, or 70% of the gross total, was for salaries and wages. Much of this went to rural areas. Tou^ forestry expenditure by the Exchequer has risen from £3.3 million in 1963 to £7.7 million in 1972 (7). The relationship between the Gross National Product and the percentage of it spent on forestry has, however, remained within very definite limits, ranging between 0.35 and 0.39% of G.N.P. over the last 10 years (15).

Income to the Forest Service over the same period has risen from £0.5 million to £1.4 million per annum. During all of this period the bulk of sales (90% in 1973) was of standing timber. Considerably higher revenue figures would be obtained were the Forest Service to do its own felling and extraction to the roadside. But their policy has always been to sell timber standing and thus the apparent return to State forestry, both financially and in employment, are not a true reflection of the total impact of forestry on the national economy.

(irnwth Rates

The average growth rate of Irish and British conifer forests are substantially better than those in Europe. Average yields of timber per hectare of most EEC countries are only about two thirds of what they are in Ireland or the UK. Yields from the Scandinavian forests - a major supplier of wood products to this country - are only about a quarter of what Irish forestry is currently achieving. Similarly, only the most productive forests in the United States equal or exceed current Irish production levels. The mean Yield Class (YC) for the main conifer species in Ireland is between YC 14 and 16 ($M^3/ha/annum$). The mean Yield Class for Sitka spruce, which in 1974 occupied 64% of the national planting programme, is 14.7 M^3/ha (16). A recent study has indicated that this figure may be an underestimate (17). Thus, average productivity per hectare under Irish forest conditions is greater than that of the countries which now supply us with timber products.

FORESTRY IN LEITRIM

*M. Bui fin**Extent*

There are seven State forests in county Leitrim with a total area of 11,400 ha (28,158 acres). Not all of this area is planted as some is in the plantable reserve and over 1,300 ha (3,211 acres) are classed as unplantable (Table 1). State afforested land, which totals 10,094 ha (24,932 acres), accounts for 6.4% of the total county area. Private forestry probably accounts for another 1,000 ha (2,470 acres) at the most.

TABLE 1: State forests in Leitrim, 1974

Purest land		Planted		Plantable reserve		Implantable		Total area	
Ha	(Acres)	Ha	(Acres)	Ha	(Acres)	Ha	(Acres)	Ha	(Acres)
10,094	(24,932)	8,979	(22,178)	1,115	(2,754)	1,306	(3,226)	11,400	(28,158)

Source: Report Forest and Wildlife Service. Minister for Lands. 1974.

Acquisition of land

Acquisition of land in the drumlin areas is hampered by the small sizes of the parcels of land becoming available. It has sometimes proved uneconomic to buy areas of good forest land because of the high cost involved in fencing and ground preparation. The expenditure on a per ha basis in such a situation may be uneconomic. If, however, it is known that major acquisition is intended for an area then it may be possible to "bank" or let these small blocks of land until they can be amalgamated by future purchases. This approach would offer definite savings in the initial stages of acquisition.

Morris states that since the late 1950's "some 65 persons (each year) voluntarily offered to sell land for afforestation (in Leitrim). On average, each year 29 of the areas concerned were ultimately purchased". The average size of each area purchased was around 12 ha (30 acres) (18). However, in recent years the pattern of land acquisition has fluctuated considerably (Table 2). The increased acquisition of 1970-71 was the result of a directive of the Minister for Lands in 1969 to acquire and plant land in Leitrim. The rate of acquisition subsequently dropped and has remained low in recent years, possibly due to the rapid increase in land prices since accession to the EEC.

Production

The projected production figures for Forest and Wildlife Service plantations are shown in Table 3. The volume of timber extracted is expected to rise from 6,273 m³ in 1975-76 to 38,433 m³ in 1990-91, a 600% increase. A further increase in total output can be expected in the 1990's as current plantations reach maturity. (16).

TABLE 2: Land acquired for afforestation in County Leitrim, 1969-1976

Month	1969	1970	1971	1972	1973	1974	1975	1976
	acres							
Jan.	31	57	71	99	31	53	32	—
Feb.	—	4	336	73	93	—	—	—
Mar.	32	154	327	146	68	476	46	1
Apr.	23	73	—	115	—	—	12	—
May	—	92	136	51	2	—	52	—
June	68	—	143	—	8	27	—	17
July	45	—	146	33	42	4	82	—
Aug.	4	34	139	20	21	—	9	22
Sept.	206	65	77	50	3	12	11	—
Oct.	156	57	137	94	—	3	222	NA
Nov.	—	60	67	—	127	159	115	NA
Dec.	156	923	125	52	—	23	110	NA
Total	721	1,519	1,704	633	395	757	691	51

Source: Ir. Stat. Bull. Qr., C.S.O.

TABLE 3: Projected production from Forest and Wildlife Service plantations, county Leitrim 1975/76 — 1990/91

Year	Pulp	Top diameter greater than 18 cm	Total
	M ³	M ³	M ³
1975-76	4,542	1,731	6,273
1976-77	4,687	1,334	6,021
1977-78	6,021	1,514	7,535
1978-79	6,995	1,695	8,690
1979-80	8,689	1,911	10,600
1980-81	10,275	2,163	12,438
1981-82	12,366	3,714	16,080
1982-83	14,386	4,002	18,388
1983-84	16,693	4,218	20,911
1984-85	18,928	4,579	23,507
1985-86	21,092	4,975	26,067
1986-87	23,291	6,490	29,781
1987-88	25,671	7,031	32,702
1988-89	27,545	7,607	35,152
1989-90	28,699	8,220	36,919
1990-91	29,528	8,905	38,433

Source: (16)

Finance

In 1976 the Forest and Wildlife Service invested £0.33 million pounds in the county. Some 75% of this was in the form of wages and salaries. A further £34,500 was paid directly to Leitrim County Council as a grant towards rates. Morris estimates the current value of the Leitrim plantations at around £10 million, which he admits is a conservative estimate (18). Since much of the plantations have not even reached thinning stage yet, the eventual value of these plantations will be considerably greater.

Afforestation in Leitrim

Plantation forestry on the lowland soils in Leitrim would face no unusual silvicultural problems. The current public road system, designed for a much larger population, makes primary access to most areas readily available. The short steep slopes and low bearing capacity of the soil may pose some problems for machine trafficability, mostly at the harvesting stage. However, intensive mechanical preparations, such as deep ploughing, of the planting site would not be necessary. Light agricultural ploughing or mound planting would probably prove most successful on these lowland mineral soils. It may, in fact, be necessary to avoid all forms of ploughing to minimise windthrow. Once established, the trees move rapidly out of the stage when they are affected by competing ground vegetation.

No major nutritional problems are envisaged in the drumlin area because the soils are sufficiently fertile for forestry. Observations made during the survey on forest potential in Part 1 showed distinct differences between the response of trees to the previous agricultural usage of the land. The best growth was found on old field systems, intermediate growth rates on rough grazing areas while the poorest growth was recorded on open mountain land. This result was regarded as due partly to fertility built up by agricultural usage as well as to intrinsic soil differences.

Rotation Length

With establishment, management and harvesting offering no serious problems it is possible to look at the economic potential of an intensive afforestation programme in this area. The most significant fact about forestry in Leitrim is the rapid growth rate achieved by Sitka spruce. Growth rates on the wet mineral lowland soils are above those achieved elsewhere in Ireland and, indeed, well above comparable European situations.

Rapid growth rates allow the forest manager a wider spectrum of management decisions regarding rotation length. Long term rotation (35 to 45 years) may be used, giving a mix of pulpwood and saw-timber. However, Leitrim offers an excellent opportunity for the forester to use short (25 years) rotations. The effects of such shortened rotations have recently been under consideration by the Forest and Wildlife Service.

The quality and strength properties of large-sized sawtimber is influenced by the growth rate of the tree in the forest (indicated by the number of annual growth rings per cm). Faster grown timber tends to have less strength than slower grown timber. However, this factor is only of importance in structural timber. Also, with the advent of stress-grading in the sawmilling industry, timber is being graded on its actual strength rather than on visual properties which were indicative of strength. Strength properties are not so vital in the smaller sizes of sawtimber, nor are they important in the particle board industry. The forest manager can choose which mix of rotation lengths will best serve his own local market.

Short rotations have an effect on the financial return from forestry because the

earlier harvesting can begin, with its consequent rapid increase in income, the more profitable it makes forestry. Short rotations reduce the period over which the interest on establishment costs are carried. These interest charges arise because the major costs of afforestation occur at the beginning of the rotation while the main financial returns occur at the time of felling. Thus, in calculations of economic feasibility, initial costs must be charged at compound rate until the end of the rotation or, alternatively, receipts from thinning and felling must be discounted back to the time of planting (see next chapter). Obviously the level of interest rate used is also important, as the higher the rate the less profitable forestry appears to be.

Forestry and Amenity

The scenic attractions of Leitrim have been greatly underrated. Both its lakeland scenery in the south of the county and its mountains and lakes in the northern part have much to offer the tourist. Forestry can make a major contribution to the landscape, particularly to the drumlin and lakeland areas. The effects of forestry on similar landscape can be seen at Killeshandra Forest where a Forest Park is in preparation. Examples of forestry's contribution to the landscape can be seen in Leitrim at Garadice Lake, Jamestown and Glenfarne forest on Lough McNea. The pursuit of a major forest programme, particularly on drumlin areas, should greatly enhance the tourist potential of the whole county.

ECONOMICS OF FOREST PRODUCTION IN LEITRIM

B. Hickey and M. Bulfin

In considering the place of forestry in the development of county Leitrim a number of economic aspects must be looked at. Firstly, forest production can be considered for its attractiveness as an investment proposition. External effects of forestry on other sectors of the economy must also be considered. Secondly since provision of employment is a major consideration in developing the county, the effect of forestry on both short and long-term employment must be considered and this aspect is treated separately. Thirdly, the best strategy for the development of forestry within the county must be decided on, e.g. which soils should be given priority for planting, whether short or long rotations should be followed, what part private forestry should play in development and how private planting might be encouraged or developed.

Any expansion of forestry in the county will mean the replacement of existing agricultural production by forestry. This means a reduction in agricultural output, or if agricultural production is to be maintained then agriculture in other areas will have to be intensified. The effect of planting on agricultural output will differ depending on the soil type planted. Thus planting of wet mountain land would cause only a slight lowering of agricultural output while planting some of the better lowland areas would cause a much greater drop in output. From a strictly economic point of view then a particular piece of land or soil type should be afforested where the prospective net revenue, i.e. value of output less all relevant costs, is greater than that from the present agricultural activity. The economics of forestry can be looked at strictly from the point of view of the planting agency, whether it be the Forest and Wildlife Service, Department of Lands. or the private forester, without considering any external effects.

As has already been said a decision to plant a particular area should be based on the prospective net revenue i.e. value of output less all relevant costs of forestry as with that of the relevant agricultural enterprise or enterprises. In the case of a planting agency the relevant costs are those incurred by that agency, whether it be the state or the private planter. Here we examine state forestry since the state is responsible for the vast bulk of total forestry. Forestry and agriculture are compared at 1973 price levels.

Agricultural Data

The main land using farm enterprises in Leitrim at present are dairying combined with store cattle production and single suckling on the lowland and lower mountain areas with sheep production on the hill and mountain areas. Estimates of the level of production for dairying and single suckling in Leitrim were derived from those Leitrim farms participating in the Farm Management Survey in 1973. In the case of mountain sheep, due to the small numbers from the county participating in the survey, returns are based on the generality of Hill and Mountain flocks participating in the Farm Management Survey in 1973. The levels of output, costs and net revenue per livestock unit for 1973 are shown in Table 4. It should be noted that subsidies such as Beef Incentive Payments and mountain lamb subsidies are excluded from output since these represent transfer payments rather than revenue derived from the sale of produce. On the cost side annuities and rates are excluded since these costs are not related to the production process

TABLE 4: Financial returns (£) from livestock systems in Leitrim at 1973 prices.

	Dairy enterprise	Store cattle	Dairying and store cattle	Suckling	Sheep
<i>Per L.U.</i>			(Per L.U.)	(Per L.U.)	(Per ewe)
Gross output	122	72	91.5	54	5.5
Direct costs	19	27	17.5 ²	9	0.5
Gross margin	103	45	74	45	5
Overhead costs ¹			12	6	1
Farm income			62	39	4
Headage payments			—	6	1.4
Farm income less headage payments			62	33	2.6
Investment per L.U.			150	150	60
Standard man days	18	5.5	12	3.5	.6
Labour days @ £4.9 per S.M.D.			59	17	2.9
Income less labour costs			3	16	-0.3

¹Overhead costs include machinery costs, car, electricity, interest payments and miscellaneous.

²Direct costs of combined dairying and store cattle system is lower than that from either system alone due to wholeroilk fed to calves.

Source: An Foras Taluntais: Farm Management Survey.

Neither is rent of conacre charged since this is a cost of acquiring land and is a transfer within agriculture rather than a production cost. All labour charges are also excluded initially for two reasons. Firstly, practically all the labour consists of unpaid family labour and no well-defined market exists for labour in the county. Secondly, the records of labour on the farm are of labour available rather than of labour required, and as was seen in Part III, there is considerable underemployment of labour on many farms.

The main items of overhead costs included are machinery depreciation, tractor fuel, machinery repairs, depreciation of buildings, together with that portion of car, electricity and telephone charges appropriate to the farm as distinct from that used for domestic purposes.

Revenue per Livestock Unit

Table 4 shows that the highest level of net annual revenue per livestock unit was generated by the dairying and store cattle system at £62, as against £31.5 for the suckling system and £12 per livestock unit from mountain sheep.

The higher level of returns being generated by dairying is not due to a high level of production from dairying. As has been pointed out in Part III, the general level of milk yields has been consistently low in farms surveyed, with an average of only about 370 gallons per cow in 1973. Rather is the higher level of returns from dairying due to the ability of the enterprise to generate consistently higher returns than cattle or sheep.

It is also worth noting that for any of the enterprises or systems of farming mentioned there is a wide variation in the level of returns being generated by individual farmers. Some farmers are earning returns far greater than the average, while others on similar soils are earning incomes well below average levels from the same system of farming. The technical potential of agriculture is much greater than the average level of production and returns as given in Table 4. However, afforestation in Leitrim is likely to replace extensive rather than intensive agriculture.

Production Data for Forestry

Data on forest production and costs were supplied by the Forest and Wildlife Service. They are based on a survey of forests in the county. These data relate to five different site types with different tree growth rates and levels of costs. The site types and yield classes are:

- 1) Drumlin, Yield Class, (YC) 25
- 2) Rolling Hill and Lower Mountain, YC 20/22
- 3) Interdrumlin Peats, YC 20
- 4) Basin Peats, YC 18
- 5) Peaty Gleys and Climatic Peats over 244m, YC 14.

The growth rate of trees on the different sites varies considerably. The lowest yield classes (YC 14) occur on the Peaty Gleys and Climatic Peats on the mountainous area over 244 m. Very high yields (YC 25 and over) were found on the wet drumlin areas of the county. The average yield class of the county, excluding unplanted areas and water, has been estimated as yield class 22 at yield of maximum mean annual increment at full rotation. This yield of maximum mean annual increment is reached with a rotation of 45 years in the case of yield class 25 and at 55 years in the case of yield class 14. Timber yields were based on the British Forestry Commission, Management Tables, using the Normal Yield Tables for Sitka spruce, less 20% to allow for roads ridges and gaps as well as for crops burned, blown etc.

Estimates of revenue and costs for forestry are at 1973 price levels. It should be noted that the revenues and costs shown for forestry in the succeeding tables are for the sale of timber 'on-root' i.e. standing. The Forest and Wildlife Service sells standing timber to private timber merchants. These merchants fell, extract and haul the timber to the mills or processing point and resell it. At the mill or other point of consumption the value of the timber would be 2 to 3 times greater than its standing value.

Forestry Costs

Labour costs per ha are derived from estimates of the number of standard man hours required to perform each operation on the different site types. A standard man hour was then costed as shown in Table 5. As in the case of agriculture, rates have been excluded from forestry costs.

Table 5: Standard man/hour (S.M.H.) components 1973

	£.
Basic pay	0.52
Bonus pay	0.10
Holiday, sick leave or compassionate leave pay	0.07
Social Welfare Insurance	0.02
Differential pay for leading workers	0.03

1 Standard man hour	£0.74
---------------------	-------

Sorce Forest and Wildlife Service

In a similar way to labour costs, machine costs were derived on the basis of machine type and number of standard machine hours required for the different operations. The standard machine hour costs include fuel, repairs and depreciation costs.

(Overhead costs include salary, travelling and subsistence allowance of wholetime forester staff and inspectorate staff. Also included are office costs, lighting, heating and maintenance. The overhead costs are allocated on an annual acreage basis.

It should be noted that costs of buying or procuring land are not included since for the purposes of comparison with agriculture the value of the land is not relevant. Details of revenues and costs for the different site types are given in the appendix.

Financial Returns from Forestry

Table 6 sets out a summary of revenue and costs per ha for each of five site types, at constant prices, with the sale of standing timber. These show that the level of costs does not differ greatly between the site types, with the exception of the basin peats, where costs are higher due to higher material and labour costs. The main differences between sites then are due to differences in yield of timber. The Yield Class affects the gross revenue per rotation, which increases from £3,908 per ha in the Peaty Gleys and Climatic Peats (over 244 m) up to £7,075 on the Drumlin site types. In addition, rotation lengths are shorter on the high yielding drumlin soils, with maximum mean annual increment being reached at 45 years as against 55 years on the Peaty Gleys and Climatic Peat site type. This difference in rotation length leads to increased differences in returns per annum. The net annual revenue then, after deducting overhead costs, on the Drumlins at £144 per ha, compares with £59 per ha on the (Climatic Peat site type, with the other site types occupying intermediate positions, as shown in Table 6.

Effect of Discount Rate on Forestry Returns

(One of the basic characteristics of forestry is the long-term nature of the production cycle. With drumlin sites, the first thinnings are harvested 15 years after planting with final felling taking place 45 years from the time of planting. This extensive period between planting and harvesting is even greater for the lower yielding sites with first thinnings taken at 20 years and final felling 55 years after planting. By contrast agricultural production cycles are short, ranging from less than one year in tillage, dairying or pigs to two or three years in a complete calf to beef system. Most of the costs in forestry occur at time of establishment while revenue is not generated until the thinning and harvesting stages.

In investment appraisal expected future revenues and expenditures are usually discounted. This discounting makes their value in present money terms less than

Table 6: Summary of revenue and costs per ha of forestry on five site types in Leitrim

	Drumlin	Rolling Hill and Lower Mountain	Inter-drumlin Peats	Basin Peats	Peaty Gleys and Climatic Peats over 244m
Yield class m ³ /ha/annum	25	20/22	20	18	14
Rotation length (years)	48	50	50	50	55
<hr/>					
Per Hectare (£)					
Gross revenue	7,074.5	6,367	5,951.8	5,024	3,908
Operating costs					
Machine costs	21.85	26.0	14.96	13.97	31.91
Materials cost	111.93	97.0	118.48	151.12	117.88
Cost of machine operators	11.55	13.72	7.90	7.30	14.49
Labour cost	217.72	221.32	225.24	262.76	224.45
Total operating costs	363.05	358.04	366.58	435.15	388.73
Gross revenue less operating costs per rotation	6,711.45	6,009.00	5,585.40	4,588.85	3,519.37
per annum	149.10	120.0	111.70	91.80	64.00
Overhead costs per annum	5.00	5.00	5.00	5.00	5.00
Net annual revenue per annum	144.1	115.2	106.70	86.80	59.00

Source: Forest and Wildlife Service
 Witli sale of timber standing.

their expected value. The main reasons for discounting future revenues and expenditures are (1) alternative uses of money or assets (2) uncertainty (3) and preference for present as opposed to future benefits or returns.

One reason that a pound in hand is more valuable than a pound to be received a number of years from now is that the pound in hand today can be invested, thereby earning more money in the intervening period.

A second reason for preferring today's money to money generated in future is uncertainty on the likelihood of change. Tastes change with time, products become obsolete while new uses may be found for existing materials.

A third reason for discounting future revenue is a preference by people for immediate rather than postponed consumption. This time preference differs for each person and also differs between different items of consumption i.e. people might be willing to postpone consumption of what are regarded as non-essentials but not of essential goods or services.

Although all the above are reasons for discounting future revenues and costs the question remains as to what is the appropriate rate of discount to use. This will vary with the investor and the riskiness of the investment project. In this context it is important to distinguish between real and nominal interest rates. Nominal rates of interest must be adjusted to allow for the rate of inflation in order to arrive at the real interest rate. The returns from forestry, because of the long-term nature of the production cycle, are much more sensitive to the rate of discount than are agricultural returns.

The real rate of return which investors realise can only be decided after the investment has come to fruition and the rates of inflation and taxation are known. Merrett and Sykes, examining British interest rates from 1919-1963, found that the real rate of return after tax on fixed interest securities changed drastically after World War II so that the average real rate of return for 1919-1963 was negative (19). The average real rate return on equities over the same period was 5.8% The Morgan Guaranty Survey found that in one extended period of price stability inside the last century of which there are good records of both rates and prices, i.e. the latter half of

tin* nineteenth century, long term British issues fluctuated around 3% for securities involving virtually no risk (20). Klemperner quotes a number of sources to show that real returns to capital in the U.S.A. have historically been fairly stable within the 3% to 6% range. He states that "once we eliminate inflationary effects, historical real returns to invested capital in the U.S.A. are clearly not so impressive as many businessmen might like to believe. Forestry need only earn real after-tax rates in the 5 to 6% range to remain competitive" (21).

Although no single unique rate can be adjudged to be the relevant discount rate for forestry, the foregoing would indicate that an appropriate rate would be in the 3 to 6% range.

Table 7 shows the effect of discount rates varying from 0 to 10% on the level of returns per ha per annum for the different site types in Leitrim, using the revenues and costs supplied by the Forest and Wildlife Service. The levels of net annual revenue shown are for 1973 and are, as before, based on the sale of standing timber, with deduction of overhead costs of £5 per ha per annum.

TABLE 7: Effect of discount rates on annual revenue (£) per ha of forestry for five site types in Leitrim, 1973

Discount rate %	(1) Wet Drumlin	(2) Rolling Hill and Lower Mountain	(3) Inter Drumlin Peats	(4) Basin Peats	(5) Peaty Gleys and Climatic Peats over 244m
	Yield Classes 25	20/22	20	18	14
0	144	115	107	87	59
1	118	91	84	67	44
2	94	53	47	35	20
3	74	53	48	35	20
4	57	38	34	23	11
5	43	26	23	13	3
6	31	16	13	4	-4
7	21	8	6	-3	-8
8	12	1	-1	-9	-12
9	5	-4	-6	-6	-15
10	-1	-9	-10	-19	-19
Breakeven discount rate %	9.8	8.2	7.9	6.6	5.4

The effect of increasing interest rate on the level of net annual revenue is considerable especially at the lower rates of interest (Table 7). Increasing the discount rate from 0 to 1% reduces net annual revenue by £26 per ha on the Wet Drumlin site type from £144 to £118. At higher discount rates, the effect of increasing the rate is much less, so that going from an 8 to a 9% discount rate reduces the net annual revenue by £7 per ha, from £12 to £5. The effect of increasing the discount rate is also less, in absolute terms, on the lower yielding than on the higher yielding sites. Thus an increase in the discount rate from 4 to 5% reduces the net annual revenue per ha by £14 in Wet Drumlin, as against £8 in the case of peaty gleys and climatic peat. The main reason for this difference however is the higher level of net annual revenue on the higher yielding Wet Drumlin site type.

Break-even discount rates for the different site types are also given in Table 7. The break-even discount rate is that rate of interest which equates revenue and ex-

penditure. The break-even discount rate goes from 5.4% in the Peaty Gleys and Climatic Feat site type up to almost 10% for the wet drumlins. It must be borne in mind that land cost and rates are not included as costs in arriving at the break-even discount rate. Rates in 1973-74 amounted to just under £3 per ha on the land planted by the Forest and Wildlife Service. The amount of rates would, of course, differ for the different site types.

I nine of Ijind for Forestry

An alternative way of evaluating discount rate is to consider its effect on the value of land for forestry. The value of land for forestry can be estimated by capitalising the net annual revenue i.e. it is the present value of the net annual revenues as given in Table 7 capitalised over 50 years which roughly corresponds with one rotation period. The figures are shown in Table 8, rates have been excluded from costs. On the credit side the land would have a terminal value at the end of the rotation as would roads constructed in the course of a rotation, and these are not included in the present value. The choice of a common 50 years for all site types was made in order to make them comparable, despite differences in rotation length.

At the very low rates of interest, the levels of net present value are very high in comparison with the prices of agricultural land prevailing in 1973. However, because of the very pronounced effect of discount rate on forestry, the levels of net present value decline rapidly with increasing discount rate. The level of net present value can be looked on as indicative of the relative values per ha of the different site types for forestry. Thus at a discount rate of 5% the net present value (N.P.V.) of the Wet Drumlin site type is £318 per 0.4 ha (acre) while the value of the peaty gley and climatic peat site type is only £22 ha 0.4 ha (acre) at constant 1973 prices. Increasing the discount rate to 6% reduces the N.P.V. of the drumlin to £198 per 0.4 ha. (acre) and that of the peaty gley and climatic peat becomes negative. A negative N.P.V. implies that the site is valueless for forestry at that interest rate and using the prices given.

Planting decisions should take into consideration the value of the land in its alternative use i.e. its value in agriculture. However, before evaluating the land in agriculture, some of the other factors influencing forestry returns must be considered.

TABLE 8: Net present value £ per ha (acre) of forestry for five site types in Leitrim capitalised over 50 years.

Discount rate %	Wet Drumlin	Rolling Hill and Lower Mountain	Inter drumlin Peats	Basin Peats	Peaty Gleys and Climatic Peats
	Yield Class 25	20/22	20	18	14
0	2914 (2100)	2327 (5750)	2165 (5350)	1760 (4350)	1194 (2950)
1	1872 (4625)	1444 (3567)	1332 (3292)	1063 (2626)	698 (1725)
2	1195 (2954)	890 (2200)	814 (2011)	636 (1571)	394 (974)
3	771 (1904)	552 (1364)	489 (1209)	364 (900)	208 (515)
4	495 (1224)	330 (816)	295 (730)	200 (494)	96 (236)
5	318 (785)	192 (475)	170 (420)	96 (237)	22 (55)
6	198 (489)	102 (252)	83 (205)	25 (63)	neg.
7	117 (290)	45 (110)	34 (83)	neg.	neg.
8	59 (147)	5 (12)	neg.	neg.	neg.
9	22 (55)	neg.	neg.	neg.	neg.
10	neg.	neg.	neg.	neg.	neg.

Figures in brackets are net present values per acre.

Timber Price

The British Land Use Study Group Report of 1966 pointed out that there had been a long-term tendency for forestry prices to improve relative to other products, and that over the past 50 years standing timber prices had risen relative to agricultural prices by up to 2% per year in Northern European countries (22).

Table 9 shows the effects of an 0.5 and 1% per year increase in the real price of standing timber on the net annual revenue from forestry. At a 5% discount rate a real price increase of 0.5% per annum would mean an extra £12 per ha N.P.V. on Wet Drumlin, declining to £5 per ha on the Peaty Gleys and Climatic Peat sites. At 1% per annum relative price increases, the extra returns would be £26 and £12 for the two site types respectively. The effect of the relative price increases is greater the lower the discount rate.

It must be borne in mind, however, that a 1% per annum relative price increase implies a 64% increase in the real price of the commodity over 50 years, or one rotation. Such trends may, however, be valid over shorter rotations. Any commodity which continues to increase in real price over a long period must have its competitive position eroded as compared with other commodities. Although timber prices have increased relative to agricultural prices in the past, this trend may not continue at a corresponding rate into the long-term future.

Rotation length

The revenues and costs of forestry in Tables 6 to 9 are based on a rotation of maximum mean annual increment for each of the five site types. This rotation has the advantage of being the one which results in the maximum amount of timber production over time. It has certain drawbacks however. One of these is that the planting agent, whether it be the state or the private forester, has to wait a long time for the revenue from sale of timber. Most of the revenue is generated at the end of the rotation, when final felling takes place, after 45 to 55 years depending on the yield class. This long waiting period is more serious in the case of the private individual and can largely explain the low level of engagement in private forestry in the country.

Another aspect of the long-term nature of forestry rotation is concerned with employment, as shown in Chapter 5. The level of employment generated in the establishment and maintenance of forests is very low at less than 1 man per 200 ha (520 acres). By contrast, considerable employment is generated in felling and extracting at one man per 46 to 84 ha (113—207 acres) depending on the Yield Class of the forest.

The processing of the wood as an even greater employment content at one person per 18 to 30 ha (45—75 acres), again depending on yield class, with the higher yield class forests generating greater levels of employment. The latter sources of employment, namely felling, extracting and processing, account for over 90% of total employment and come at the end of the rotation. Total employment at full production ranges from one person per 12—20 ha (31—51 acres). Forestry would not be able to provide on-the-land employment for all those whose land is acquired for planting. Forestry then with rotations of maximum mean annual increment can only play a part in alleviating unemployment in the long-term, while in the short-term it may even have an unfavourable affect on employment. However, rationalisation of farm structure and the creation of 32 ha (80-acre) farms would also reduce the number employed on the land.

To bring forward the generation of revenue and the provision of employment in felling, extracting and processing the length of rotation can be shortened at the expense of an overall reduction in the amount and unit value of timber produced.

TABLE 9: Net annual revenue per ha (f) at 0, .5 and 1% per year real increase in standing timber prices

Site type	r'											
	price increase	Discou rit rate (%)										
	0	1	2	3	4	5	6	7	8	9	10	
Wet Drumlin	0	144	118	94	-4	57	43	31	21	12	5	-1
	.5	179	147	118	93	-2	55	41	2*	18	10	3
	1	223	182	147	116	91	69	52	37	25	16	8
2) Rolling Hill and Lower Mountain	0	115	91	70	53	38	26	16	8	1	-4	-9
	.5	148	117	91	69	50	35	23	13	5	-1	-6
	1	188	150	116	89	66	47	32	20	11	3	-3
(3) Inter Drumlin Peat	0	107	84	64	4	^4	2}	13	6	-1	-6	-11)
	.5	137	108	84	63	46	12	20	11	3	-3	-x
	1	175	139	108	82	60	43	29	17	8	1	-5
(4) Basin Peats	0	112	88	66	48	33	20	10	-3	-9	-15	-19
	.5	145	113	86	64	45	29	17	7	-1	8	-15
	1	188	150	116	89	66	47	32	20	11	3	-3
(5) Peaty Gieys and Climatic Peat	0	59	44	31	20	11	3	-4	-8	-12	-16	-19
	.5	-9	59	43	29	18	8	1	-5	-10	-14	-17
	1	105	80	58	41	26	15	6	-1	-12	-16	-17

Short rotations are most relevant in the higher yielding sites such as the Wet Drumlin and Rolling Hill and Lower Mountain area. Table 10 shows the effect on net annual revenue per ha of shortening the rotation by up to 30 years in the case of these two higher yielding site types. As can be seen the rotation of maximum mean annual increment gives the highest level of net annual revenue at the lower rates of discount. This rotation of maximum mean annual increment is 45 years in the case of the Wet Drumlin site type and 50 years for the Rolling Hill and Lower Mountain site type. However, the longer rotations are more sensitive to increasing discount rate. Thus, in the case of the Wet Drumlin site type the difference between the 45 and 35 year rotations becomes progressively less as discount rate increases, until the net annual revenues for the two rotations are equal at a discount rate of 6%. At discount rates in excess of 6% the 35 year rotation has a slight financial advantage over the longer 45 years' rotation. The net annual revenue is still positive at the 10% discount rate with a 35-year rotation, although it has become negative with the 45-year rotation. However, there is little difference between the 25-year rotation and the longer rotation at the higher rates of discount.

The rate of discount has little effect on net annual revenue with a 15-year rotation. Because of the low level of timber production with this rotation length, and consequent low level of revenue, net annual revenue is negative at all discount rates above zero.

The trends in revenue are the same for the Rollins; Hill and Lower Mountain site types as for that of the Wet Drumlin. In this case a 40-year rotation gives the same net annual revenue as a 50-year rotation at a 6% discount rate, while a higher discount rates the 40-year rotation is financially superior.

Higher rates of discount then would favour a shortening of the rotations so that at a discount rate of 6% or greater a 35-year rotation is at least as attractive financially as the rotation of maximum mean annual increment (45 years) on Wet Drumlin soils. Similarly in the case of the Rolling Hill and Lower Mountain site type a 40-

TABLE 10: Net annual revenue (£) per ha of forestry with shortened rotations

Discount rate	(1) Wet Drumlin (YC 25)					(2) Rolling Hill and Lower Mountain (YC 20—22)			
	Rotation length (yrs)								
(%)	45	35	25	15	50	40	30	20	
0	144	115	57	1	115	93	54	11	
1	118	96	49	-1	91	75	45	8	
2	94	80	42	-3	70	60	36	5	
3	74	65	35	-5	53	47	29	2	
4	57	52	28	-7	38	35	22	-1	
5	43	41	22	-9	26	25	15	-3	
6	31	31	16	-11	16	16	10	-6	
7	21	22	11	-12	8	9	5	-9	
8	12	14	6	-14	1	3	0	-11	
9	5	8	2	-16	-4	-3	-6	-13	
10	-1	2	-2	-18	-9	-7	-8	-15	

year rotation would be favoured at the higher discount rates in preference to a 50-year rotation.

Table 13 (Chapter 5) shows that there is little difference in overall employment content between a 45-year and a 35-year rotation at Yield Class 25. With Yield Class 20/22, a 40-year rotation provides more total employment than a 50-year rotation. Rotation length, however, has a major influence on the timing of employment. As can be seen from Chapter 5, roughly 70% of total employment in forestry is provided by processing, with a further 20% coming from felling and extraction. Hence shorter rotations bring forward the attainment of maximum employment. Consequently, from the employment point of view, rotations of 35 to 40 years are preferable to those of 45 to 50 years on the higher yielding sites.

A rotation of 25 years on the high yielding Wet Drumlin (YC 25) is not as attractive financially as a 35-year rotation and would lead to a reduction of 21% in total volume output; neither does it provide as great a level of total employment. However, because final felling and processing are brought forward, peak employment will occur 20 years earlier. The desirability of shortening the rotation length to 25 years depends then on the urgency of the employment problem. Since the net present value is still positive up to 9% discount rate, excluding the cost of land and rates, a case can be made for a rotation of about this length where unemployment is a very serious problem. Short rotations of this length could be practiced initially in order to bring forward the establishment of processing facilities. Rotation length could subsequently be gradually lengthened as provision of employment becomes less critical and supplies of timber increase.

Financial Returns from Forestry Compared with Agriculture

A starting point in comparing the financial returns from agriculture and forestry is to consider the return from forestry and agriculture on an overall basis for the county. The measure of financial return used is net revenue i.e. total revenue or income from the sale of produce (whether it be agricultural or timber) less the costs incurred in producing that produce. The net revenue for the county can be estimated by multiplying the net revenue per unit of production by the total number of units produced. In the case of agriculture, net annual revenue from the land-using enterprises is derived for 1973 by multiplying the numbers of each type of grazing livestock, as given in the June agricultural enumeration 1973, by the net annual revenue per unit of each type of livestock. The net annual revenue figures for the different types of livestock are those shown in Table 4. In calculating net annual

revenue for agriculture, allowance is made for the acreage at present under forestry 10,300 ha (some 25,000 acres) in that it could have been devoted to agriculture. The derivation of the total net annual revenue figures for agriculture is shown in the Appendix, Tables 1—2. Revenue arising from non-land based agricultural enterprises, namely pigs and poultry, are not included, since these enterprises are largely independent of land. In order to estimate net annual revenue from dairying, cow numbers were broken down into dairy and suckling cows on the basis of the number of cows grant-aided under the Beef Incentive Scheme. Labour charges were calculated by using a schedule of standard man day requirements from the Farm Modernisation Scheme and using available information on the number and type of milking machines. The derivation of the agricultural labour requirements is set out in the Appendix, Table 3 (this chapter).

Total net annual revenue from forestry was estimated from the acreage of the different site types, as shown in Part 1, multiplied by the net annual revenue per ha for each site type as given in the Appendix Tables 4—5. The net annual revenue figures are shown both with and without deduction of labour charges in order to make them comparable with those for agriculture.

Table 11 gives total net annual revenue of both agriculture and forestry at discount rates ranging from 1 to 10%. The table shows that forestry would generate a much higher total revenue than agriculture at the lower discount rates. Thus, excluding labour costs, forestry would generate £17.6 million as against £3.95 million for agriculture at zero discount rate. However, since the rate of discount used affects forestry returns greatly, the level of returns from forestry declines rapidly as discount rate is increased. The result is very low or negative returns from forestry at the highest discount rates shown. So that at a 10% discount rate the N.A.R. from forestry is only £0.9 million as against £2.45 million for agriculture without deduction of labour costs. The discount rate at which agriculture and forestry give equal returns is 7.4% without deduction of labour costs and 8.4% with labour costs deducted. At discount rates lower than these levels, forestry yields a higher net revenue, while at higher discount rates net revenue from agriculture is greater. Earlier it was suggested that discount rates in the 3 to 6% range were appropriate and at these rates the total net annual revenue from forestry is greater than that from present agricultural production. These figures on financial returns would favour a considerable expansion of forestry in Leitrim.

TABLE 11: Estimated total nett annual revenue generating capacity of agriculture and forestry in Leitrim at 1973 prices (£ million)

Discount rate %	Labour not Charged		Labour Charged	
	Agriculture	Forestry	Agriculture	Forestry
0	3.95	17.6	1.45	16.4
1	3.8	14.4	1.30	13.1
2	3.65	11.7	1.15	10.3
3	3.5	9.2	1.00	7.9
4	3.35	7.3	.85	5.8
5	3.2	5.6	.7	4.1
6	3.05	4.3	.55	2.7
7	2.9	3.2	.4	1.5
8	2.75	2.2	.25	.5
9	2.6	1.5	.1	-0.3
10	2.45	.9	.005	-0.9

Effects of Recent Price Changes on Returns

Both agricultural and timber prices have changed considerably since 1973. Taking 1976 prices, in the case of timber the price increase has varied according to the size of the material, with increases ranging from 37% to 87%. The overall wood price increase between 1973 and 1976 was approximately 60% (23). In the case of agriculture, the dominant component of output is cattle. Beef cattle prices increased by 60% between 1973 and 1976, as in the case of wood prices, with store cattle prices increasing by 50 to 55%. The price of milk increased by approximately 63.5%. Thus the overall level of agricultural produce price increases between 1973 and 1976 would not differ greatly from that of timber. As regards input prices, both forestry and the low input agricultural systems practiced in Leitrim are far more influenced by produce prices than by input prices. Hence if agriculture and forestry were compared at 1976 prices there would be little change in their relative returns. The net annual revenue however in both cases would be roughly 60% higher than in 1973. Thus the total net annual revenue, excluding labour costs at zero discount rate, would be in the region of £28 million for forestry and £6.3 million in the case of agriculture.

Priority Areas for Planting

Given that overall financial returns favour expansion of forestry, the question arises as to which site types should be priority areas for planting. In Part I of the Leitrim Resource Survey it has been stated that potential for forest production varies considerably both with soil type and with elevation. Yield Classes are shown to vary from 14 to 26, with some areas at high elevations being classified as unplantable. The different soils and elevations were condensed into 5 site types as outlined earlier in this chapter. It has also been shown in Part I that potential grazing capacity varies greatly from 25 livestock units per 100 ha up to 197 with low levels of nitrogen application and up to 247 with high N. Actual livestock densities have also been shown to vary greatly in different parts of the county. Not only does grazing capacity vary but some soils, particularly hill and mountain, are limited in the range of livestock systems they can support. The financial returns from agriculture in an area are affected both by stocking density and by the mix of livestock enterprises.

In considering priority areas for planting within the county the main comparison made here is between two major areas namely

- a) the Drumlin area including inter-drumlin peat and
- b) the Mountain and Hill area which comprise the Aughty soil series.

The net annual revenue (N.A.R.) per ha is estimated for both agriculture and forestry (Appendix, Tables 6 and 7)

Net annual revenue per ha for agriculture is calculated from the estimated stocking density and the mix of livestock, namely, dairy cows, cattle and sheep as shown in the Appendix, Table 6.

The estimated net annual revenue per ha of agriculture and forestry, for both the Drumlin and Hill and Mountain Areas, are shown in Table 12. The difference between the N.A.R. of agriculture and forestry is also shown for discount rates ranging from 0 to 10%. As for the county as a whole the N.A.R. of forestry is much greater than agriculture at low discount rates, as shown in Table 12. Thus, for the Drumlin area, the N.A.R. is £141.1 per ha for forestry at 0% discount rate as against £36.3 for agriculture without charging labour - that is a difference of £104.8. When labour is charged the difference in favour of forestry is even greater at £122.4.

TABLE 12 Estimated net annual revenue per ha (£) of agriculture and forestry in different areas of Leitrim.

Discount rate %	Labour not charged			Labour charged		Difference in favour of forestry
	Agri-culture	Forestry	Difference in favour of forestry	Agri-culture	Forestry	
Drumlin Area						
0	36.3	141.1	104.8	9.7	132.1	122.4
1	35.0	116.0	81	8.5	106.7	98.2
2	33.8	94.8	61	7.2	84.6	77.4
3	32.5	75.7	43.2	5.9	65.6	59.7
4	31.2	60.1	28.9	4.7	49.5	44.8
5	30.0	47.1	17.1	3.4	36.1	32.7
6	28.7	36.4	7.7	2.2	24.9	22.7
7	27.5	27.5	nil	.9	15.5	14.6
8	26.2	20.2	-6.0	-0.4	7.8	8.2
9	24.9	14.2	-10.7	-1.6	1.5	3.0
10	23.7	9.4	-14.3	-2.9	-4.0	-1.1
Hill & Mountain Area (Aughy Series)						
0	7.8	56.8	49.0	3.3	51.6	48.2
1	7.4	45.2	37.8	2.9	39.6	36.7
2	7.1	35.2	28.1	2.6	29.4	26.8
3	6.7	26.8	20.1	2.2	20.8	18.6
4	6.4	20.0	13.6	1.8	13.7	11.9
5	6.0	14.4	8.4	1.5	7.8	6.3
6	5.7	9.9	4.2	1.1	3.0	1.9
7	5.3	6.2	.9	.8	-0.9	-1.7
8	4.9	3.2	1.7	.4	-4.1	-4.5
9	4.6	.9	3.7	.1	-6.8	-6.8
10	4.2	-1.1	-5.3	-0.3	-9.1	-8.8

As discount rate increases the N.A.R. per hectare from forestry declines rapidly so that for the drumlin area the N.A.R. from agriculture and forestry are the same at £27.5 when the discount rate is 7% without charging labour. At discount rates greater than 7% the level of returns from forestry is lower than from agriculture. When labour is charged the N.A.R. from forestry is higher than agriculture at all discount rates less than 10%.

In the case of the Mountain and Hill area the N.A.R. of both agriculture and forestry are much lower than in the Drumlin area. However, the trends are similar with N.A.R. from forestry being greater than agriculture at low discount rates. The levels of net revenue from both uses become equal at discount rates between 6 and 8 % while at higher discount rates net revenue from forestry is lower than agriculture.

The difference between the net revenue of agriculture and forestry can be taken as a guide in determining priority areas for planting. It has already been said that discount rates in the 3 to 6% range are the most appropriate. Without charging labour, the difference in favour of forestry at 3% discount is £43.2 for the Drumlin area as against £20.1 for the mountain and hill area. At 6% discount, the corresponding figures are £7.7 for Drumlin and £4.2 for the Hill and Mountain area. With labour charged, the difference in favour of forestry for the Drumlin area go from £60.1 per ha at 3% discount to £23.1 at 6% discount. For the Hill and Mountain area the corresponding difference in favour of forestry are £18.7 and £1.5 per ha.

Thus, within the range of discount rates which are generally considered appropriate, the financial results favour planting of the Wet Drumlin areas in preference to the Mountain and Hill areas.

It must be remembered that the Drumlin area is not completely uniform. Some Drumlin soils such as the Drumkeeran series are less suitable for agriculture than others. Thus Drumkeeran series should be planted in preference to Howardstown, Ballinamore or Garvagh soil series.

APPENDIX

TABLE 1: Estimation of net annual revenue of land using agricultural enterprises in Leitrim 1973

A. Existing Agricultural Area		Gross margin per unit (£)	-Potat] (£'000)
Animals/enterprise	No. of units		
Dairy cows	11,500	103	1,185
Cattle	73,750 L. U's	45	3,320
Sheep	23,800 ewes	5	120
Potatoes	1,600 acres	115	185
Total gross margin			4,810
Less overhead costs@£6.5 per livestock unit equals Income			590 4,220
Less Beef Incentive Scheme payments			396
Less sheep subsidies @			34
Net annual revenue (labour not charged)			3,790
Less labour charge (1,950 standard man years @ £1,225 per S.M.Y.)			2,390
Net annual revenue (labour charged)			1,400
Investment in machinery, livestock and other working capital @ £150 per grazing livestock unit			14,000
B addition to net annual revenue for area at present under forestry			
Labour not charged			157
Labour charged			52
Investment in machinery, livestock and other working capital			540
C. Total county (A + B) Net annual revenue			
Labour not charged			3,947
Labour charged			1,452

TABLE 2: Estimation of net annual revenue from grazing on forestry area

Total Forestry 1973		10,300 ha
Lowland 30%		3,000 ha
Hill and Mountain 70%		7,300 ha
Lowland 70 L.U. per 100 ha		2,100 L.U.
Dairy cows # 28%		600
Cattle		1,500 L.U.'s
Hill and mountain:		
25 L.U. per 100 ha		1,825 L.U.'s
70% suckling		1,300 L.U.'s
30% sheep		525 L.U.'s
Net annual revenue		Gross Margin (£)
Dairy: 600 cows # £103 gross margin		61,800
Cattle: 2,800 L.U.'s # £45 gross margin		126,000
Sheep: 525 # £20 gross margin		10,500
3,925 Total gross margin (£)		198,300
Less O.H. costs # £6.5/L.U.		25,500
Net annual revenue (£)		172,800
Subsidies (Beef Incentive Scheme)		13,500
Hill sheep subsidy, 1,800 ewes # £1.5		2,700
		16,200
Net annual revenue net of subsidies		156,600
Est. labour charge 600 cows # 18SMD ¹ 's		
1,000 suckler cows # 3.5 S.M.D.'s	10,800 S.M.D.'s	
1,600 other cattle # 3.5 S.M.D.'s	5,600 S.M.D.'s	
1,800 ewes # 0.6 S.M.D.'s	1,100 S.M.D.'s	
Total labour requirements	21,000 S.M.D.'s	
Labour cost (£) 85 S.M.Y.'s # £1,225=		104,125
Net annual revenue after charging labour (£)		52,475
Capital investment 3,925 L.U.'s # £1.5=		540,000

1. Standard Man Days
2. Standard Man Years

TABLE 3: Estimation of agricultural labour requirements in Leitrim

Enterprise	No.	S.M.D.'s per unit	Total S.M.D.'s
Dairy cows	11,500	3,800 @ 15	57,000
Suckler cows	29,500	7,700 @ 20	154,000
Dairy calves		@ 3.5	103,250
6 months		9,700 @ 2	19,400
Calves 6-12 months		34,400 @ 1.5	51,600
1 to 2 yrs		22,400 @ 2.0	44,800
2 yrs		11,300 @ 0.4	4,520
H.I.C		3,900 @ 2	7,800
Sheep: ewes		23,800 @ .6	14,280
Total livestock			456,650
Potatoes		1,600 @ 15	24,000
Cereals		1,000 @ 4	4,000
Total S.M D 's			484,650
S M Y's			1950

TABLE 4: Forestry - net annual revenue (£ per ha) of different site types - labour not charged

Discount rate	Yield class				
	25	20/22	20	18	14
0	153.2	123.9	115.4	96.2	67.3
1	127.0	100.0	93.0	76.9	52.3
2	104.8	79.5	73.8	60.4	39.6
3	84.4	62.4	57.6	46.5	29.0
4	67.8	48.1	44.2	34.9	10.4
5	53.8	36.4	33.3	25.4	13.4
6	42.2	27.0	24.4	17.6	7.8
7	32.6	19.4	17.2	11.2	5.9
8	24.6	13.2	11.4	6.1	-0.6
9	18.1	8.2	6.7	1.8	-3.4
10	12.6	4.2	2.9	-1.8	-6.0

TABLE 5: Forestry - net annual revenue (£ per ha) of different site types - labour charged

Discount rate	Yield class				
	25	20/22	20	18	M
0	144.1	115.2	106.7	86.8	59.0
1	117.5	91.0	84.0	67.0	43.6
2	94.2	70.1	64.4	49.8	30.5
3	74.1	52.5	47.9	35.2	19.6
4	57.0	37.9	34.0	22.9	10.6
5	42.6	25.7	22.7	12.5	3.1
6	30.6	15.8	13.3	3.9	-2.9
7	20.5	7.7	5.7	-3.3	-7.9
8	12.1	1.0	-0.6	-9.4	-12.0
9	5.1	-4.5	5.8	-14.7	-15.5
10	-0.8	-9.1	-10.1	-19.2	-18.6

TABLE 6: Estimation of net annual revenue per ha from agriculture

Drumlin Area (including inter-drumlin peat)				
Grazing capacity (L.U. per ha.)				1.32
Actual stock density * 64% of capacity				.84
	Dairy	Suckling	Sheep	Combined
Est. proportion of cows	.35	.65		1.00
Net annual revenue per L.U. (£)				
(a) Labour not charged	62	33		43.2
(b) Labour charged	3	16		11.5
Net annual revenue per ha (£)				
(a) Labour not charged				36.3
(b) Labour charged				9.7
Investment in machinery, livestock and other working capital per L.U. (£)	150	150		150
Hill and Mountain Area				
(Aughty Soil Series)				
Grazing capacity (L.U. per ha)				.28
Actual stock density				.28
	Dairy	Suckling	Sheep	Combined
Est. proportion of L.U.'s		.75	.25	1.00
Net annual revenue per L.U. (£)				
(a) Labour not charged		.33	12	27.8
(b) Labour charged		16	-1.4	11.7
Net annual revenue per ha (£)				
(a) Labour not charged				7.8
(b) Labour charged				3.3
Investment in machinery, livestock and other working capital per L.U. (£)	150	150	60	127.5

Note: Livestock headage payments excluded.

TABLE 7: Estimation of net annual revenue per ha from forestry

Drumlin Area: (including inter-Drumlin peat)							
	Yield class						
	25	20/22	20	18	14	Un-plantable	Total area
No. of ha	59,430	13,312	16,35	nil	nil	90,411	
% of area	66	14	18	2			100
N.A.R. per ha							
at zero disc. rate:							
Labour not charged	153.2	129.3	115.4	96.2	67.3		141.1
Labour charged	144.1	115.2	106.7	87.0	59.0		132.2
Mountain and Hill (Aughty Soil Series)							
No. of ha	nil	nil	10,032	nil	11,092	12,666	33,790
% of area			30		333	37	100
N.A.R. per ha							
at zero disc. rate:							
Labour not charged			115.4		67.3	nil	57.5
Labour charged			106.7		59.0	nil	51.5
All Areas							
No. of ha	65,228	32,068	16,034	7,575	16,043	—	136,948
% of area	48	23	12	5	12	—	100
	Net annual revenue per ha				Total net annual revenue		
Discount rate (%)	Labour not charged (£)	Labour charged (£)	Labour not charged (£ million)	Labour charged (£ million)			
0	128.77	119.89	17.63	16.42			
1	105.24	95.99	14.41	13.15			
2	85.22	75.22	11.67	10.30			
3	67.58	57.49	9.25	7.87			
4	53.10	42.57	7.27	5.83			
5	41.07	30.08	5.62	4.12			
6	31.21	19.77	4.27	2.71			
7	23.12	11.18	3.17	1.53			
8	16.45	4.06	2.25	.56			
9	11.06	-1.88	1.51	-.26			
10	6.55	-6.88	.90	-.94			

EMPLOYMENT IN FORESTRY

M. Bulfin

The main topics of concern when considering forest employment are: the distribution of employment within the different sectors of the forest industry, the relationship between Yield Class and employment, the type of employment and total employment.

Employment by Sector

Forestry's contribution to employment can be separated into three different sectors which together comprise the forest industry in Ireland. The distribution of employment between these sectors is important particularly as it differs greatly from the pattern in agriculture. This difference lies at the heart of many of the misconceptions that exist regarding the contribution of forestry to employment. Employment by the Forest Service which is often taken as forestry's sole contribution to employment is, in fact, only a small percentage of total employment.

The major difference in the employment pattern between agriculture and forestry lies in the relationship between on-the-land or "in-the-wood" employment and that provided in the processing sector. In agriculture, with 180,000 farmers, there are 28,000 persons employed in primary processing e.g. meat processing, dairying, milling, canning and malting (24). In forestry, with some 3,000 people, on the land there are 3,500 persons employed in processing. However, this is not a true picture because most of our forests are immature and volume production will quadruple by the end of this century. Employment in timber processing will, therefore, expand rapidly over the next twenty years. Thus, timber processing is labour intensive to a much greater extent than primary processing in agriculture.

A further consideration is that under Irish conditions, where afforestation means the establishment of new forests on bare land, employment in forestry must be considered in two stages. The first stage deals with the flow of employment during the period while plantations are being established. The second deals with the levels of employment once a sustained yield forest has been established either on a national or regional basis. Sustained yield is the normal production situation in forestry and is typical of most EEC member countries, with the exception of Britain. It denotes a situation where the volume production from a forest tract, region or country is maintained at the same level on an annual basis by a process of continuous felling and replanting. This provides a steady and secure supply of raw material to the processing industries. Irish forestry has not reached this stage yet — some 66% of current plantations are less than 20 years old (16). Plantations established in the last 10 years will not be ready for final felling until well into the next century.

The flow of employment resulting from a planned build up to 60,000 ha (150,000 acre) plantation is given in Table 19. In this Chapter the employment levels under current conditions within the industry are considered.

Analysis of current employment trends indicates that 32.5% of the total employment generated by a sustained yield forest will be provided in field work e.g. planting, maintaining, felling and extracting. Thus, two-thirds of forest employment is generated in the processing industry. One man in the forest will provide the raw material for two men in the factory.

The type of employment provided in the establishment and maintenance of plantations is suitable for rural areas, as it requires a mostly unskilled or semi-skilled work force. Within the Forest and Wildlife Service the ratio of field operatives to management is about three to one. In private forestry, however this management ratio would be considerably less. If the employment involved in felling, extraction and transport is considered then one third of all employment provided by forestry is field work of an unskilled nature. A considerable portion of the employment in processing would also be of a relatively unskilled nature and thus also suitable for a rural population.

If a processing enterprise is to be established it is recommended that the older generation, of the small farmers, should be employed in unskilled, forest and processing work while the younger (and presumably more adaptable) generation be employed in the skilled sections of the processing industry. Such a division of labour would cause least difficulty in the transition from agricultural to forest employment.

Total employment in the forest industry is strongly linked to the volume of raw material available for processing. Only the establishment of plantations is independent of this link with volume production. Felling and extraction employment levels are obviously linked to the total volume of timber to be harvested from any area. Thus, the greater the volume output per acre the greater the employment that will be generated by that acre. Similarly processing employment, whether in sawmilling or the particle wood industries, is also tightly linked to the volume processed. Conversely, in estimating employment levels, used a factor of 0.156 men employed per 1,000 Hoppus ft. (36.1m^3) of volume processed in the pulping sector (0.111 men/1,000 H ft. in sawmilling) (25). Because of the powerful volume / labour linkage the more productive forest areas will employ more men. This can be clearly seen in Table 13.

In Table 13 the employment generated under current industrial conditions by a 60,000 ha (148,200 acres) plantation is given. Data for five different site types (Yield Class) is given to illustrate the relationship between employment and site productivity. The Yield Classes used are those detailed in Part I as being typical of the sites found in drumlin areas. The highest employment is provided by Yield Class 25 sites, the drumlin soils of Garvagh, Ballinamore, Drumkeeran etc., where a total of 4,909 persons would be permanently employed when the forest reached full production. A 60,000 ha block was chosen as under Yield Class 25 conditions this would yield approximately 1.2 million m^3 of timber (1 million tonnes) per annum under sustained yield conditions. This would be sufficient to support a totally independent fully integrated forest processing industrial complex. Even under the shorter rotations advocated in the Drumlin Afforestation Proposal (see Chapter 7) there would still be an output of 975,000 m^3 which is still sufficient for a self-contained industry. As the Yield Class (or output per annum per ha) diminishes with less favourable sites so the total employment content declines. Yield Class 14 (an output level somewhat less than the national average output per ha of state forests) has an employment content of less than 60% of Yield Class 25.

If the employment content of forestry is compared to agriculture then an area of 60,000 ha (148,200 acres) of forestry on wet drumlin soil can provide as much employment as is currently provided in agriculture in the whole of County Leitrim. Analyses show that for Yield Class 25 conditions the forest industry can provide one job per 11.3 - 13.35 ha (28 - 33 acres) depending on rotation length.

Rotation length is influenced by site productivity - the more productive the site the shorter the time taken to reach maximum output. Table 13 indicates that for Yield Class 25 maximum production is reached at 45 years, while Yield Class 14 requires a further 10 years to reach full production. The advantages of providing full employment 10 years earlier are obvious, particularly in an area such as Leitrim where off-farm employment is difficult to find.

Because of the very high timber production levels achieved on drumlin soils it is possible to shorten maximum production rotations by 10 to 20 years and still retain

TABLE 13: Effect of different Yield Classes (site productivity) on the permanent employment provided by a 60,000 ha¹ plantation at full rotation²

Yield Class M/Ha/annum	Rotation length Years	Establishment and maintenance Persons	Felling and extraction Persons	Processing Persons	Total Persons
25	45	285	1307	3317	4909
20/22	50	254	1088	2780	4122
20	50	263	1028	2687	3978
18	50	302	925	2445	3672
14	55	242	716	1966	2924

¹148,200 acres

imcs a failure allowance of 20_f

an economically feasible forest enterprise. Such shorter rotations have the advantage that they provide much needed employment 10 to 20 years earlier depending on the rotation length chosen. The economic effects of shortened rotations have already been discussed and it was seen that shortening rotations on Yield Class 25 sites from 45 to 35 years reduced total income by 4.6% at an interest rate of 5%. The effect of the 10-year reduction of rotation is to increase employment marginally from 4,909 to 4,923 persons. Shortening the rotation further to 25 years decreases income by 49% while decreasing total employment by 11.3% to 4,355 persons. The advantages of having 4,355 persons employed at year 25 are clearly greater than waiting another 10-20 years to employ some 10% more people. While the loss of income resulting from a reduction to a 25 - year rotation is large the net present value of the crop is still positive up to 9% discount rate. Thus, a serious case can be made for such rotations where unemployment is an urgent problem. Shorter rotations will also mean larger initial employment because if a certain area is allotted for forestry, then, the shorter the rotation the larger the annual planting programme must be. Once industrial processing has been established it is always possible to lengthen rotations somewhat to move closer to the optimum financial rotation while retaining the benefits of rural employment.

Conclusions

The role and importance of the different sectors of the overall forest industry in forestry employment are clearly shown in Table 13. Harvesting and processing of forest products are the key to employment in any region. To equate employment in the Forest and Wildlife Service with total forest employment would be to make a major underestimate of the employment content of a regional forest industry. As a rule of thumb it seems likely that for every one man employed on the land there will be two more employed in the processing sector. Thus for a YC 25 site, with a short rotation, the likely on-the-land employment i.e. establishment, maintenance and harvesting, is one man per 36 - 38 ha (89 - 95 acres); total employment including processing would be one man per 28-33 acres. Such on-the-land figures compare well with the proposed agricultural structure. Elsewhere in this report we advocate 80-acre farms as the minimum necessary size to give a comparable income. However, these farms will produce very few jobs in processing - approximately one job for every six farmers (24). Forestry on the other hand will provide, under present conditions, two jobs for every one person on the land. Forestry, therefore, has a distinct advantage in long term employment prospects.

When one examines the flow of employment, particularly in the first 15 years of any rotation, the lack of short term employment is obvious. There is no easy solution to this problem. It must be faced and mitigated, if it is decided that afforestation for economic reasons and for long term employment prospects, is advisable. It must be pointed out that any rationalisation of farm structure would also reduce the numbers

on the land but there would be no subsequent increase in employment as would occur in forestry.

The significant effect of shorter rotations must be stressed. The shorter the rotation the more rapidly harvesting and processing, with consequent maximum employment, would begin. Shorter rotations would also mean larger initial employment.

Shorter rotations are also less likely to suffer from loss due to failure or damage and so a higher percentage of the total crop would be harvested. As employment is proportional to volume harvested it is vital that optimum utilisation be made of any area, thus maximising both the possible employment and the economic return per acre. Wind-blow which is assumed to affect progressively crops over 50 feet (15.5m.) on these gley soils, would be reduced to the minimum by shorter rotations.

While final decisions on rotation length will depend greatly on economics it is possible that taken in a regional context, rotations shorter than the economically optimum may be adopted because of their contribution to regional welfare. This would be especially true in the initial stages of establishment of a forest-based industry in the region.

PROCESSING OF CURRENT PLANTATIONS

M. Bulfin

(Current production from a single county could not support a forest processing plant. Timber production must be dealt with on a regional basis, as the combined output of a region would be needed to support a modern integrated timber processing plant. This chapter deals with the potential of the current Forest and Wildlife Services plantations in the north-west region. If the in-forest storage system proposed here were adopted, then it would be possible for a large processing plant to go into operation by 1984.

Regional Production

Since 1950, the Forest Service has greatly increased its planting programme in the north western region. By 1974 the Service had acquired some 60,000 ha of land, of which 51,000 ha was classed as capable of production. Of this productive area, 44,100 ha had been planted. While the greater proportion of these plantations are still very young, the plantings of the 1950's have begun to produce thinnings. Indeed, the long wait for production from State forests is over. We are now entering a period when employment and income generated by the extraction and processing of forest produce will increase steadily over the next 20 years.

Timber production from the region i.e. counties Cavan, Donegal, Leitrim, Roscommon and Sligo, will rise from 55,500m³ in 1978/79 to 211,500m³ in 1992—'93 (Table 14). As most of these plantations are still very young, production will continue to rise into the next century. If production from Mayo is considered, then these total production figures would be increased by about 14% in the early period, rising gradually to 25% by 1991. With output of this scale it is obvious that a planned regional approach to harvesting and processing is necessary.

Timber Processing Plant Recommended

This report, therefore, recommends that a timber processing plant be established in the Drumshanbo area.

Because no major processor currently exists in the North West area, it is possible to plan in advance for a processing facility which can handle the projected output of the region. Much of the raw material becoming available in the next two decades will be in the form of early thinnings whose small dimensions make them unsuitable for sawmilling. While this is currently the case in the North-West, over the longer period, it is likely that sawmilling should be integrated with the pulping plants. At least sawmills should be concentrated in the vicinity of the pulping plants so that sawmilling residues can be utilised for pulping. Such integration of timber processing facilities is standard practice among timber producing countries.

Size of Plant

Considerable debate exists as to the size a modern processing facility would need

to be before it becomes an economic proposition. Rankin, in dealing with British conditions in 1972, gave details of the raw material requirements of various integrated processing facilities of small, medium and large sizes. In dealing with a combination of sawmilling and particle board processing — the most suitable combination for Irish conditions — he put the raw material requirements for a small plant at 53,000 m³ (less bark) of timber. His medium-sized plant has a total intake of 158,000 m³ (26). Irish sources have indicated that a particle board plant to be established in the 1980's would need to have an intake of 150 — 200,000 m³ and would cost in the region of £5 million (26). There is general agreement within the industry that concentration on a specialised product and intensive marketing are necessary for a successful enterprise. Despite the huge market for timber products within the EEC (over 180 million m³) it is still necessary to produce a sophisticated product aimed at a definite market. It appears that if such a market niche for a specialised product can be found, then the size of the production plant need not necessarily be very large (27). A comprehensive study of the future of the wood processing industry in Ireland is now being conducted by the Industrial Development Authority. Although the nature and size of a timber processing facility are beyond the compass of this report, because forestry is a land-use enterprise, the location and effect that such a plant could have on the local economy and on land use within the region is of concern to us.

Location of Processing Plant

Because a pulping enterprise would concentrate a large proportion of new employment in one locality and because this employment would increase over the years, its effect on regional employment levels would be readily visible. The location of such a plant is of vital importance and should take long term production sources as well as current sources into consideration. Particularly, if the Drumlin Afforestation Project (see Chapter 7) is to go ahead, then the siting of a pulp-mill to handle current production would also depend on where future plantations are located. Employment provided by the Forest and Wildlife Service, as well as that provided in harvesting and transport although making a valuable contribution to the region, are so scattered that their contribution to employment is less visible.

Thus, the success of an afforestation project, such as that proposed in Chapter 7, could depend to a large extent on the impact made by the location of a timber processing plant. There are a number of reasons which make the mid-Leitrim area a suitable site for such a plant.

Unlike many new industries being established in rural area, which import all their raw materials and export all their products, timber processing is dependent on local raw material. In this, forestry is similar to agriculture and particularly similar to the fresh food sector where processing plants must be located close to their raw material source. Because forestry is a land using enterprise, the location of a processing plant in any region should tend to increase the amount of afforestation in that region. It is therefore, desirable that future timber processing plants be located both where the production from current plantations is sufficient and that from future plantations will be economic. The potential of the hinterland for the production of the raw material must be taken into account.

The bulk of raw material is already coming from the Leitrim region. Some 60% of the production detailed in column 3 of Table 14 comes from counties Cavan, Leitrim, Roscommon and Sligo, with the remainder coming from Donegal. Processing timber from Donegal poses certain problems regarding the distance timber must be transported to be processed. If Donegal timber is to be processed in the Republic,

then a long haul is inevitable. This ratio between the counties does not change over the next 10 to 15 years. By this time production from the Drumlin Afforestation Project would become the dominant element in the supply of raw material to the processing plant. Thus, while short term considerations might indicate other locations, in the long term, the mid-Leitrim area would be more suitable. Again, if production from Mayo is included, then the argument for processing in Leitrim is strengthened as the arguments that apply to Donegal also apply to Mayo.

Mid-Leitrim is a depressed area, desperately in need of off-farm employment. The impact of such an industry would be a major element in revitalising the surrounding areas. The location of a forest processing enterprise, with an initial employment of 200 to 300, would provide a major source of employment for the region. As this employment level is expected to rise steadily, the effect on the surrounding rural areas would be cumulative. It is also likely that land would become more readily available for the Drumlin Afforestation Project.

By locating such a major enterprise, with its potential for expansion in an area of declining rural population, the decline may be stemmed or halted, if not immediately, then in the longer term. The influx of money in wages and salaries would improve the local economy as well as helping to maintain the level of social services, housing, schools and roads.

The location of such an industry in any other place, whether on the fringes of the Drumlin area or in the Sligo urban area, would not have the same long-term effect on the Drumlin region which, as this report shows, has considerable potential under forestry. If the latter location were chosen, while a few jobs would go to north Leitrim, none would be within reach of mid-Leitrim or north-west Cavan. The major improvements in rural welfare — such as a speed up in farm restructuring or an improvement in the economy of local towns — would not take place.

Therefore, the opportunity of placing an industry using local raw material, in mid-Leitrim, should not be missed.

Processing — How Soon?

Timber is a most flexible material as regards time of processing. While agricultural crops must be harvested when ripe, timber can be stored almost indefinitely in the forest. Indeed, much of the timber we import comes from natural forests which have been growing for hundreds of years. The ability to "store" timber in the forest allows certain options regarding the timing of a major processing facility within the region. Under Irish conditions, where the plantations are still young, it is possible to delay the thinning cycle in order to build up a greater volume for subsequent harvesting.

Proposed Storage System

Irrespective of the projected volume intake of a planned processing plant, the storage system outlined below can be used to bring forward the date at which this volume of timber is available. Thus, using the storage system, it is possible to bring forward by at least 5 years, the date at which large-scale timber processing plant can go into production in the north-west region. Table 14 shows how the storage system could operate in the north-west region. This is a very rough example but the principle as illustrated is vitally important because it would allow an earlier start to timber processing, which in turn would bring much needed employment to the region. Taking 1978-79 as the starting year, it is assumed that all 55,523 m³ (Column 2) of timber is harvested. In the following year, rather than harvesting the projected 63,177 m³ only 44,418 m³ are harvested. This 44,418 m³ represents four-fifths of the

previous years 55,523 m³ harvest. Total harvest is again reduced in subsequent years in one-fifth 11,104 m³ increments until, by 1982-83 rather than harvesting 93,718 m³ only 1,104 m³ are harvested. Column 3, thus, shows the reduced cut over the 4-year period. The annual amount stored is shown in column 4, which is equal to the total material projected for that year (column 2) less the actual cut (column 3). In column 5, the total cumulative amount stored, which amounts after 4 years to 200,000 m³ is shown. Between 1983-84 and 1987-88 there is a projected output of 674,368 m³, if to this is added the 200,000 m³ in storage, then, if production over this 5-year period is averaged, there can be an annual cut of 174,874 m³. Thus, a steady annual production of 174,874 can be achieved from 1983-84 onwards.

Using; the same principle, the level of output could be increased to over 200,000 m³ in 1985. Without the storage system, such production levels would not have been reached until 1988-89. To put the principles involved in the storage system into practice requires a temporary change in current forest management practices. However, full details of every forest stand in the region already exist on computer records. Such a management system could easily be developed from this information and could be put into practice immediately. To continue to sell timber according to the projected production figures given in the Census of Woodlands (Table 14, column 2) would be to lose a major opportunity for the various sectors of the forest industry to co-ordinate their operations on a regional basis. Lost too, would be the improved image that forestry would acquire through the provision of much-needed industrial employment in a depressed rural area.

Employment Content

Total employment levels would be determined by the productive capacity of the plantations. It is difficult to predict future employment levels over a 25 to 30 year period and the employment figures given here can only be taken as approximate guidelines. They are used only to indicate trends. In Table 15, the possible trend of

TABLE 14: Projected timber output and adjusted output from north-western region¹

Year 1	Total material 2 m ³	Reduced cut 3 m ³	Annual amount stored 4 m ³	Accumulated store 5 m ³	Redistributed output 6 m'
	35,884				35,884
	44,332				44,332
1977-78	49,819				49,819
1978-79	55,523				55,523
1979-80	63,177	44,418	18,759	18,759	44,418
1980-81	70,469	33,314	37,155	55,914	33,314
1981-82	83,682	22,209	61,473	117,387	22,209
1982-83	93,718	11,104	82,613	200,000	11,104
1983-84	106,245				174,874
1984-85	117,761				174,874
1985-86	130,253				174,874
1986-87	153,141				174,874
1987-88	166,968				174,874
1988-89	178,736				178,736
1989-90	185,162				185,162
1990-91	195,487				195,487
1991-92	203,321				203,312
1992-93	211,444				211,444

Cavan, Donegal, Leitrim, Roscommon and Sligo.

future employment generated by the current Forest and Wildlife Service plantations in the region, which total 44,000 ha (108,700 acres), is given.

TABLE 15: Projected employment from current Forest and Wildlife Service plantations 1976 - 2005

Calendar year 1	Establishment and maintenance 2 persons	Felling and extraction 3 persons	Pulp manufacture 4 persons	Saw-milling 5 persons	Total 6 persons
1975-76	403**	57	90	140	690
1976-77	403	70	104	140	717
1977-78	403	-7	117	14H	737
1978-79	4i)3	83	131	14./	759
1979-80	403	96	150	140	789
1980-81	403	106	16~	140	816
1981-82	403	125	190	140	858
1982-83	403	138	215	14(i	896
1983-84	403	155	24-	140	945
1984-85	403	170	27S	140	988
1985-86	403	187	304	140	1,034
1986-87	403	217	MI	140	1,101
198^88	403	234	371	140	1,148
1988-89	403	248	394	140	1,185
1989-90	403	25^	411	140	1,211
1990-91	403	269	419	140	1,231
1991-92	403	277	430	140	1,250
1992-93	403	285	44 3	140	1,271
1993-94	403	293	456	140	1,292
1994-95	403	302	469	140	1,314
1995-96	403	311	483	1411	1,337
1996-97	403	320	498	1411	1,361
1997-98	403	330	512	14H	1,385
1998-99	403	3 39	32-	140	1,409
1999-00	403	330	34 3	1411	1,436
2000-01	403	360	559	140	1,462
2001-02	403	370	576	140	1,489
2002-03	403	381	593	140	1,517
2003-04	403	391	610	14ii	1,544
2004-05	403	402	628	140	1,573

*This table does not include employment generated through private forestry

**March 1976 employment levels by FWSs in the five counties Cavan, Donegal, Leitrim, Rossmmon, Sligo

Column 2 of Table 15, gives details of the employment generated by the establishment and maintenance of these plantations. This is the employment that can be attributed to the Forest and Wildlife Service itself. Employment levels within the Service have declined over the past two decades. This decline will continue within the region especially if the planting programme is curtailed. A further 25% drop in regional Forest and Wildlife Service employment is possible - but it is unlikely that Service employment levels will be allowed much below current levels, especially if the region is designated for a major afforestation programme. Further, as the felling and extraction programme increases in the future (Table 15, column 3) employment levels within the Service will increase. Thus, the current level of employment with the region (403 men) is taken as continuing in the future for the purpose of this projection.

Felling and extraction employment levels are totally dependent on the volume of timber extracted. There may be some variation due to the size of material extracted - whether small sized thinnings or large saw timber logs - but for this study, employment levels are taken as being totally volume dependent. Pulp manufacture is also treated as being volume dependent. Although no pulp mill exists in the region, it is

assumed that all thinnings of pulp size material will be felled and extracted on schedule and processed in the region. Because new methods of extraction and harvesting are being developed and tested and, in the pulping and sawmilling industry new machinery and techniques are leading to increased volume output per man, a scaling factor is used to allow for changes in productivity over time. Thus, numbers employed per unit volume under each of these headings are reduced at the rate of 1% per annum over the total period. The use of such an arbitrary factor as a volume/labour ratio has obvious disadvantages because of the difficulty of projecting past trends in processing into the future. Also, using a percentage reduction factor, which acts in a cumulative manner to allow for increased productivity, can obviously lead to absurd predictions over very long periods. As used here, it will reduce the employment per unit of volume by 23.6% over the 25-year period studied.

Projecting employment in sawmilling also presents certain difficulties because of the scattered nature of the industry at the moment. In contrast to the particle-board industry where just a few large plants absorb all the raw material, the sawmilling set tor of the industry is composed of a large number of small, scattered mostly out-of-date mills.

Very few sawmills have modern sawing plant and fewer still have timber drying or stress grading facilities. Currently, therefore, sawing is labour intensive. However, it is expected that a rationalisation of sawmilling will take place and that as time goes by, fewer and larger mills will handle the increasing volume of timber. A recent survey by the Institute of Industrial Research and Standards indicated that there are approximately 140 people employed in sawmilling in the region (28). It is not known what volume they process as these mills draw from both private as well as State Forests. Thus, it is assumed that while the volume of sawtimber from local State Forests would increase from 8,000 to 80,000 m³ between 1975-76 to 2004-05 no increase in sawmilling employment would take place.

In column 6, details of the cumulative employment from each of the three sectors of the forest industry are given. Employment within the current Forest and Wildlife Service plantations amounts to 60% of the total but this proportion will drop to 25.6% by the end of the period. Eventually, the employment distribution pattern between sectors, indicated in Chapter 5, will be approximated. Total employment will increase twofold by the end of the century even if no further planting takes place.

Future Plantations

Plantations established between now and the end of the century, unless planted on the wet lowland soils, are unlikely to yield any appreciable volume before the year 2000. They will, however, contribute to maintaining employment levels in the Forest and Wildlife Service. A cessation of planting in part or all of the region would result in a reduction in employment levels within the Forest and Wildlife Service. The Service had a plantable reserve, in December 1974, of some 7,000 hectares, of which Donegal accounts for 56%, so that unless acquisition "remains buoyant in the other counties, the planting rate in these counties must eventually decrease. (See Table 2 for acquisition rate in Leitrim and Table 16 for details of planting progress in other counties).

Total employment levels are limited by the productive capacity of these plantations. Most of the land afforested in the region is planted on soils consisting of peats, peaty gleys or peaty podzols, either at low elevations in Donegal or in the mountainous areas of the more inland counties. Production from these sites is likely to be at or below the national average of yield cases 4-16 m³/ha/annum. In these

cases, rotations are long (55 years) and production from thinnings is not significant until the 25th year.

TABLE 16: Plantable areas acquired and areas afforested, by county, 1973-74

County	Plantable area acquired 1/4/73-31/12/74 Ha	Area afforested 1974 Ha	Plantable reserve Ha
Cavan	84.4	118.4	320.3
Donegal	1156.7	1195.3	3120.1
Leitrim	260.3	298.3	1114.7
Roscommon	887.2	206.9	1229.6
Sligo	224.6	291.8	1252.2
Total	2613.2	2110.7	7036.9

Source: Report of Minister for Lands, April 1, 1973 — December 31, 1974. Stationery Office Dublin.

Conclusion

The current plantations of the Forest and Wildlife Service in the north-west region are now coming into production. They offer the opportunity for a co-ordinated approach to harvesting and processing. As no large processing plants exist in the area it is possible to plan for a modern fully integrated processing enterprise. Using the information on future production gathered by the Forest Service during its various Censuses, predictions of output are available. Mid-Leitrim is recommended as the site for a processing facility because it is felt that in this location there would be a long-term beneficial effect on the local economy. Such a development would also improve the outlook for future afforestation of the highly productive drunlin soils as outlined in the Drumlin Afforestation Proposal. However, because of production already coming on-stream employment levels from these plantations will double by the end of the century.

DRUMLIN AFFORESTATION PROJECT

M. Bulfin

The Drumlin Afforestation Project has two objectives (i) to provide local and regional employment — 3,200 jobs over the period (1980-2005), and (ii) on a national basis to provide the timber raw material for home and export markets. This Project is advanced, not as a substitute for agriculture, but as a means of diversifying land-use in the area by transferring some land to a productive forest enterprise. A land use ratio of 80% agriculture to 20% forestry on the drumlin areas is taken to be an acceptable compromise. Such a ratio would allow agriculture to remain the dominant enterprise while giving forestry sufficient productive area to supply a major processing industry, thus providing industrial employment to the region. Even in the areas where intensification of forestry is advocated, afforestation would be limited to within the target ratio of approximately 20% of the area. It must also be borne in mind that the change to forestry outlined in the Project would be gradual, taking 25 years to full achievement. Such a determined programme of afforestation of the highly productive drumlin soils would diversify the land-based enterprises in this region and help provide for the long-term stability of the population.

The Project can be undertaken as a special State forestry venture or as a combined state and private enterprise afforestation programme. If the private forestry proposals (see next chapter) are adopted and result in an appreciable afforestation in the drumlin area, then the State afforestation programme can be scaled downwards accordingly to maintain the 80/20 land use ratio.

The remarkably high growth rates on the drumlin soils allow a unique opportunity for a different type of forest enterprise. The adoption of the Project programme of afforestation on drumlin soils could help to balance or reverse current trends within the country of planting poorer and poorer land. Such plantations on impoverished western peats or on the higher slopes of mountainous areas elsewhere in the county — (currently the bulk of the Forest and Wildlife Service's planting programme) face major long-term difficulties. Planting such sites results in low production and long rotations. When both long rotations and low production are involved then the economic feasibility of such plantations is questionable. A further argument against such plantations is the extremely long period before any worthwhile employment or local income is generated from thinning or felling.

As has already been emphasised in this report (Chapter 5) around 90% of the employment generated by a forest enterprise is in the harvesting, sawmilling and pulping sectors. A fast-growing forest crop not only yields a greater total volume of timber, but volume production is also greater in the earlier years, thus allowing the possibility of an earlier harvest. As employment in harvesting and processing is almost totally dependent on volume, the earlier a plantation reaches thinning stage the sooner secondary employment in harvesting and processing begins. To take an example; a plantation of YC 25, typical of drumlin soils, will have produced more volume at age 30 than a plantation of YC 12 at age 55. Current projections indicate

that in Europe, timber production will increase at a little over 1% for the next 20-30 years while demand will increase by over 2% per annum over the same period. The EEC imports some 90 million cubic metres of wood, which is one third of the total international trade in timber (2). There is a growing concern that Europe will experience increasing difficulty, from world trade competition and increased prices, as developing countries realise their monopoly position, in importing adequate supplies of this essential raw material. A timber shortage and increases in the real value of timber are therefore very likely. Against this background the Drumlin Afforestation Programme is proposed.

The Planting Programme

The Drumlin Afforestation Project envisages an annual planting programme on the highly productive drumlin soils of 2,400 ha (6,000 acres) over a 25-year period. The eventual target would be the planting of 60,000 ha (148,200 acres) over the period. By planting such an area within the drumlin region it is hoped to ensure a steady and continuous supply of timber raw material for processing (Table 17). If, as this report has suggested, processing is concentrated in the mid-Leitrim area then wet mineral lowland soils within a 30 to 40 mile (48 km-64 km) radius of mid-Leitrim could be drawn on to meet this annual target.

Most studies on timber haulage indicate that for pulping, a 30-mile (48 km) average haul is the most desirable (26). Such a haulage pattern has not been the case in Ireland but the planned nature of this project should allow the adoption of a more rational approach to timber haulage for processing. The sphere of influence of a processing plant located in mid-Leitrim would encompass a large portion of the wet mineral soils of counties Sligo, Roscommon, Leitrim, Mayo and reach as far as South Donegal. If the acquisition programme were spread evenly over the wet mineral soils within this radius any undesirable effects on land-use for agriculture would be minimised.

Of the 900,000 ha (2,250,000 acres) within the Republic which fall within a 35-mile (56 km) radius of mid-Leitrim, approximately 300,000 ha (741,000 acres) would be of wet mineral lowland type suitable for planting (29). Other suitable soils beyond this radius could also be considered providing that the average haulage distance would not be too greatly extended. Thus, at the end of the planting programme (25 years) approximately 20% of the drumlin soils within the 35-mile (56 km) radius would have been afforested. If the planting programme were evenly distributed, one third of this area (20,000 ha, 49,400 acres approx.) would be within Leitrim.

TABLE 17: Drumlin afforestation proposal: basis of production forecasts¹

Plantation area	Thinning		Felling*		Total production m ³ /ha
	Mean diameter	Volume m ³ /ha	Mean diameter	Volume m ³ /ha	
	B.H. cm		B.H. ² cm		
15	13	50			
20	15	~4			
25			20	2h2	406

¹This table is based on a 25-year rotation on sites of Yield Class 25; failure allowance is 15%. M.A.I. at 25 years is 16.24 m³/ha/annum

² A measurement taken at 1.3m above ground level

Assuming completion of the Drumlin Afforestation Project (20,000 ha, 49,400 acres) and taking the 10,094 ha (24,932 acres) already planted on the uplands, then the combined total land area afforested in Leitrim will amount to 19% of the county. This is within the 80/20 ratio already proposed.

Production Forecast

The production and employment figures used for the Drumlin Afforestation Project are based on data given in Table 17. This shows the average volume production which could be expected from a large-scale planting programme on wet drumlin soils. The table is based on data supplied by the Forest and Wildlife Service but because of the shortening of the rotation the final felling volume was calculated using the British Forestry Commission Management Tables (30). (Production figures, from thinnings, differ slightly from those of the Forest and Wildlife Service data because a failure allowance of 15% was used as against a 20% allowance in the Forest and Wildlife Service data supplied. The British Forestry Commission use a standard allowance of 15% for all rotations in their Management Tables.)

Table 18 indicates the expected flow of production from the Project. If the planting programme begins as outlined in the 1980-81 season, then the first harvest of thinnings would become available in the 1993-94 period. First thinning, which the Forest and Wildlife Service indicate would occur in the fifteenth year, has been split, half to be harvested earlier, in the fourteenth year. Experience on private estates has shown that an earlier thinning is possible where very high growth rates occur (31). The first two thinning years would then yield 60,000 m³ per year with the subsequent three years yielding 120,000 m³ per year.

The second harvest of thinnings has been treated in the same way with production yielding 297,000 m³ in the 21st year — enough production for a second medium to large-scale sawmilling and pulping enterprise (26). Production would then treble again to almost one million cubic metres in the 25th year when final felling would take place on the areas planted in the first year. The production pattern in the initial stages would increase by large increments but once the final felling stage is reached a steady flow of close on a million cubic metres would ensure a constant supply of raw material for processing.

Combined Production

Production from the Drumlin Afforestation Project would, in the early thinning stage, complement production from current plantations. At final felling stage of the Project, production would be treble the production forecast from present plantations. However, when the production flows from both sources are combined, a smoother rate of increase is obtained (Table 18). The combined raw material supply would offer a long-term basis for a major timber processing industrial complex in the region.

Only production from already established Forest and Wildlife Service plantations is taken into account because it is likely that any new planting by the Forest and Wildlife Service, unless specifically concerned with the Drumlin Afforestation Project, is likely to be on the poorer upland sites typical of the land acquired by the Service elsewhere. As growth on these sites is slow, such plantings would not reach thinning stage before Project plantations would have reached planned output. Adoption of the Drumlin Afforestation Proposal does not exclude planting on these poorer sites. Obviously if planting on marginal forestry sites was also concentrated within a certain radius of mid-Leitrim, the eventual impact of the combined production of all these plantations on the output of raw material for processing would be greater.

The steady increase in the annual volume of timber produced makes it imperative that any processing enterprise which is established should be sufficiently flexible and capable of expansion to handle the envisaged increase in raw material. Even if production from the Forest and Wildlife Service only is taken into account, a plant established in the early 1980s would have to be capable of trebling its processing capacity within the following 15 years. If the Drumlin Afforestation Project were adopted, total raw material available for processing would move from approximately 70,000 m³ to about 1,300,000 m³ by the turn of the century. Production of raw material at such a level would make the drumlin area a major national centre for timber processing.

Employment Potential

The situation outlined in Table 18 is one of plantations on rapid growth, high yield sites where it is possible to thin and harvest early. Starting from scratch, it

TABLE 18: Estimated total production from one 25-year rotation of the Drumlin Afforestation Project combined with projected Forest and Wildlife Service production for North West region¹

Calendar year	Project year	FWS production m ³	Project production m ³	Combined production m ³
1975—76		35,884		35,884
1976—77		44,332		44,332
1977—78		49,819		49,819
1978—79		55,523		55,523
1979—80		63,177		63,177
1980—82	1	70,469		70,469
1981—82	2	83,682		83,682
1982—83	3	93,719		93,719
1983—84	4	106,245		106,245
1984—85	5	117,761		117,761
1985—86	6	130,253		130,253
1986—87	7	153,141		153,141
1987—88	8	166,968		166,968
1988—89	9	178,736		178,736
1989—90	10	185,162		185,162
1990—91	11	193,487		193,487
1991—92	12	203,321		203,321
1992—93	13	211,444		211,444
1993—94	14	219,892 ²	60,000	279,892
1994—95	15	228,700 ²	60,000	288,700
1995—96	16	237,870 ²	120,000	357,870
1996—97	17	247,364 ²	120,000	367,364
1997—98	18	257,256 ²	120,000	377,256
1998—99	19	267,545 ²	208,809	476,354
1999—2000	20	278,231 ²	208,809	487,040
2000—01	21	289,350 ²	297,617	586,967
2001—02	22	300,938 ²	297,617	598,555
2002—2003	23	312,960	297,617 ²	610,577
2003—04	24	325,478 ²	297,617	623,096
2004—05	25	338,497 ²	974,404	1,312,901

Cavan, Donegal, Leitrim, Roscommon and Sligo
Estimated

would be possible, utilising an area only 36% greater than that now under current plantations to produce a volume three times greater than that forecast for current plantations for the year 2000. By the end of the century the employment potential would be at least double (3,200) that forecast for current plantations. If a premium is set on rural employment in the north-west region, and if the limitations on economic returns outlined are acceptable, then forestry offers a long-term labour intensive land-using enterprise which can bring employment to the region.

The employment schedules given in the following tables are based on Forest and Wildlife Service schedules for planting. If a large proportion of the area were being afforested under the Annuity Purchase Scheme (see next chapter) then the number employed in establishment and maintenance would be less. However, this would be compensated for by the greater number of farmers who remain on the land tending their forest.

The employment potential of the Drumlin Afforestation Project is given in Table 19. If the first planting of 2,400 ha (5,928 acres) takes place as indicated in the 1980-81 planting season, then first thinnings should be available in the 1993-94 season. Because of the high volume produced once harvesting begins, processing employment (felling, extraction, pulp manufacture and sawmilling) would increase rapidly, rising from approximately 250 to 2,850 annually within 10 years.

Thus, the first major employment contribution from this proposal could come 14 to 15 years from the time of planting. Herein lies the main difficulty for any such proposal — the long delay before any results are discernible. But if existing Forest and Wildlife service plantations and their expected output are also considered, then the groundwork has already been laid to integrate the Drumlin Afforestation Project into the region. The resulting benefits from the combined enterprises are greater and would flow more smoothly than either enterprise could achieve independently.

The combined total employment from current Forest and Wildlife Service plantations and employment from the Drumlin Afforestation proposal are given in Table 20. In column 5 their combined flows of employment show the effect of integrating current production and production from the high output soils proposed under the Drumlin Afforestation Project.

The advantages of this approach are clearly shown in the steady rise in employment. Only one major increase in employment level takes place coming at the end of the period when clear felling of the high yielding sites begins. If a pulping enterprise is established in the region, in the early 1980's, as recommended, then the employment which it would generate, as it receives an ever-increasing volume of timber, would make a major impact on the region. Employment increases at an annual average rate of about 100 persons over the period until the final felling begins for the Project. At this point there is a 60% jump in employment from 3,000 to 4,800 persons, which would then be the final staffing level. Approximately 40% of this employment would be spread through the region in the form of Forest and Wildlife Service employees and those engaged in felling and extraction for private companies. Sawmilling and pulping, probably in the form of large-scale integrated enterprises, would provide the remaining 60% of employment. Some small sawmills would continue to operate to supply local needs but the bulk of sawmilling would have transferred to large-scale mills where grading and drying would be handled automatically. A major sawmill should be associated with the pulping plant thus providing a large-scale integrated timber processing plant.

TABLE 19: Projected employment from one rotation (25 years) of the Drumlin Afforestation Project

Calendar year	Project year	Establishment and maintenance persons	Felling and extraction persons	Pulp manufacture persons	Saw-milling persons	Total persons
1980—81	1	100				100
1981—82	2	100				100
1982—83	3	135				135
1983—84	4	155				155
1984—85	5	156				156
1985—86	6	156				156
1986—87	7	157				157
1987—88	8	157				157
1988—89	9	170				170
1989—90	10	170				170
1990—91	11	171				171
1991—92	12	171				171
1992—93	13	172				172
1993—94	14	247	81	167		495
1994—95	15	322	161	331		814
1995—96	16	333	160	327		820
1996—97	17	333	158	324		815
1997—98	18	333	157	321		811
1998—99	19	333	155	318		806
1999—2000	20	370	381	780		1,531
2000—01	21	370	377	772		1,519
2001—02	22	370	373	765		1,508
2002—03	23	370	369	757		1,496
2003—04	24	370	365	749		1,484
2004—05	25	393	731	1,600	536	3,792

TABLE 20: Combined projected employment from current Forest and Wildlife Service plantations and the Drumlin Afforestation Project

Calendar year	Project year	FWS generated employment	Project employment	Combined total
1975—76		690		690
1976—77		717		717
1977—78		737		737
1978—79		759		759
1979—80		789		789
1980—81	1	816	100	916
1981—82	2	858	100	958
1982—83	3	896	135	1,031
1983—84	4	945	155	1,100
1984—85	5	988	156	1,144
1985—86	6	1,034	157	1,190
1986—87	7	1,101	156	1,258
1987—88	8	1,148	157	1,305
1988—89	9	1,185	170	1,355
1989—90	10	1,211	170	1,381
1990—91	11	1,231	171	1,421
1991—92	12	1,250	171	1,443
1992—93	13	1,271	172	1,443
1993—94	14	1,292	418	1,710
1994—95	15	1,314	814	2,128
1995—96	16	1,337	820	2,157
1996—97	17	1,361	815	2,176
1997—98	18	1,385	811	2,196
1998—99	19	1,409	806	2,967
1999—2000	20	1,436	1,531	2,215
2000—01	21	1,462	1,519	2,981
2001—02	22	1,489	1,508	2,997
2002—03	23	1,517	1,496	3,013
2003—04	24	1,544	1,484	3,028
2004—05	25	1,573	3,260	4,833

PRIVATE FORESTRY

M. Bulfin and B. C. Hickey

Within the European Economic Community there is a definite emphasis on private forestry. Of forests within the EEC, 80% are privately or co-operatively owned. Most of the subventions from Commission funds are allocated to private forestry. Ireland is alone in having 95% of its new planting in State hands. It may be necessary for the State to consider the promotion of private or co-operative forestry in order to avail of these financial supports. The major problem for any private individual is the lack of income in the early stages of the plantation. Financial supports should be directed to assisting the private grower during this period.

The strong resistance to State forestry in certain areas must also be a cause for concern, particularly when the resistance occurs in areas which could derive the most benefit from forestry. The kernel of the problem lies in the landowners' reluctance to part with his land while at the same time not putting his land to maximum use. If the State is to continue to achieve its 10,000 ha planting programme (25,000 acres) in the face of rapidly rising land prices then it must consider the encouragement of private forestry as part of its overall strategy. Otherwise State forestry will be forced onto even poorer and less productive land at high elevations. If, however, a serious attempt is made to encourage private forestry, particularly on marginal agricultural land which is highly productive for forestry, then the average production for the country can be maintained.

The drumlin belt is one of the areas which offers the best prospects of economic success for private forestry in Ireland. The rapid growth rate achieved by Sitka, spruce gives early thinnings which mean quick returns for the private planter. Short rotations are possible and the private individual could see two or three harvests in his own lifetime. Farmers who have changed to forestry on these wet soils have found forestry a far more congenial way of life than the continuous struggle which they faced while farming.

In this Chapter we deal with private forestry from the point of view of the small landholder of 6-20 ha (15-50 acres) - the typical landholding in the drumlin area - and indicate a method of financing whereby he can transfer his land from agriculture to forestry and have an annual income at the same time. Large-scale private forestry by private industry, particularly by those already engaged in forest processing should also be encouraged. Such an integrated forest enterprise, where a timber processing plant owns its own forest, is frequently met with in other countries but, as yet, has not developed in Ireland.

Necessity for Financial Agency

Because of the high eventual returns on forestry as a land use enterprise a number of institutional methods of financing private forestry are suggested for consideration by the relevant authorities. The situation where a large company would

purchase land for planting is similar to and would have the same economics, to the operations of the Forest and Wildlife Service. Purchase by private individuals occurs on a very small scale in the drumlin areas today. It is unlikely that the rate of this type of planting will increase unless there is a considerable change in the grants available for planting. The situation considered here is one where the present owner afforests all or part of his land. To enable him to do this some form of financial support during the early years of the rotation is necessary.

Annuity Purchase Scheme

In this scheme the small landowner plants his own land and receives an annual income from a timber purchasing agency. The agency, which contracts in advance to buy the entire crop, could be an agricultural co-operative or a specially formed forest co-operative or the Forest and Wildlife Service. The role of the purchasing co-op is to act as an intermediary financial agency between the small landowners and a major financial institution interested in long term investment. The State could also establish and finance the purchasing agency through the Forest and Wildlife Service who currently have responsibility for private forestry.

An agricultural co-op, some of whose members would likely avail of and benefit from such a scheme, could act as an agency or form a subsidiary to undertake this enterprise. Otherwise, special forest co-ops would need to be established. If sufficient interest is evoked and enough land is planted then after 15 years the returns from timber sales would begin to cancel out much of the long-term borrowing. Almost half of the money borrowed up to that period could be repaid to the lending institution out of timber sales at first thinning. The advantages to the agency are:

- 1) Land acquisition and transfer problems do not arise
- 2) There is no long term leasing of land
- 3) Labour is provided by the landowner
- 4) The only involvement by the agency would be in organising the purchase and resale of the timber crop and possibly in advising on the management and assessment of the crop.

If the agency is a co-op such a scheme would enable it to put a new option to its members, who through disability or advancing age may not be able to continue full time farming. Farmers employed part time in off-farm employment are also likely participants due to the flexibility of forest operations, which can be carried out at any time of the year. If the State operated the scheme, it would have the added advantage that it could consider any plantings under the private scheme as contributing towards its own annual afforestation targets. The current upsurge in land prices could make this an attractive incentive to State support of private plantings.

The Annuity Purchase Scheme offers a number of advantages to the landholder as well as to the purchasing agency. The advantages to the landowner are:

- 1) He would retain ownership of his land
- 2) He would continue to work his land
- 3) He could avail of all State grants for afforestation
- 4) Using his own labour reduces his costs and would contribute to his annual income
- 5) He would receive an annual income based on the expected value of the crop
- 6) This income could be linked to the price of timber and would move up in line with market prices
- 7) He would retain his social welfare entitlements

By use of this system, small woodlot forestry is put on the same basis as any other agricultural enterprise, in that the landowner receives an annual income based on

the value of his crop. A change to forestry would still suit those farmers who through disability or increasing age were finding it difficult to continue in farming. As the bulk of forest work is concentrated in the first years of a plantation, a landowner who has succeeded in establishing his crop will have little further work to do in subsequent years. Thinning and harvesting can be contracted out if necessary.

Importance of Contract

The success of this proposal would hinge on the nature of the contract entered into between the landholder and the agency. Obviously, certain safeguards for the agency must be included in the contract. In our calculations, as well as the inbuilt (rop failure allowance which is standard, it is envisaged that, perhaps, only a proportion, say 50% of the expected final value, of the crop would be utilised for calculating the purchasing annuity. The remainder would be paid at the end of the rotation when all outstanding payments are met and the final settlement made with the landowner. In this way the landowner would have participated in the scheme by contributing his land, labour and enterprise and by foregoing part of the value of his crop. This could be interpreted as a financial participation by the landowner in the scheme.

The drafting of the contract would require considerable care as many long-term contingencies must be covered. The landowner must retain his right to sell his land or to pass it on through inheritance. However, the contract would still be binding on the inheritors. The agencies' rights in protecting the crop and in maintaining it in good condition must also be considered. The contract will determine the relationship between the agency and the landowner and, therefore, requires detailed planning to eliminate subsequent dissension.

Minimising Costs

For private forestry, the establishment and management methods which apply to State forestry must be reconsidered. Thus, all silvicultural practices, which are normal within State forestry must be reassessed and in many cases adjusted to suit private forestry. Only essential costs should be incurred. For the small private landholder the cost of afforestation could be minimised by omitting ploughing and roadbuilding, both of which involve heavy machinery, and by reducing fencing requirements to the minimum. Ploughing on these wet mineral soils seems unnecessary and could lead to instability in the later stages of the crop. Rotations would be reduced to somewhere between 25 and 35 years. In Chapter 4 it was indicated that a rotation of 35 years was most economic for State forestry. With private forestry, and the need to reduce payments under this proposal to the minimum, a 25-year rotation is considered. Some private forest owners operating on these soils are already using such short rotations (31).

The financial calculations detailed below show how the system could work. The calculations are based on the rotation shown in Table 17.

Economic Calculations — Costs

The costs to the landholder of growing the forest, either using a 25 or a 35 year rotation, are shown in Table 21. The year in which each cost is incurred is given and the costs are broken down into labour costs and material costs. To simplify the operation it is suggested that no machinery need be used in planting. The number of hours of labour required of the landowner are also given so that an estimate of the total labour content can be calculated. If, as is assumed, the landowner does his own

planting then the out of pocket expenses will be those listed under the material column in Table 21.

TABLE 21: Private forestry proposal; costs of growing

Year	Operation	Labour	Labour cost £	Material cost £/ha	Total cost £/ha
		Hours/ annum	£/ha	£/ha	£/ha
0	Fencing 300 yds. of wire	7	11.41	30	
	60 posts • 35p			21	
	10 cwt. of Phosphatic Fert.			24	
	Spray rushes			10	
	Plants 3.000 a £30/1000			90	
	Delivery of Plants			9	
	Planting	30	48.90		232.90
2	Veg. control	25	40.75		40.75
3	Veg. control	15	24.47		
3	Replanting 200 plants	2	3.26	8	35.71
4	Protection	1	1.63		1.63
5	"	1	1.63		1.63
6	"	1	1.63		1.63
8	"	1	1.63		1.63
8	Fence repairs	7	11.41		13.04
10	Protection	1	1.63		1.63
12	"	1	1.63		1.63
14	"	1	1.63		1.63
15	Brashing	47.5	77.43		77.43
15	Thinning	26.4	43.03		43.03
16	Fencing	7	11.41		11.41
20	Thinning	21.9	35.70		35.70
	Total 25 yr rotation	195.8	319.18	192	511.18
25	Thinning	17.6	28.69		28.69
30	Thinning	17.6	28.69		28.69
	Total 35 yr. rotation	231.0	376.57	192	568.56

Labour is costed at 1.63 per hour

In Table 22 the estimated costs of felling, extraction and haulage are shown. As a guideline it can be taken that 75% of the costs of felling and extraction are for labour. These operations could be undertaken by the landowner himself. However, haulage to the processing mill is regarded as beyond the scope of the individual landowner.

Economic Calculations — Revenue

Revenue is detailed in Table 23. It shows the position where standing timber is sold "on root" by the landowner either with a 25 or a 35 year rotation. Total revenue per annum is much greater with a 35 year rotation at £238 per ha, as against £102 for the 25 year rotation. This is due to a high rate of timber production in the 25 to 35 year period coupled with a higher price for sawlog timber. In the case of the 25 year rotation all the timber is taken as going for pulp milling. Revenue is given in three forms: 1) total revenue, 2) revenue less costs including labour, and 3) revenue less costs of materials only. These three forms correspond to the situation from different points of view. Total revenue is the basis on which the agency will make its annual payment. Revenue exclusive of material costs corresponds to the income a landowner could expect if he carries out operations himself. Revenue less costs would indicate the income to the landowner if he pays for labour.

Annuity Purchase Scheme: Financial Considerations

In this proposal the timber purchasing agency, whether co-operative, state or private business firm, pays the landowner an annual sum based on the estimated final sale value of the crop. The objective of this is to provide the small landholder with an annual income rather than having to wait several years for his payment when thinning or final felling of the forest takes place. This should put forestry on an equal footing with cattle production or dairying for the small landholder. Since the landholder retains ownership of his land, a major objection to forestry by many people is thus removed.

Annual Payment

The annual payment would be increased in line with increases in timber prices, thus making it largely inflation-proof. A moving average price for timber could be used to prevent major fluctuations in the annuity.

Since the timber purchasing agency has to wait until thinning or felling before it receives any revenue and since it pays out money each year to the grower, then it will have to use borrowed funds or its own reserves which will almost certainly have to bear an interest charge. The purchasing agency also incurs expenditure in administering the scheme. It is also necessary that there should be a safety margin to allow for the probability that the timber when finally sold may not fetch the price expected. For these reasons, the annual payment will be less than the total revenue divided by the number of years of the rotation. Thus for a 35-year rotation shown in Table 24 the estimated total gross revenue with sale of standing timber is £8,332 per ha or £238 per ha per annum. The annual payment in the first year would be a proportion of the £238. The higher the annual payment the greater the accumulated interest charge will be. When final felling takes place the difference between the total value of timber produced during the rotation and the accumulated annual payments, including interest and overhead charge, is paid to the landholder/grower as a lump sum payment. Thus, in the example given in Table 24 the revenue per ha at final felling is £46,445, with a 6% per annum increase in timber prices. The accumulated annual payments, including interest and overhead charge at 10% per annum less the value of thinnings, amount to £39,317. The difference of £7,128 is paid out to the landholder/grower as a lump sum payment at the time of final felling of the crop.

Table 24 gives a rather simplified example of how the system of payments might work. The first annual payment to the landholder/grower is taken to be 50% of gross annual revenue. The annual payout then increases in line with timber price increases. In the example, the price of timber is taken to rise by 6% per annum and the annual payment to the landholder rises correspondingly from £119 in the first year to £814 in year 34. In practice, timber prices do not rise at a constant rate and a moving average price could be used to make payments relatively stable.

The interest and overhead charge is taken to be 10% per annum. The table shows the accumulated payments and interest plus overhead charge. The revenue from sales of thinnings as they occur help to reduce the accumulated payout plus interest and overheads. The actual interest rate charged could be varied with changes in the general level of interest rates.

Share-cropping

It must be emphasised that Table 24 is just an example of a type of system that might be operated. Flexibility of choice could be introduced by varying the type of contract to suit the needs of the landowner. There are several possible variations that could be adopted; for example, a share-cropping arrangement whereby the

considered necessary to encourage the transfer of land from marginal agriculture to forestry. The Draft Directive was particularly aimed at lands which, while marginal for agriculture, are very suitable for forestry. EEC subventions would be aimed at furthering this aspect of afforestation. Under present circumstances the state would have difficulty in gaining EEC grants, being itself the main afforestation agency. Such subventions might be more readily available to the Irish government to promote private or co-operative rather than state forestry. Any avenue which would bring EEC subventions or raise the level of grants to private forestry should be explored. In making decisions on financial aids to private forestry it should be borne in mind that, while grants are a loss to the Exchequer, the Annuity Purchase Scheme would eventually pay its way.

SUMMARY AND RECOMMENDATIONS

European Economic Community policy on rural development and land-use clearly indicates that afforestation should not be considered in isolation but as part of general rural development strategy. The proposed Forestry Directive indicates that the Community favours a transfer of non-viable agricultural holdings, on land suitable for timber production, to forestry.

In Ireland, the state now accounts for 95% of all planting and employs some 4,000 people in the development and management of plantations, which total 350,000 ha (865,000 acres). This employment is scattered over most of the country being concentrated mostly in the remote mountain areas and the climatic peats in the west. A further 3-4,000 people are employed in the forest processing industry. There has been little development of private forestry and little recognition of its possible role in diversifying land use in rural areas.

The Forest and Wildlife Service has built up a high level of expertise in establishing tree crops on even the poorest soils — concentrating on planting exotic (non-native) conifers. Sitka spruce and Contorta pine are now the most favoured species for these sites.

Expenditure by the Forest and Wildlife Service amounted to £7.73 million in 1972-73, of which 70% goes towards wages and salaries. The Service spent £0.33 million in Co. Leitrim in the same year.

There are seven State forests in Co. Leitrim, with a total afforested area in 1974 of 8,979 ha (22,178 acres) which amounts to 5.7% of the total county area. Acquisition of land for forestry has declined from 1,500 - 2,000 acres in 1969-70 to almost none in 1976.

Five site types have been used in assessing the costs and returns from forestry. The cost of establishing plantations varies little between sites but there is a marked difference in the returns. Yield Classes vary from 14 m³ to 25 m³/ha annum, with gross revenue for a rotation varying from £3,905 per hectare on the Hill and Mountain areas to £7,075 on the Drumlin site type.

The production cycle to achieve maximum mean annual increment varies from 45 to 55 years on the different site types. Therefore, it is necessary to use discounting techniques when undertaking an investment appraisal of forestry. Because of the long period over which discounting is necessary the interest rate used will have a considerable influence on the level of profitability of forestry. Although no single unique rate of interest can be adjudged for forestry it seems that an appropriate rate would be in the 3-6% range. At a 5% interest rate the Net Annual Revenue (NAR) is £43 per ha per annum for wet drumlin soils. The break-even discount rate, which is the rate of interest which equates revenue and expenditure, varies from 5.4% in hill and mountain areas to almost 10% for the wet drumlin areas.

Over the past 50 years standing timber prices have risen by up to 2% annually relative to agricultural prices. Current indications are that this trend will continue until well into the next century. If such a trend were to continue even at 1% per annum it would mean an extra return of £26 per ha on the best (wet drumlin) sites.

Because of the rapid forest growth rates, even over short rotations, it is necessary to look at the economic feasibility of shortening rotations. Short rotations, while they produce less total volume, are also less sensitive to increasing discount rate. On the wet drumlin sites, the difference between the 45 and 35 year rotations become progressively less as discount rate increases. Net annual revenues are equal for the

two rotations at a 6% discount rate. Above this discount level the shorter rotation has a slight financial advantage. The discount rate at which agriculture and forestry give equal returns is 7.4%, without deduction of labour costs, and 8.4% with labour costs deducted.

The priority areas for forestry are those where the difference in the net annual revenue per ha between agriculture and forestry is greatest. The greatest differences are found on the wet drumlin soils where forestry yields £141.1 per ha and agriculture £36.3—a difference of £104.8, labour costs not deducted. If labour costs are deducted the difference rises to £122.8. When labour costs are deducted the NAR from forestry is higher than agriculture at all discount rates up to 10%. Financial calculations indicate that the priority areas for planting are the lowland drumlin areas in preference to the mountain and hill areas. Within the drumlin areas, similar calculations indicate that the lowland Drumkeeran soils should be priority planting areas.

Employment

Employment in the forest industry comes from three sources, 1) planting and maintenance, 2) harvesting and transport, 3) processing. In Ireland the State plants and manages the plantations while private enterprise is involved in extraction and processing.

Employment levels in extraction and processing are almost entirely dependent on volume, thus, the higher Yield Classes give the highest levels of employment. Yield Class 25 on a 45 year rotation will provide a total employment level of 4,909 as against 2,924 for Yield Class 14 for a 60,000 ha plantation in full production.

Shortening rotations will increase total employment in the higher Yield Classes. Total employment increases from 4,122 to 4,451 when Yield Class 20/22 is shortened from 50 to 40 years. Shortening rotations to 30 years or less will, however, reduce the total employment level but has the advantage that full employment levels are reached some 20 years earlier.

Over most rotations, only 6 to 9% of employment will be provided in forest management; some 21 to 27% will be in extraction and transport while the remaining 65 to 70% is provided in processing.

One man is employed for every 12 ha (30 acres) where the forest is on land capable of Yield Class 25 production but total employment drops to one man per 21 ha (51 acres) for YC 14 sites. Changing rotation length has little effect on employment per acre on rotations of 25 years and upwards.

Because employment is closely linked with extraction and processing the flow of employment resulting from the establishment of a plantation is greatest at the end of the rotation. Thus, shortened rotations can bring maximum possible employment some 20 years earlier in the higher Yield Classes.

The timber raw material requirements of a modern processing plant are such that no single county could supply its needs. However, Leitrim is well situated to be the location for such a processing plant in the north-west region. Timber production from current plantations in the north-west region will rise from 35,800 m³ to 130,250 m³ by 1986 and double again by the year 2,000. An in-forest storage system is proposed which will enable the date of opening of a large scale processing plant to be brought forward by at least five years.

In the Drumlin Afforestation Project an annual planting programme of 2,400 ha (6,000 acres) over a 25-year period is proposed. Planting should be concentrated on the highly productive wet mineral lowlands within a radius of 30-40 miles of Drumshanbo. One third of the plantations would be within Co. Leitrim itself.

Production would rise from 60,000 m³ after 14 years to 974,000 m³ after 25 years. The combined production from current plantations and the Drumlin Afforestation Project would make the north-west region a major forest products centre. Total employment generated by the combined output would be between 4,600 and 5,000 persons within 25 years.

Within the European Economic Community there is a definite emphasis on private forestry, 80% of forests within the E.E.C. are privately or co-operatively owned. Most of the subventions from Commission funds are allocated to private forestry. Ireland differs from her E.E.C. partners in having 95% of its planting programme in State hands. Thus, it is difficult for Ireland to avail of Community grants for private forestry. It may, therefore, be necessary for the State to consider the promotion of private or co-operative forestry in order to avail of these financial supports.

Leitrim is potentially one of the most lucrative areas for private forestry. At present only those with outside capital are entering private forestry in the county. Some form of bridging finance in the early years of a rotation is necessary, to encourage small landowners into private forestry. Therefore, an Annuity Purchase Scheme is proposed. Under this scheme the landowner would sell his crop to a financing agency and receive payments on an annual basis. Payments would be based on the expected value of the crop as indicated by the production potential of the site. A state agency, or large co-operative, insurance firm or pensions trust would organise the financing of such a scheme either directly or through an intermediary agency. The advantages to the purchasing agency are that it would purchase a valuable raw material that it could either process itself or sell for processing, while the landowner would retain ownership of his land but transfer it to more profitable use under forestry.

Recommendations based on current plantations

A timber processing plant to be established at Drumshanbo before 1984.

An in-forest storage management system to be instituted now to ensure adequate raw material for processing.

Increased attention to be given to the amenity value of forestry with the possible provision of a Forest Park at Lough Gill.

Recommendations based on future plantations

The Drumlin Afforestation Project proposes that 60,000 ha (148,000 acres) be planted at the rate of 2,400 ha per annum over the next 25 years, not more than 20% of any one area or region to be afforested.

Grants for private forestry to be considerably increased.

Afforestation of smallholdings to be encouraged by the initiation of an Annuity Purchase Scheme.

REFERENCES

1. European Economic Community Commission "Forest Policy Aims in the European Community, Discussion paper prepared by Services of the Commission, 1976.
2. European Economic Community Commission "Proposal for a Council Directive concerning forestry measures", Official Journal of the European Communities, No. C44/14, 1974.
3. Johnson, D. R. "Tree growth and wood production in Britain Phil Trans R. Soc. Lond. B. 271, 101-104, 1975.
4. Luhr, Fredrik, "Guide to Swedish Forestry" Swedish Forestry Institute, 1971.
5. Forest Service U.S.I) \ The outlook for timber in the United States", Forest Resources Report No 20, 1973. Superintendent of Documents, Washington, I.J.C
6. Cameron R., "Report on Forestry Mission to Ireland". Stationery Office, Dublin, 1951.
7. Reports. Minister for Lands. 1926-1975, Stationery Office. Dublin.
8. Hummel, F. C, "The Role of Forestry in a Land-use Policy", Agricultural Science Association Annual Conference, Killarney, 1974.
9. Westoby, J. C, "Forest industries in the attack on economic underdevelopment", Unasylya, 16 (4), No. 67, 1962.
10. King, K. F. S., "Forest policies and national development", Unasylya, 27 No. 107, 1974/75.
11. Bulfin, M., "Timber and timber products trade", Ir. J. agric. Econ. rur. Sociol. 5: 239- 251, 1974-75.
12. Deasy, J., "Public lands in relation to landscape and recreation in the Republic of Ireland", Irish Landscape Association Journal, 1 (1), 1978.
133. Malmberg, G. von "The role of forestry for income and employment" in Evaluation of the Contribution of Forestry to Economic Development, Grayson, A.J. (Ed.) British Forestry Commission, Bulletin No. 56, 1976.
14. Kury, C, "Gifford Pinchot's Philosophy". Journal of Forestry, 73(3), 1975.
15. Convery, F., "Forestry and Irish economic and social development". Irish Forestry, 27 (2), 1970.
16. O'Flanagan, L. P., "Inventory of woodlands of the Forest and Wildlife Service". Stationery Office, Dublin, 1973.
17. Gallagher, G. J., "Some patterns in crop structure and productivity for unthinned Sitka spruce". Irish Forestry, 29 (2), 1972.
18. Morris, N., "Leitrim's Future". Seminar paper, Regional Science Association, Carrick-on-Shannon, 1977.
19. Merrett, A. J., and Sykes, A. Return on equities and fixed interest securities, 1919 - 1963.
20. Morgan Guaranty Survey. "How to keep interest rates down". Testimony presented to the Committee on Banking and Currency of the U.S. Senate, 1969.
21. Klempener, W. D., "Economic analysis applied to forestry", Journal of Forestry, 74 (9), 1976.
22. British Land Use Study Group. "Forestry, agriculture and the multiple use of rural land". HMSO London, 1966.
23. Morris, N., Forest and Wildlife Service. Personal communication.
24. Economics and Rural Welfare Centre, "Irish Agriculture in Figures". An Foras Taluntais, 1976.
25. Convery, F. J., "Some regional impacts of alternative rural land uses". Ir., J. agric. Econ. rur. Sociol., 4 (2) 1973/74.
26. Rankin K., "Forestry in Britain - the pattern of Industry". Commonwealth Forestry Review. 52 (1), 1972.
27. Hallett, R. M., Timber Research & Development Corporation. Personal communication, 1977.
28. Gallagher, L. L), Personal communication, 1977.
29. National Soil Survey, Ireland. General Soil Map. An Foras Taluntais, 1969.
30. Hamilton, G. J., and Christie, J. M., Forestry Management Tables (metric). HMSO London, 1971.
31. Tottenham, R., Personal communication, 1977.