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IRISH FORESTRY POLICY

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IRISH FORESTRY POLICY

by

Frank J. Convery

PART I

THE COUNCIL'S COMMENTS

on

IRISH FORESTRY POLICY

INTRODUCTION

1. In November 1977, the Minister for Economic Planning and Development, requested the National Economic and Social Council to undertake a study of, and to advise on, the potential and implications of forestry for economic and social development in Ireland.

2. In February 1978, Professor Frank Convery of Duke University, North Carolina, USA, and visiting Professor at the Economic and Social Research Institute during 1977-78, was engaged as consultant by the Council to undertake a broad study of Irish forestry policy. This study is published in full in Part II of this report.

3. The Institute for Industrial Research and Standards has already completed a study of the softwood sawmilling industry in Ireland as part of a timber promotion study at present being carried out jointly by the Department of Fisheries and Forestry, the IIRS and the Home Grown Timber Merchants' Association. The Industrial Development Authority has also been engaged in a detailed analysis of the Irish wood processing sector. The Council understands that, on the basis of its analysis, the IDA will submit recommendations to the Minister for Industry, Commerce and Energy on possible options for the development of the wood processing industry in Ireland. To avoid unnecessary duplication, Professor Convery has confined his examination of wood processing to broad policy questions although he has had the benefit of consultations with personnel of both the IIRS and the IDA on their respective studies.

4. It is clear from Part II to this report that Irish forestry has reached an important cross-roads in its development for a number of reasons. First, until now the main preoccupation of those concerned with planning for Irish forestry has been the growing of timber. The

processing of the timber output from our forests did not become a major concern until recently as ready markets existed for all produce available. However, as is shown in Chapter 10 of the consultant's study, the supply of home grown timber now exceeds our processing capacity and this surplus is expected to increase unless processing capacity is increased very substantially in the near future. Second, because of the increasing difficulty experienced by the Forest and Wildlife Service (FWS) in acquiring land to meet its annual planting targets, it would appear that a cutback in the annual rate of afforestation in Ireland is threatened unless ways are found to overcome the difficulties of acquiring land. Third, there has been in recent years a developing public interest in the preservation of our wildlife and natural environment which are, in turn, closely related to the development of Irish forestry. Fourth, in a European Community context, there has been mounting pressure from the EEC Commission and the EEC Economic and Social Committee for the adoption of common measures to assist the development of forestry on a Community wide basis. It is important, therefore, that in discussing at European Community level common measures for the development of forestry, we should be in a position to do so on the basis of a clearly defined development strategy for Irish forestry. These four developments call for a reappraisal of existing policies on forestry and wood processing industries.

The Processing of Irish Wood Products

5. As has already been noted, the IDA is at present carrying out a detailed examination of the alternative ways of using the rapidly increasing supply of native timber. Examples of the type of enterprise being considered are given in Table 18 of Part II to this report. The Council does not propose in this report to comment on the specific types of industrial projects which might be undertaken. Instead, it puts forward recommendations on the general principles which should guide the future development of timber processing.

6. The Council wishes to emphasise at the outset, in regard to wood processing, that the issue is not whether there should or should not be further substantial investment in the industry. In effect, that decision has already been taken because large sums of money have been spent

over the years on an afforestation programme which is already providing us with more timber than can be processed in this country at present. Unless remedial measures are taken, this surplus will continue to grow at an increasing rate. The real question is what kind of investment will allow this timber output to be most efficiently developed, processed and most effectively marketed in the years to come in order to increase the net returns to the Irish economy.

7. The growing and processing of forest products are mutually interdependent. There is little point in planning a detailed afforestation programme without considering how the eventual output is to be used. Equally, in establishing timber based industries, attention must be paid to the type and extent of available supplies. In this country, afforestation has primarily been the responsibility of the State through the FWS. Processing has been left mainly to private enterprise and, until the recent slump in the market for certain timber products, Government intervention has been minimal. The main point of formal contact between grower and processor has been at the point of sale of the timber output.

8. In considering the future of timber processing, it is first necessary to look at the likely future pattern of timber supplies. In Chapter 10 of his report, Professor Convery provides estimates of the likely available supply to the end of the century, based on forecasts of national and international agencies. Already, domestic output of pulpwood exceeds domestic demand and is expected to be at least double the level of domestic consumption by 1983; the long-term prospect is for a continuous widening of the gap between production and consumption. Furthermore, although this country is still a large importer of sawnwood, Professor Convery has estimated that within 10 years we will have to begin exporting sawnwood if all available supplies are to be utilised.

9. What are the prospects of disposing of our excess supplies of pulpwood and sawnwood in export markets? Chapter 4 of the consultant's report gives projections of the future supply of, and demand for, timber products in Europe generally, and in Britain in particular. The conclusions are that Europe as a whole will need to increase its annual level of imports from 45 million cubic metres in

1969-71 to 115 million cubic metres by the year 2000 (Ireland's total production from State forests by then is projected to be over 3 million cubic metres). It is estimated that the United Kingdom will be importing 75 per cent of its wood requirements, or a total of at least 50 million cubic metres, by the end of the century. In Chapter 6 of his report, Professor Convery also examines the likely trend in market prices for timber products and concludes that standing wood prices will at least maintain their present level in real terms and may well show some real growth. It would seem that, on the basis of the information at present available, there is likely to be a large export market for our timber products within relatively easy reach; and the prospect of stable prices for the products for the foreseeable future. Provided we are competitive, the long-term prospects for the wood processing industry in Ireland seem promising.

10. Although the long-term prospects appear to be good, there are serious short-term problems currently facing the timber processing industry in this country. The chipboard factory at Scarriff, Co. Clare has had to seek assistance from Foir Teoranta while the chipboard plant in Waterford and the fibreboard mill at Athy in Co. Kildare are now in receivership. These current problems should, however, be seen in a broad medium-term context and should not be allowed to influence unduly planning for the long-term future of the industry. The nature of, and reasons for, the current difficulties are outlined in detail in Chapter 4 of Part II to this report. The world-wide recession, which followed the oil crisis in 1973, led to a sharp fall in the demand for forest products. This fall in consumption was not matched by a corresponding cutback in production. The nature of timber production is such that it is difficult to make sudden sharp cutbacks in output. In any case, major producers such as Sweden opted to maintain production rather than cause redundancies by closing down plant. As a result, timber products have been sold on European markets at prices which are often below cost with the help of large Government subsidies and our own firms are being priced out of the market. Despite the current gloom, there is a general expectation that prices will recover and that the long-term pattern of firm markets will be re-established. This optimism is based on a wide concensus among international organisations about the likely future pattern of demand for, and supply of, timber products outlined in paragraph 9 above.

11. If the long-term possibilities are to be fully exploited, it is evident that more resources, both public and private, will need to be devoted to the processing side of the forestry industry than in the past. In order to maintain competitiveness, a number of conditions will have to be met. From Professor Convery's survey, advanced wood processing industries in Europe and the US, appear to have certain common characteristics. First, timber processing is an activity, particularly in the case of pulpwood industries, where substantial economies of scale can be reached. Second, there is a very high degree of integration between the growing and processing of timber. Clearly very substantial investments will be required in establishing processing capacity in this country on a scale which will allow unit costs to be kept as low as our competitors. Moreover, a greater degree of co-ordination in the growing and processing of timber will be required in this country than has been the case up to now.

12. These two conclusions have important implications for Government forestry policy. If the necessary investment in timber processing is to be undertaken by the private sector, the Government will no doubt be looked to for assistance through the various State agencies which provide grant-aid for new industries and for re-equipment. There are, however, two reasons why the State itself might consider getting involved directly in timber processing, through, for example, the establishment of a State agency. First, the scale of investment that will be required to ensure a viable timber processing industry in this country will be very substantial and may, for that reason, deter private enterprises from becoming involved. Second, since the State is already the main timber grower, the extension of its direct involvement beyond the tree-growing stage would facilitate the vertical integration of the growing, processing and marketing of wood products similar to that found in more advanced wood producing countries. Such a development could, of course, go hand-in-hand with the private development of processing and marketing. Indeed, the possibility of a joint venture between the State and private enterprise in timber processing, through the State taking equity in a private concern, might be considered. Professor Convery has, in Chapter 11 of his report, put forward recommendations on what organisational changes might usefully be made in the present structures, and what new

structures might be introduced, to meet the challenge with which the forestry industry is now faced. These are examined in the section on "Institutional Issues" below.

13. One further suggestion put forward by the consultant in regard to processing, which is of a more short-term nature, might also be considered. It has been intimated by the consultant that there is dissatisfaction in the industry with the present method used by the FWS in selling timber which is mainly by means of the sealed tender system. This method has the advantage of maximising competition among buyers, but it also causes uncertainty about the future supply of timber to individual buyers which makes it difficult to maintain production at full capacity over a long period. The various suggestions for alternative systems of timber sale, discussed in Chapter 9 of Part II to this report, should therefore be examined to see how the advantages of the sealed tender system can be combined with a method which might give a better guarantee of supply to individual processors.

The Growing of Timber in Ireland

14. In a number of notable respects forestry in Ireland is unique compared with other European countries. The proportion of the total land area in this country under forest is, at 5%, the lowest in Europe; 77% of the country's forest area is owned by the State which is by far the highest in Europe; and the rate of growth in forest area is higher here than in any other European country. All of these features can be attributed in part to the fact that forestry in Ireland is still at a relatively early stage in its development. It should, of course, be recognised that our land is, by comparison with most other European countries, generally more suited to agricultural than to forestry production and it should not, therefore, be expected that the area under forest in this country, as a proportion of the total land area, should necessarily be on a par with that in other European countries.

15. Responsibility for the development of our forests has rested with the Forest and Wildlife Service of the Department of Fisheries and Forestry which has been very successful in its afforestation programmes. For various reasons, the State has over the years assumed a predominant role in the development of Irish forests while

private investment in tree planting has been given relatively little encouragement. At present only 0.25% of total State expenditure on forestry goes to private forestry. The Council believes that a reassessment of this overall strategy is now necessary.

16. Professor Convery argues in his study that the future of the afforestation programme is threatened by the increasing difficulty of acquiring land for planting and has identified three factors which have contributed to this. First, land prices have increased rapidly since the beginning of the 1970s, but the prices offered by the FWS for land suitable for forestry have not kept pace and are no longer competitive. Second, a limited degree of flexibility has been allowed by the FWS in making offers for land. Third, as is explained in Chapter 15 of Part II to this report, is the fact that for social and cultural reasons farmers are still reluctant to sell land even though the alternative may be to leave it unused.

17. To tackle these problems a number of recommendations are put forward by the consultant with which the Council is in broad agreement. In relation to the State afforestation programme, Professor Convery calls for a land acquisition plan which would:

(i) outline how much land might realistically become part of the forest estate,

(ii) establish priorities for purchase, and

(iii) contain a programme for acquisition.

The Council recommends that a clearly stated planting programme be prepared as a priority.

18. An annual planting area of about 25,000 acres has been the target for the State afforestation programme in recent years. If this planting target is to be maintained a number of changes in present policy will be required. Sufficient land for afforestation will not be made available unless the price offered is set at a realistic level but the present method of determining the FWS price offered for land suitable for afforestation does not seem to result in such a price. The offer price for land for afforestation should be based on, though not necessarily be

exactly equal to, the estimated present net worth of the land under timber after deduction of costs involved in converting it to forest. The FWS should also be allowed greater flexibility within its overall budget in making individual offers for land.

19. While these measures should go some way to lessen the present difficulties encountered in acquiring land for State afforestation, it is doubtful whether they would overcome the more fundamental reluctance of certain landowners to part with their land even if prices offered are competitive. These measures could be complemented by giving greater encouragement to private investment in forestry. In this context, two issues raised in Part II to this report are relevant.

20. Private forestry has, for various reasons, been neglected in Ireland, not only in relation to the attention given to State afforestation but also compared with the support given to agricultural production. Professor Convery suggests in his study that the output of the existing private forest estate could be almost doubled by better organisation and management of private estates. To achieve this improvement in organisation and management, a greater commitment by the State to encouraging the development of private forestry will be needed. Investment in private forestry should at least not be placed at a disadvantage compared with investment in other types of land use.

21. The tax system, the various schemes for grant-aid and the advisory services should be operated in such a way that land is put to its most efficient use, whether it be forestry or agriculture. If this principle is to find practical application, grants available to farmers for land improvement and capital investment should also be made available on the same terms for comparable investment in forestry. In addition, the provision of advisory services available for private forestry would need to be improved so that the possibilities from afforestation are widely recognised. The assistance of the agricultural advisory service might be useful in this respect. There is also the question of taxation. At present, income from forestry is not subject to income tax but land under forest is liable for Capital Acquisitions Tax which is levied on the value of the land plus the standing timber, although

abatement for agricultural value can be used. In keeping with the principle that there should be equity in the treatment of agriculture and forestry, the Council considers there should be broad comparability between the tax treatment of the two sectors. This means, for example, that (a) forestry should be subject to income tax in the same way as agriculture, account being taken of the fact that income from treegrowing is normally much more irregular than that from agriculture, and (b) the application of capital acquisitions tax to forestry should take account of the long crop rotation for timber.

22. Also in the context of private forestry, Professor Convery puts the case for a scheme through which large areas of drumlin soil in Leitrim, Monaghan, Cavan, Longford and Roscommon, and to a lesser extent in Limerick, Clare and Kerry, would be converted to forest. In essence, the proposal is that landholders would lease their land to investors who would finance the afforestation, maintenance and harvesting of the plantation. During the growing period the landholder would be paid an annuity based on the estimated net worth of the plantation after costs are deducted. The eventual return to the investor would come through the sale of the timber.

23. The proposal is attractive in a number of respects. Professor Convery's analysis, which is based on studies carried out by the FWS and is supported by a study recently published by the Agricultural Institute[1], suggests that the rate of return to forestry on drumlin and related soils appears to be at least as good, and often better than the return from alternative land uses. The scheme, since it would involve leasing land rather than selling it, might also help to overcome the problem caused by landowners' reluctance to sell land. It could also be flexible enough to allow the farmers who so wished, to carry out the planting, maintenance and harvesting operations and so provide them with part-time employment. The financing of such a scheme does, of course, present particular problems. The bulk of revenues from afforestation only accrue after about 35 years and there is an initial period of 15 to 20 years when no revenue at all would be forthcoming. Most financial institutions are not at present geared to finance long-

[1]M. Bulfin and B. C. Hickey, *County Leitrim Resource Survey Part IIIA* (Forestry: Economics, Employment and Development Proposals), An Foras Talúntais, 1978.

term investments of this kind when no repayment is made for such a long period. Professor Convery suggests, in Chapter 15 of his report, a number of ways in which this problem might be overcome and the Council understands that the various possibilities are already being explored by the FWS.

24. To encourage landowners and investors, either as individuals or financial institutions, to become committed to the scheme, the State should be prepared to make available the substantial expertise of the FWS in helping to get the Scheme off the ground. There might, however, be a natural tendency for the State to opt out of this kind of venture and to concentrate its efforts on acquiring land outright for its own afforestation programme. If this were to happen a potential means of adding significantly to our national forest estate might be lost.

25. The use of cut-away bogs is another potential means of increasing the public forest estate. There are different views on what use the cut-away bog should be put to once the peat has been extracted, and an inter-departmental committee has been established to examine the various options. Certain areas of cut-away bogs are already becoming available, and in some cases are being cut to a depth which would rule out the forestry option, even if it was considered the most attractive. It is important that particular options should not be ruled out merely because decisions are delayed. The Council, therefore, looks forward to the early completion of the inter-departmental committee's deliberations and the publication of its report.

Institutional Issues

26. In Chapter 11 of his report, Professor Convery puts forward a model for the future organisation of a State forestry body in Ireland. He recommends that a new Forestry Authority should be established which would comprise three divisions, each responsible for three separate but related functions. First, a reorganised FWS with a single management structure would have responsibility for the State afforestation programme. Second, a Forest Products Development Board should be established to co-ordinate the development of wood processing and could itself become directly involved in processing.

Third, a Tree Farming Development Board should be formed to develop and administer a national plan for private afforestation.

27. In outlining his model, Professor Convery makes it clear that he has four main objectives in mind, namely, that:

(i) continuous attention should be given to the successful development of a forest products industry through improving and expanding processing capacity and the establishment of an effective marketing operation;

(ii) a substantially expanded tree farming programme should be carried out;

(iii) goals, budgets and responsibilities should be separately identified so that progress and performance can be evaluated; and

(iv) the existing dual management structure of the FWS should be eliminated and mobility between the various administrative units responsible for forestry be facilitated.

28. The Council agrees with the aims of enterprise, development and responsibility for achieving results which it sees as the basis of Professor Convery's organisational proposals. It agrees that the State's role in forestry should change significantly in the near future and believes that urgent consideration needs to be given to what institutional arrangements can best achieve the objectives of creating a viable and commercially oriented forest industry (including production and processing) in this country and of establishing a national tree farming programme. The Council, therefore, recommends that this matter be examined in the context of the public service restructuring programme currently on hands under the aegis of the Government and the Minister for the Public Service. While the Council believes that the organisational model put forward by Professor Convery may need to be modified to ensure a sound division of responsibility between overall formulation and review of policy for forestry, on the one hand, and implementation of policy on the other, it does consider Professor Convery's proposals to be worthy of examination. State and private structures for forestry development in other countries which have

reached a more advanced stage of development of their forestry than Ireland should also be considered in this context.

Amenity Policy

29. Forestry and amenity policy are closely related and the FWS has an important role in the amenity area. Preservation of the natural and wildlife environment, and the provision of amenity areas are all activities in which the FWS has been engaged. However, a number of other agencies, such as Bord Fáilte and the Office of Public Works, also have responsibilities in relation to the provision of wildland related outdoor recreational facilities, and functions relating to the protection and preservation of natural areas are also divided between a number of State or State-aided agencies such as the Office of Public Works and An Taisce as well as the FWS. The Council recommends that the proposals, outlined by Professor Convery in Chapter 8 of his report, for achieving better co-ordination between these various agencies in the acquisition and development of land for recreational and preservation purposes, should be examined. The Council also supports the suggestion that the prices charged for the use of amenity services provided by the FWS should be more closely related to the actual cost of their provision, although it does accept that, in certain instances and for certain purposes, subsidised amenity services may be warranted.

Conclusions

30. The Council believes that there are substantial benefits to be derived from forestry development in Ireland. Forestry is a renewable indigenous resource which can contribute indefinitely to the national economy. If developed to its full potential, it can provide much needed employment which could be located in the less developed regions of the country. It is estimated in Part II to this report that, if the proposals for the extension of the State and private forest estate and the development of a modern processing industry were adopted, total employment in planting, harvesting, transportation and processing could rise from around 5,000 at present to 15-25,000 over a period of about 20 years. If the indirect employment thus created is included, the eventual total jobs resulting from forest based employment could be in region of 30-50,000.

31. The balance of payments would also be improved through import substitution at first, and eventually through revenue from the export of our processed timber surplus. It should be remembered that, as in agriculture, the import content of forest products is relatively low. The expansion of the forest estate would offer the added bonus of contributing to the preservation of our natural environment and the provision of related recreation facilities.

32. There would of course be sizeable costs involved. Professor Convery has estimated, in Section IV of his report, that the net additional annual cost to the Exchequer of adopting his proposals would be in the region of £1.5 million[1]. This estimate does not include any expenditure by the State on investment in the processing of timber products which, as is explained above in paragraph 11, could be substantial. Until detailed proposals on wood processing are available from the Industrial Development Authority, it would not be possible to quantify with any precision the level of this investment. It should, however, be remembered that, if the State were to invest directly in processing, it would presumably do so on the basis of an anticipated long-term overall net profit on the investment.

33. The Council believes that, on balance, the case for increased investment in forestry development is compelling. Indeed, unless this increased investment is undertaken, valuable resources—in the form of the timber which is already coming from our forests but cannot be processed and in the form of large areas of under-utilised land which are ideally suited for forestry production—will be wasted. The Council therefore, shares the consultants' view that " . . . Irish forestry is at a threshold and that major policy initiatives are required." This report is intended to provide guidelines on what these initiatives should be.

[1]In the 1979 Budget it is estimated that £16.1 million will be spent on forestry during 1979 under existing programmes.

PART II

IRISH FORESTRY POLICY

by

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I am very grateful to Robert and Jane Tottenham for showing me the realisation of Sitka Spruce's potential on drumlin soils and to Lord Ardee for providing insights regarding the problems and potentials of the more mature woodland estates. A. J. Grayson arranged an excellent series of meetings for me with Forestry Commission personnel in Edinburgh. while A. Dukes, F. C. Hummel and J. Scully at the Commission of the European Communities, and S. O'Shea at the Irish Mission, Brussels, educated me in the ways of the EEC.

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O'Rourke of Sligo Regional Technical College, J. O'Mahony of the North Connacht Farmers Co-operative Society Ltd., and T. J. Maher of the Irish Agricultural Organisation Society deserve credit for pioneering the tree farming concept at the co-operative level.

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I appreciate very much the facilities which were generously put at my disposal by both the Economic and Social Research Institute (ESRI) and Trinity College Dublin. I am especially grateful to the excellent secretarial staff at ESRI, and to Mrs. Phil Brown in particular, who typed the early drafts of this report. Finally, Hugh Quigley of the NESC staff provided both background information for the study and liaison between the researcher and Council in a pleasant, expeditious and efficient manner.

While many people have provided valuable assistance in preparing this report, I should point out that the opinions expressed and conclusions reached are entirely my own responsibility.

It has been exciting reviewing Irish forestry policy, in part because a major resource now exists to be analysed; forestry in Ireland is no longer simply a combined act of faith and hope. That this is so is a vindication of those individuals—notably Professor Clear at University College Dublin, some personnel of the Forest and Wildlife Service and a few private tree farmers—who persevered over the past 40 years in promoting forestry when initially the tangible evidence in support of their case was limited. This report is dedicated to them.

PREFACE

In this Report I have attempted to (i) identify some of the major emerging forest policy issues in Ireland which are likely to be of substantial long-term significance, and (ii) provide suggestions for policy makers concerning opportunities for fruitful action.

In Section I, some historical background is provided, with the emphasis on institutional arrangements and the economic environment. In Section II policy choices concerning the use of the existing forest are discussed, while in Section III options relating to the extension of the forest estate are examined. Section IV consists of a summary followed by recommendations.

Financial efficiency, employment, equity and feasibility are used as guiding criteria in evaluating choices. Where the data, time and the nature of the problem allowed, quantitative analysis has been used to support the arguments presented. Where the necessary prerequisites for useful quantitative analysis are absent, qualitative judgments are presented.

A study of the Irish softwood sawmilling industry has recently been completed (IIRS, 1978), while, with the assistance of consultants, the IDA is conducting an analysis of the wood processing sector. In view of this, I have restricted my attention in this area to a consideration of the employment potential and institutional aspects.

SECTION I

BACKGROUND

"Cad a dhéanfhaimid feasta gan adhmad"? The poet's lament has conveyed to generations of Irish schoolchildren the despair of the 17th century Irish at the wholesale clearances of the primaeval forest. In this section the history of forests and forestry in Ireland will be outlined briefly, followed by a short discussion of technical aspects of tree growing. The existing woodland estate will be described and then the market and policy context will be outlined.

CHAPTER 1

FOREST HISTORY

Up to 1900

1.1 The evolution of the Irish landscape is traced with wonderful clarity by Frank Mitchell of Trinity College, Dublin, from whose book much of the following discussion is drawn (Mitchell, 1976).

1.2 Land plants first developed woody tissue and grew to tree size in Ireland about 350 million years ago. Between then and the onset of the ice age, there gradually evolved and developed forest types which we now associate with North America. Species found included redwood (sequoia) and swamp cypress (taxodium) followed later on by hemlock (tsuga).

1.3 Substantial ice masses probably formed for the first time in Ireland about 200,000 years ago. A succession of cold stages (in some of which ice formed) followed, interspersed by transient inter-glacial warm stages, the latter being defined as periods "having sufficient duration and a temperature adequately high for the establishment of closed deciduous woodlands" (Mitchell, p. 35). The present era in Ireland is now named the Littletonian Warm Stage. On the basis of pollen counts, the successive stages of plant colonisation consequent on a warming and cooling cycle can be traced, epitomised by the Gortian woodlands (Co. Galway) cycle described by Mitchell. As the cold stage ended and temperatures began to rise, the grasses and herbs were first colonised by juniper *(juniperus)*, followed by birch *(betula)* and willow *(salix)*. At the climax stage oak *(quercus)*, alder *(alnus)*, hazel *(corylus)* and ash *(fraxinus)* occur, together with the evergreens holly *(ilex)* and yew *(taxus)*. As the climate became more severe and soil acidity increased, fir *(abies)* makes its appearance, followed by spruce *(picea)*. Rhododendron also appears in quantity. At Gort the record ends, but we know records elsewhere that, with further

leaching of soil nutrients and falling temperatures, pine *(pinus)* and birch *(betula)*—the hardiest trees—would predominate until they too were finally eliminated and polar desert conditions were established once more.

1.4 About 10,000 years ago the most recent cold stage came to an end, and the process of in-migration and colonisation recommenced. The remoteness of Ireland from the sources of vegetation—mainly southern continental Europe—combined with the relative inhospitality of climate and soil (compared to conditions elsewhere in north western Europe) and the fact that a land bridge to Ireland from Britain only endured for 1,500 years from the commencement of the warm stage, has resulted in a rather paltry indigenous biotic endowment. We find that while 1,349 flowering plants are "native" to Great Britain, only 907 can be so classified in Ireland. Among the more well-known tree species which made it to Britain, but not to Ireland, are beech *(fagus sylvatica)*, hornbeam *(carpinus betulus)*, and the small-leaved lime *(tilia cordata)*.

1.5 The successional process described earlier commenced again with the initiation of this most recent warm stage, so that 8,000 years ago the climax stage of deciduous woodland, dominated by oak, alder and elm, had become firmly established on the better lowland soils, while birch and pine predominated in the upland areas. It was about this time that *homo sapiens* first became firmly established in Ireland. Farming, embracing both domestication of animals and crop cultivation, commenced first in the Middle East, reaching south eastern Europe about 7,000 years ago and Ireland 1,500 years later. These Neolithic farmers initiated the large-scale interference by humans with the indigenous woodlands which continued until only a few remnants of the original endowment remained.

1.6 The reduction of the great stretches of water which were established at the end of the cold period commenced as they were invaded by rushes and other water tolerant plants. This process culminated in the formation of the raised bogs now so typical of the Midlands. In the uplands, whether as a result of human disturbance or climatic change, or both, leaching of iron and other nutrients in the mineral soils resulted in the formation of an iron pan ("hard pan") about 30 cms. below the surface. This blocked downward movement of water and initiated the process which resulted in the formation of the

blanket bogs now so characteristic of the Irish uplands, particularly in the West. Some 3,000 years after their formation these latter areas were to provide the basis for the westward expansion of plantation forestry in Ireland.

1.7 Until ploughing was introduced—in the Dowris Period, about 700 BC—the trees could always re-occupy the site once the shifting cultivators, with their primitive scratching of the surface soil layer, had moved on to the more fertile soils of the adjacent forest. As ploughing improved—particularly after the introduction of the coulter (vertical iron knife) plough and share, about 300 AD—and as population became more settled and larger, the pace of permanent forest clearance increased. By the eighth century timber scarcity was such that severe penalties, ranging from the forfeiture of two milch cows to the loss of a sheep, were to be imposed for destroying a valuable tree or bush.

1.8 Nevertheless, Ireland was still predominantly a wooded country in the middle of the sixteenth century. However, the successful Tudor conquests and subsequent plantations in the sixteenth and early seventeenth centuries resulted in rapid forest exploitation; the cutting of wood for use in ship construction, as barrel staves, and for charcoal for iron and glass work was such that by the early 1700s all but the least accessible forests had been cleared. To a modest degree this trend was reversed during the following 150 years, as the big landowners established amenity woods inside the desmesne walls, often using exotic species, some of which had, however, been native to Ireland in pre or inter-glacial times. However, this planted area at its greatest extent amounted to less than 2% of the land area, and in any event was of little benefit to the rapidly growing population of peasants inhabiting the treeless and often fuel-scarce lands outside the desmesne walls. The famines of the 1840s and crop failures of the 1870s, combined with the implementation of the Land Acts (which facilitated the transfer of land from landlord to tenant) finally terminated the afforestation efforts on private lands and indeed effected the diminution of the already forested area.

1.9 Ireland entered the twentieth century with its original woodland patrimony eliminated, and with the proceeds thereof invested elsewhere. The demesne tree planting which followed this exploitation created an association in the popular mind of forestry as an avocation for the gentry, not an activity for the common man.

The Modern Era

1.10 Between 1892 and 1895 the Congested Districts Board planted, by way of experiment, 500 acres of forest on virgin peat in the townland of Knockboy, County Galway. The site was fully exposed to western winds and salt spray from the Atlantic. Because of these adverse site conditions, this first attempt by the State to establish a forest plantation in Ireland failed. In spite of this unhappy experience, state involvement gradually expanded through the first decades of the 1900s. In 1904 a Forestry Branch was formed in the Department of Agriculture and Technical Instruction, Avondale estate in Wicklow was purchased and a forestry centre and school established. After a Departmental Committee in 1907 recommended further acquisition of land for afforestation by the State, a number of woodland estates were purchased from the Land Commission and some mountain land was also acquired. The impetus thereby given to direct State involvement in the establishment and management of plantations has endured to the present day. By 1923 annual planting amounted to 1,000 acres, and this rate gradually increased, achieving 7,600 acres in 1939. The rate of afforestation was reduced during the second world war, but increased again rapidly afterwards, achieving 8,000 acres by 1950. Up to this time, most of the planting had taken place in the South and East. A. C. Forbes, an Englishman who served as the First Director of Forestry, and M. L. Anderson, a Scot who retired as Director in 1946, were the dominant influences on forest policy during this period. Their professional instincts were conservative, and with the help of the long shadow cast by Knockboy, they successfully resisted political pressure to extend large scale afforestation to the West. However, the development of heavy ploughs powered by crawler tractors which drain and mound simultaneously, and of a subsoiling plough capable of breaking the iron pan, facilitated westward expansion in the 1950s onto blanket bog and Old Red Sandstone soils. These technological advances coincided with strong political support for afforestation, and resulted in an expansion of annual afforestation from 15,000 acres in 1956 to 26,000 acres in 1961. This planting level, or close to it, has since been maintained, and the locational emphasis has shifted to the West. About 22,000 acres were planted in 1976; 59 per cent of this area occurs in the eight western counties.

1.11 While the story of State afforestation is one of steady progress and expansion, the same cannot be said of private forestry. The dissolution of most of the old estates which followed the passage of the Land Acts and the activities of the Land Commission resulted in the simultaneous liquidation of the estate woodlands and the creation of a new land-owning class which had no tradition of forestry and, more important, did not have the wherewithal to invest in a crop with long deferred returns. However, a few of the old estates have remained intact and continue to practise forestry, while some small-scale private afforestation of bare land has also taken place. A planting grant which was initiated in 1928 has since been maintained, with periodic revisions.

CHAPTER 2

TECHNICAL ASPECTS

2.1 For those readers who have little background in technical forestry, a brief discussion of some of the practices, terminology and concepts used in the practice of forestry in Ireland may be of value. Most of the nation's forests consist of even-aged plantations, that is, blocks of trees which have been planted in the same year, usually in straight lines at regular intervals of about six feet. Phosphatic fertiliser is often applied before or shortly after planting, especially on peatland sites. Evergreen coniferous species are favoured; in 1976 Sitka Spruce (Picea sitchensis) and Lodgepole Pine (Pinus contorta) accounted for 55% and 33% respectively of all species planted by the State. Sitka Spruce is a native of the coastal belt of western North America, and is the "miracle tree" of Irish (and British) forestry. It favours high rainfall and humidity, and while it does best on moisture retaining mineral soils, it also thrives on many exposed upland peat sites. It has excellent pulping and chipping qualities, and is very acceptable to sawmillers. Lodgepole Pine is also a native of western North America and grows on the poorest peat soils. It is used in the manufacture of chipboard, but its acceptability to the sawmilling trade is still in question.

2.2 A group of trees with some distinguishing characteristics such as age, species etc. is termed a *stand*, and the annual wood growth of the stand is termed the *annual increment*. Standing wood volume and the annual increment are measured in cubic metres over bark (M^3O.B.). Wood volume can also be expressed in M^3 under bark (M^3U.B.) which reduces volume by 10–15%, depending on species. Sometimes wood products are converted into wood raw material equivalents (WRME), giving the average amount of wood raw material required to produce the unit in question, e.g., 10M^3 of sawtimber = 20 M^3 WRME if it takes

two M^3 of wood intake to produce one M^3 of sawnwood. As a plantation matures, trees are periodically removed from the stand; these periodic removals are called *thinnings*. Early thinnings tend to be small dimension material used for pulping and chipping; later thinnings of larger size are converted into boxwood and pallets while still later removals may achieve sawlog size. The logic behind thinning is two-fold: it provides revenue and it allows the remaining trees to grow more rapidly. When the trees reach rotation age the balance of the crop remaining is removed—clear-felled—the site is replanted and the cycle recommences.

2.3 In conventional silviculture (the science of tree growing) rotation age (the age of clear-felling) has been chosen as the age of maximum mean annual increment. Total volume divided by age yields mean annual increment (growth). Choosing this rotation age will maximise the volume of wood grown on a site over time. However, it has been recognised for some time that at a positive rate of interest this rotation age will usually not maximise net financial return; a somewhat shorter rotation is required. When financial return is a primary objective, the age which will maximise present net worth over an infinite series of rotations is chosen. The productivity of a site for tree growing for a particular species is described in summary form by its maximum mean annual increment per hectare. Thus a site classified as Sitka Spruce Yield Class 24 is expected, if planted with Sitka Spruce, to have an annual average wood growth of 24 cubic metres per hectare per year, if the final crop is harvested at the age of maximum mean annual growth (increment).

2.4 Production functions (called Yield Tables), with time as the variable input, have been developed for many species. Table 1 presents production information per hectare for Sitka Spruce Yield Class 24. The second last column on the right shows the mean annual increment (M.A.I.) culminating at 24 cubic metres per hectare per year in year 45; at year 35 it is 22.6 and at year 55 it is 23.7, so that there is relatively little variation in average production over a 20 (35–55) year period. The table also provides estimates of both thinning and main crop after thinning yield. Thinning commences in year 15 and is undertaken each five years thereafter. Thus if thinning continues to year 35 total thinning volume harvested (to top diameter of 7 cm.) will amount to

375 (39+84+84+84+84) cubic metres; if the remaining trees are clear-felled that same year this will yield 417 cubic metres for a total harvest of 792 cubic metres, an average annual harvest of 22.6 (792/35) cubic metres. The volumes are given to top diameter. As one moves from the base of a conifer to its tip, the diameter of the trunk diminishes. The volume to 24 cm. diameter gives the volume of all of the trees from their base to this diameter. Likewise, as the trunks continue to taper the table tells us the total volumes to top diameters of 18 and 7 cm., this latter estimate indicating the total usable wood volume. The dimension information is useful for giving an indication as to the end-uses to which the wood can be put. Thus if we assume that all of the material to top diameter 24 cm. will be used for sawlogs, while that in the 18–24 and 7–18 cm. ranges respectively will be used for boxwood and pulpwood, then for the year 35 clear-felling we find 230M³ suitable for sawing, 124M³ (354–230) suitable for boxwood and 63M³ (417–354) suitable for pulpwood, for a total harvest of 417M³ (230+124+63).

2.5 Yield tables are developed from plot data, and simply represent the average production response over time under given conditions of site, treatment and technology. No site is immutably consigned to a particular yield class. Advances in knowledge and its application continue to increase the productive capacity of a wide spectrum of sites. Likewise utilisation standards and patterns change; in Ireland at present it is assumed that material down to 20 cms. top diameter is sawlog size, while 14–20 cm. top diameter is classified as boxwood. In the southern US whole tree chipping is practised, and the feasibility of utilisation of roots and stumps is being tested.

2.6 Forests, of course, are of value for purposes other than growing wood. They provide habitat for wildlife, stabilise the soil and regulate water flow; they supply a vertical dimension to the landscape, buffer the effects of noise and wind and provide recreating space. The extent to which a forest provides these services is in part a function of the manner in which the forest ecosystem is managed. Up to a point, output of wood and other services is complementary; beyond that point they become competitive—the deer herd can only be increased at the expense of some wood production. Evaluating the merit from society's

TABLE 1
NORMAL YIELD TABLE: YIELD CLASS 24

Age	Main Crop after Thinning						Yield from Thinnings				Cumulative Production		Increment			Age
	Number of trees	Top Ht.	Mean Diam.	Basal Area	Volume in cubic metres to top diameters of 7 18 24		Number of trees	Mean Diam.	Mean Vol. per Tree	Volume in cubic metres to top diameters of 7 18 24	Basal Area	Vol. to 7 cm.	Basal Area	Vol. to 7 cm.	Vol. to 7 cm.	
Yrs		m	cm	m²	cm cm cm			cm	m³	cm cm cm	m²	m³	m²	m³	m³	Yrs
10	3342	5.9	7.7	15.4	32 0 0		0	0.0	0.000	0 0 0	15.4	32	5.20	16.8	3.2	10
15	2510	9.9	11.5	26.3	96 0 0		832	12.6	0.047	39 1 0	36.6	135	3.76	24.8	9.0	15
20	1365	14.1	15.5	25.8	157 18 0		1145	13.6	0.073	84 4 0	52.9	279	3.01	31.4	14.0	20
25	875	18.2	20.5	28.8	242 108 18		490	16.8	0.171	84 15 0	66.7	448	2.55	34.5	17.9	25
30	625	22.0	25.4	31.7	333 239 99		250	21.2	0.337	84 42 8	78.5	624	2.18	34.4	20.8	30
35	477	25.3	30.2	34.1	417 354 230		148	25.7	0.570	84 61 26	88.5	791	1.85	32.1	22.6	35
40	383	28.2	34.6	36.0	487 444 350		94	30.0	0.879	82 70 45	97.0	944	1.57	28.8	23.6	40
45	324	30.6	38.6	37.9	549 517 446		59	34.1	1.238	72 66 51	104.2	1079	1.35	25.4	24.0	45
50	285	32.7	42.2	39.9	606 580 525		39	37.8	1.635	63 59 50	110.5	1198	1.17	22.4	24.0	50
55	258	34.4	45.4	41.8	656 635 589		27	41.2	2.057	54 52 46	115.9	1302	1.01	19.7	23.7	55
60	238	36.0	48.2	43.5	701 682 641		20	44.3	2.469	47 46 42	120.6	1395	0.86	17.2	23.2	60
65	223	37.3	50.6	44.9	739 722 683		15	47.0	2.877	42 41 38	124.5	1475	0.74	14.9	22.7	65
70	211	38.5	52.7	46.0	770 754 717		12	49.4	3.231	38 37 35	127.9	1544	0.64	13.0	22.1	70
75	201	39.5	54.6	47.2	797 782 747		10	51.5	3.696	34 33 32	131.0	1605	0.56	11.4	21.4	75
80	193	40.3	56.3	48.1	818 804 770		8	53.4	4.160	31 31 29	133.5	1657	0.49	9.6	20.7	80

Source: Forest Management Tables (Metric) Booklet No. 34, Forestry Commission, 1971

point of view of providing these non-timber outputs is difficult because the markets for them, if they exist at all, are imperfect. With this technical background, we can turn now to a description of the existing woodland estate.

CHAPTER 3

THE EXISTING FOREST ESTATE

3.1 Some summary data concerning Ireland's forest estate are presented in Table 2. At the end of 1977, forests covered 5.2% of the nation's land area; 77% of the country's forest area is in State ownership, with the balance (23%) being privately owned. McCracken

TABLE 2

AREA, VOLUME AND ANNUAL GROWTH OF IRELAND'S FORESTS, 1977

	Unit	State Forests	Private Forests	Total
Area	Hectares (Acres)	278,000 (687,000)	81,000 (200,000)	359,000 (887,000)
Standing Volume				
Industrial	000 cubic metres (M^3)	13,605	4,400	18,005
Firewood	000 tonnes	328	4,100	4,428
Annual Growth				
Industrial	000 M^3	1,637	82	1,719
Firewood	000 tonnes	n.a.	16	n.a.
Harvest				
Industrial	000 M^3	483	70	553
Firewood	000 tonnes	8	20	28

Sources: Forest and Wildlife Service (1977), pp. 5, 19; Gallagher and Purcell (1976); O'Flanagan (1973), p. 61; Purcell (1978); Department of Fisheries (1978), p. 11.

(1971) estimates that the year 1880 marked the zenith of plantation forestry in Ireland, when there were 345,000 acres of plantation, all privately owned. The acreage afforested by the State alone in this present century now far exceeds this area.

3.2 However, with the exception of Iceland, Ireland is still the least forested country in Europe. EEC and Scandinavian data provide a useful basis of comparison (Table 3). While Ireland has the smallest percentage of its total area afforested, it has more forest area per capita than Belgium, Denmark, the United Kingdom and the Netherlands. The growth rate in Ireland, represented by annual net increment per hectare, is strikingly higher than that of the other countries listed. It is almost double the EEC average and 19% higher than Denmark's, its closest competitor. This advantage would be much more pronounced if the large area of rapidly growing young plantations, which are included in the forest area but do not yet have measurable volume, had reached full production. Thus, while in Table 3 an annual net increment of 6.91 M^3 per hectare is recorded, it has been estimated (O'Flanagan, 1973, p. 62) that the existing State coniferous forest plantations have a mean yield class of 12 (i.e., average annual growth of 12 M^3/Ha/An)[1] while the Sitka Spruce plantations now being established are thought to have an average yield class of 16 (Purcell, 1978). The average yield class of existing private coniferous plantations falls in the 13–15 range (Gallagher and Purcell, 1976). However, as we shall see, much of this latter material has passed the age of maximum mean annual increment, so that actual annual growth on private forests will be less than the yield class would imply.

3.3 The age class distribution of the nation's forests reflects the dynamic expansion of State forests and the relative senescence of private forestry (Table 4). Just over 94% of the State plantations are coniferous, and 40% of these fall in the 1–10 year age bracket. As

[1]However, if a 15% reduction is made for roads and rides, and a further 15% is deducted for losses due to fire, insects and diseases, actual average production works out at 8.67 M^3/Ha/An.

TABLE 3:

FOREST AREA AND INCREMENT, EEC 1974 AND NORDIC COUNTRIES 1970

Country	Forest as % of Total Area	Forest Area per Capita	Annual Net Increment per Ha
	%	Ha	M^3O.B. (over bark)
Belgium	20	0.06	4.3
Germany	29	0.115	4.82
Denmark	11	0.09	5.9
France	25	0.26	3.14
Great Britain	8	0.03	3.49
Italy	21	0.11	2.12
Ireland	4	0.10	6.91
Luxembourg	32	0.24	4.87
Netherlands	7	0.02	4.35
N. Ireland	5	0.05	—[a]
EEC	20	0.12	3.5
Nordic Countries[b]	52	3.14	2.67

[a] Included in the estimate for Great Britain
[b] Includes Finland, Norway and Sweden
Source: Appendix Table 1.

noted above, this young forest would have negligible measurable volume, thus lowering the estimate of annual net increment per hectare of forest. Only 12% of the State coniferous forest area is 31 years or older. Conversely, only 20% of the private coniferous area, and none of the broadleaf falls in the 1–10 year age category; 50% of the private coniferous forest is 31 years or older and 63% of the private broadleaf forest is over 70 years old.

3.4 The predominance of the State in Ireland as a forest owner is unique in the western world. The ownership pattern obtaining in the EEC and the Nordic countries is indicated in Table 5. The United Kingdom, with 40 per cent in State ownership, comes closest to

Ireland's 77% State share. Both the UK and Ireland differ from the rest of Europe in having no local authority (county, municipality, village—church ownership is also included in this category) forests. The Nordic countries in turn are unique in Europe in having a substantial area of forest—7.9 million hectares—in forest industry ownership, although this is a prominent feature of forestry in the US, where industry owns 17% (34 million hectares) of the commercial forest area.

TABLE 4

PERCENTAGE AGE CLASS DISTRIBUTION, STATE AND PRIVATE HIGH[a] FORESTS 1973 BY AREA

	State		Private		Total	
	Coniferous	Broadleaf	Coniferous	Broadleaf	Coniferous	Broadleaf
Total Area (Ha)	215,657	12,981	15,060	32,853	228,638	47,907
	% of Area	% of Area	% of Area	% of Area	% of Area	% of Area
Age Class						
1–10	40	27	20	–	38	8
11–20	36	23	19	2	35	8
21–30	12	10	11	7	12	8
31–40	8	13	7	10	8	11
41–50	3	4	5	8	4	6
51–60	1[b]	23[b]	5	5	1	10
61–70	–	–	6	5	–	4
71 +	–	–	27	63	2	45

[a] Excludes scrub areas, notably 33,000 hectares of scrub in private ownership
[b] Some (unknown) portion of this forest falls in the 60 + age classes.
Source: Appendix Table 2.

3.5 In Section II the implications for policy of the structure and ownership of the existing forest estate are examined. Following is a brief review of wood markets.

TABLE 5

PATTERN OF FOREST OWNERSHIP

Country	Ownership Category: % of Total Forest Area		
	State	Local Authority	Private
Belgium	12	35	53
Germany	31	45	44
Denmark	28	4	68
France	10	16	74
Italy	5	34	61
Ireland	77	–	23
Luxembourgh	5	37	58
Netherlands	24	16	60
United Kingdom	40	–	60
EEC	18	21	61
Nordic Countries[a]	20	5	75[b]

[a] Includes Finland, Norway, Sweden
[b] 20% of this area (15% of total) is owned by forest Industries
Sources: Commission of the European Communities (1976), p. 7; Swedish Institute (1977). Economic Commission for Europe (1976), p.69.

CHAPTER 4

WOOD MARKETS

Introduction

4.1 The structure of the Irish wood processing industry and the outlook for the future is being examined in great detail by the Industrial Development Authority. I will attempt neither to duplicate the IDA analysis or anticipate its conclusions; a summary of the existing situation and long-term prospects is developed here to provide context for the discussion in succeeding chapters. Data provided, unless otherwise indicated, are taken from Commission of the European Communities (1976), Economic Commission for Europe (1976) and the Forestry Commission (1977).

4.2 Forest products can be conveniently categorised as sawnwood, wood-based panels, paper and paperboard, and other industrial wood, including fuelwood. Sawnwood is produced by mechanically slicing the log into boards of various dimensions. Wood-based panels include plywood, particle board (also called chipboard) and fibreboard. Particle board, as the name implies, involves chipping the wood into small particles, and then applying a screening, bonding and high temperature-pressure process to produce the board. The production of fibreboard requires further disintegration of the wood into wood pulp, usually by a mechanical grinding process, and its compression into boards. Wood pulp is also the basic raw material constituent of the paper industry. Three types of pulp can be distinguished: mechanical pulp, which is produced by grinding the wood to fibres which contain all of the wood's constituent parts (as in the case also of fibreboard); chemical pulp, which involves the chemical separation of the lignin component from the cellulose, the latter then forming the pulp; semi-

chemical pulp which is intermediate between mechanical and chemical. Paper is made by suspending, spreading, draining and drying the pulp. Other industrial wood includes pit props, fence posts etc. together with fuelwood.

4.3 The sawmilling industry is the most demanding concerning the specifications—straightness, diameter, length etc.—of its wood intake. In the sawing process up to 50% of the sawlog gets removed in the form of sawdust and slabs, and this byproduct is available for use by the wood panel and paper sectors. Particleboard is the least demanding as to wood raw material intake, and can manage on a diet of slabs and sawdust. The stringency of the pulping sectors' requirements will depend on the processes used and the end product specifications desired. Small dimension roundwood, called pulpwood, and sawmilling by-products comprise the wood intake sources for the panel and paper industries. Waste paper is also a major source of fibre for the paper industry. Technological advance in the forest industries has resulted in the relaxation of requirements *vis-à-vis* the size, species, etc. of wood used. Over time, the dimension of material that can be successfully sawn has fallen, while the range of species which can be commercially pulped has broadened.

Europe

4.4 Projections of European consumption are provided in Table 6. In the '61–'71 decade consumption of sawnwood grew at an annual average compound rate of 2%, while consumption of wood-based panels and paper and paperboard grew at annual compound rates of 10% and 6% respectively. In the same period annual consumption of "other wood" (mainly fuelwood) fell by an annual compound rate of 3%. The implied compound average annual growth rates (low-high) in consumption up to the year 2000 are: sawnwood (0.5%–1.5%), wood-based panels (6%–6.5%), paper and paperboard (4%–5%), while consumption of "other wood' is expected to decline annually by 1.5%–2%. These projections are based on expected trends in population, GNP, housing starts, price, etc., and they incorporate a consideration of the impacts of the mid-'seventies recession. The "Adjusted" column represents the expected consumption under the low growth assumptions when supply considerations have been taken

TABLE 6

Projections of Forest Products Consumption, Europe, 1959–61 to 2000 (Million Units)

	Actual		Projected 2000		
	1959–61 Average	1969–71 Average	Low Growth Assumption	High Growth Assumption	Adjusted[1]
Sawnwood (M^3)	76	93	110	144	113
Wood-based Panels (M^3)	9	23	130	143	113
Paper and Paper-board (M.T.)[2]	21	38	114	162	100
Other wood (M^3)	129	99	50	60	

[1]Adjusted for expected supply constraints.
[2]Metric ton.
Source: Economic Commission for Europe (1976) pp. vii, xvii.

into account. The expected sources of supply for this consumption are listed in Table 7. Net wood imports are expected to increase from 45 million M^3 (equivalent) in 1969–71 to 115 million M^3 (equivalent) in the year 2000.

4.5 These European totals mask a high volume of intra-European trade in forest products. In 1970 the countries now in the EEC consumed 193.5 million M^3 (round wood equivalent), of which 106 million M^3, or 55% of the total was imported. Conversely, the Nordic countries achieved average annual net exports of almost 80 million M^3 in the 1972–74 period, most of which went to the EEC. The trade position of the UK is of particular interest.

TABLE 7

Sources of Supply for Expected Consumption, Europe, 2000

	Year 2000 Consumption equivalent volume of wood in the rough
	Million M^3
Sawnwood	
Domestic Removals	195
Net Imports	45
Total	240
Wood Panels, Paper and Paperboard	
Domestic Removals	205
Net Imports	70
Industrial Wood Residues	80
Waste Paper Recycling	115
	470

Source: Economic Commission for Europe (1976) p. xix.

4.6 Present and projected wood consumption estimates are provided in Table 8. These are based on very conservative anticipations of growth in population and Gross Domestic Product. From 1972 to 2000 zero growth in sawntimber consumption is expected, while consumption of paper and panels is expected to increase by about 60% and 100% respectively. The share of pulpwood and residue based products will increase from 61% to 73% of the total wood intake over this period.

TABLE 8

Forest Products Consumption,[1] 1972, 2000, 2025, United Kingdom

	Million M^3 (Wood raw material equivalent, under bark)		
	1972	2000	2025
Sawnwood and Sleepers			
High	17.146	17.923	18.468
Low	17.146	16.231	15.130
Paper and Paper Board			
High	22.006	36.590	58.894
Low	22.006	34.850	53.403
Wood Based Panels			
High	5.144	11.633	19.667
Low	5.144	9.772	14.975
Total			
High	44.296	66.146	97.029
Low	44.296	60.853	83.508

[1]In the source study, four combinations of consumption projections, based on alternative population and Gross Domestic Product (GDP) projections, were made. The consumption estimates listed in this table are the most conservative of those derived, being based on assumptions of low growth in both population and GDP.

Source: Forestry Commission (1977) pp. 94–97.

TABLE 9

Production and Trade in Selected Forest Products, UK, 1975, in Million M^3 (roundwood equivalent) and Million £

	Domestic Production Millgate Value	Exports Dockside Value	Imports Dockside Value	Apparent Consumption
Sawnwood				
Volume (Mill. M^3)	1.8	0.1	9.7	11.4
Value (Mill. £)	50	3	340	387
Chipboard				
Volume (Mill. M^3)	0.63	0.03	1.3	1.9
Value (Mill. £)	35	3	63	95
Fibreboard				
Volume (Mill. M^3)	0.05	—	0.5	0.55
Value (Mill. £)	3	—	25	28
Paper				
Newsprint				
Volume (Mill. M^3)	0.9	—	2.6	3.5
Value (Mill. £)	54	—	157	211
Other Paper				
Volume (Mill. M^3)	8.3	0.5	5.1	12.9
Value (Mill. £)	556	92	261	725
Paper Board				
Volume (Mill. M^3)	2.6	0.2	0.7	3.1
Value (Mill. £)	245	20	127	352
Total Paper				
Volume (Mill. M^3)	11.8	0.7	8.4	19.5
Value (Mill. £)	855	112	545	1,288
Total				
Volume (Mill. M^3)	26.1	1.53	28.3	52.85
Value (Mill. £)	1,798	230	1,518	3,086

Source: Forestry Commission (1977), p. 57.

4.7 In 1975 domestic production in the UK amounted to 16%, 33%, 9%, and 60% of sawnwood, chipboard, fibreboard and paper consumption respectively (Table 9). However, the paper industry in Britain depends on waste paper and imported pulp for most of its fibre needs. Net imports of pulp amounted to 7.2 million M^3 (roundwood equivalent) and cost £300 million. This compares with a domestic pulp production of 1 million M^3 valued at £15 million, and waste paper intake amounting to 4.1 million M^3 valued at £110 million. Thus total fibre intake to the paper industry came to 12.3 (7.2+1+4.1) million M^3 with a millgate value of £425 (300+15+110) million.

4.8 It has recently been proposed that Britain embark on an ambitious extension of its afforestation programme, involving the planting of an additional 1.8 million hectares (4.5 million acres) by the year 2025. If this expansion is undertaken, the wood outputs listed in Table 10 are expected to be forthcoming from existing and new plantations. A comparison of these data with the expected consumption in Table 8 shows that even with an intensive afforestation programme Britain will still be importing more than 75% of its wood requirements by the year 2025. There is therefore a substantial long-term potential market for forest products adjacent to Ireland.

TABLE 10

Annual Production—Great Britain, 1976, 2050
Millions of Cubic Metres O.B.

	Sawlogs	Small wood	Total
1976	2.155	1.775	3.93
2000	4.1	4.2	8.3
2025	10.9	5.5	16.4
2050	13.8	8.4	22.2

Source: Forestry Commission (1977) p. 103.

The Domestic Market

4.9 Data on production, net imports, and apparent consumption of forest products in Ireland are not available in accessible form. For the wood processing sectors manufacturing in Ireland, it can be seen from Table 11 that net imports amounted to £73 million in 1977. Self sufficiency was attained in particle board in terms of quantity but not value, and there were net exports of fibreboard and mechanical pulp, while domestic production of sawnwood accounted for 27% of consumption. There is also a substantial domestic production and trade in unprocessed roundwood, stakes, poles etc., while in addition there is a large Irish paper and paper products industry using waste paper and imported chemical and semi-chemical pulp as fibre furnish.

4.10 Ireland has over 100 sawmills, 2 chipboard mills, one mechanical pulp mill and one fibreboard mill. Up to 1974 the industrial picture was one of steady growth as capacity was increased in line with growth in the supply of wood. Up to this time wood supply was viewed as the principal constraint on expansion. However, the recession has had a very adverse effect on the industry. First, consumption of forest products on the domestic and export (mainly British) markets fell substantially. Following a period of steady growth, apparent average annual consumption in the UK fell from 43 million M^3 WRME (UB) in the 1972–74 period to 33 million M^3 in 1975, increasing again to 39 million M^3 in 1976 (Forestry Commission, 1978). Secondly, this drop in consumption was not matched by a comparable contraction of production. Sweden in particular opted to maintain output and engage in stockpiling. This was facilitated by subsidies in the form of interest free loans from the Swedish government. From 1975 to the beginning of 1977 Swedish forest industry received 350 million kronor (£41.4 million) for this purpose (Swedish Forest Owners, 1977, p. 9). This matching of low demand and large supplies has resulted in lowered prices. For domestic producers the market situation has been further exacerbated by the strengthening of sterling in relation to the kroner.

4.11 Sweden and Spain were both charged by the Commission of the EEC with dumping chipboard on the EEC market. In April 1978 agreement was reached between the Commission and Swedish and

TABLE 11

Processing Sectors using Native Wood, Production, Exports and Imports, Ireland 1977

	Unit	Domestic Production (1)	Exports (2)	Imports (3)	Net Imports (4)	Apparent Consumption (5) (1)+(4)	Domestic Prod. as % of Consump. (6) [(1)÷(5)]×100
Sawnwood							
Coniferous							
Output	000's M.T.	61.0[1]	4.9	195.4	190.5	251.5	24
Value	000's £	8991	866	28804	27938	36929	
Hardwood							
Output	000's M.T.	18.9[1]	4.4	35.3	30.9	49.8	38
Value	000's £	3463[2]	929	7187	6258	9721	
Total							
Output	000's M.T.	79.9	9.3	230.7	221.4	301.3	27
Value	000's £	12454[2]	1795	35991	34196	46650	
Panels							
Fibreboard							
Output	000's M^3	24.0	13.1	2.2	−10.9	13.1	183
Value	000's £	3326[2]	1816	436	−1380	1946	
Particle Board							
Output	000's M^3	106.6	46.1	44.7	−1.4	105.2	101
Value	000's £	6929[2]	3560	4788	1218	8147	
Total							
Output	000's M^3	130.6	59.2	46.9	−12.3	118.3	110
Value	000's £	10255[2]	5376	5224	−162	10093	
Mechanical Pulp							
Output	000's M.T.	19.1	27.6	0.2	27.4	n.a.[3]	100
Value	000's £	1337[2]	1934	46	1888		
Grand Total							
Value	000's £	24046	10900	77242	72878	96924	

NOTES

M.T. = Metric Ton.

Conversion Factors: 1 Metric Ton = 1.82 M^3 solid volume coniferous sawnwood.
1 Metric Ton = 1.43 M^3 solid volume hardwood sawnwood.

[1]Based on annual production of 111000 M^3 softwood and 27000 M^3 hardwood sawn lumber (IIRS, 1978, Gallagher, 1978).

[2]Estimates based on unit price of exports.

[3]Exports exceed production. May result from exporting inventory and/or re-exporting imports.

Sources: Industry sources and CSO (1978) pp. 13, 14, 24, 44, 50.

Spanish manufacturers to observe minimum price (thought to be £60/M³) and export levels to the EEC. Dumping of fibreboard has also been alleged, and indeed it is widely felt that most forest products in the European market are now being traded at variable cost prices. In the Autumn of 1977 the Swedish government eliminated the stockpiling subsidy and this has put further downward pressure on prices, as producers liquidate inventory. Thus imported softwood sawn timber averaged £143/ton in 1977, but the price per ton for December 1977 fell to £123/ton. In addition a number of European processors have gone out of business in the past year and their stocks are also coming on the market.

4.12 The result of these circumstances for Irish processors has been that, while output has been maintained close to pre-recession levels, losses have been sustained by the two particle board plants—Chipboard Ltd., Scarriff and Munster Chipboard Ltd., Waterford—necessitating loans of £1,050,000 and £350,500 respectively (outstanding on 31/12/'77) from Foir Teoranta, the state rescue company. The fibreboard mill (Irish Board Mills Ltd., Athy) also incurred losses necessitating a £200,000 loan (outstanding on 31/12/'77) from Foir Teoranta and the firm has been in receivership since September 1978 while the mechanical pulp mill (Clondalkin Paper Mills Ltd., Dublin) and the sawmilling sectors have also had difficulty maintaining profitability.

4.13 The heavy discounting of pulp prices has, on the other hand, been of some advantage to the Irish paper industry, based as it is primarily on imported chemical pulp. In Appendix Table 3 the imports, exports and net imports of all forest products are listed; these data are summarised in Table 12. There is a substantial export—35,600 tons valued at £214,000—of fuelwood and pulpwood, amounting to more than half of the current average intake of one of the four pulpwood processing plants. Most, if not all, of this is exported to N. Ireland. Quite apart from the projections of expanding domestic pulpwood supplies, there is, therefore, an existing wood "surplus" to support expansion of processing capacity in the Republic. The import levels of newsprint and sulphate wood pulp, valued at £11.046 and £4.603 million respectively, also imply a substantial home market if these were to be

TABLE 12

Total Forest Products Imports, Exports and Net Imports by Quantity and Value, Ireland 1977

	Imports		Exports		Net Imports	
	Quantity 000's M.T.	Value 000's £	Quantity 000's M.T.	Value 000's £	Quantity 000's M.T.	Value 000's £
Wood and Lumber	256.4	38924	85.4	2716	171	36208
Pulp & Paper Waste	33.0	6129	39.8	2443	—6.8	3687
Wood Manufacturers	60.8	19209	39.9	8391	20.9	10818
Paper, Paper Board	222.7	84613	57.6	22940	165.1	61673
Total	572.9	148875	222.7	36490	350.2	112386
Items of Interest[1]						
Fuelwood & Wood Waste	0.1	8	18.3	122	—18.2	—114
Pulpwood	—	—	17.3	92	—17.3	—92
Sulphate Wood Pulp	21.0	4603	0.2	47	20.8	4556
Builders' Woodwork and Prefab	3.4	2246	6.2	3222	—2.8	—976
Newsprint	45.3	11046	0.4	84	44.9	10962
Kraft Paper	48.6	10901	3.6	1065	45.0	9836
Paper in Rolls and Sheets	54.4	23008	10.4	7280	44.0	15728

[1]See Appendix Table 3 for full details.

produced domestically. However, economies of scale are such that a plant of economic size would need to be of at least 100,000 ton capacity, i.e., even assuming that the entire domestic needs were met by the home plant, more than half of the output would have to be exported.

Conclusion

4.14 In spite of the current gloom, the longer-term prospects for forest industry in Ireland are excellent. The rapid reduction in capacity now taking place in Europe combined with even modest economic expansion will result in much firmer prices. In 1973 the predominant concern in Swedish forestry and industrial circles was how to meet the fibre needs of the Swedish industry, as the limits of economically sustainable wood harvest were being reached. Wood chips were imported from the south eastern US to augment domestic supplies at this time. As the European economies expand, these limits will once more begin to re-assert themselves. Comparing Irish forest product manufacturers with Swedish, we have (in terms of the Irish and UK markets) a freight advantage of about £5/M³, a wood price advantage of about £8/ton for pulpwood [£12/ton in Ireland v. £20/ton in Sweden (Swedish Forest Owners Assoc., 1977, p. 41)] and a unit labour cost which is about 50% of the Swedish level. On the negative side, we have higher electricity costs, higher ex-forest moisture content in our wood, and a fragmented, small-scale industry, with little quality control, market power or expertise, and relatively little research and development capacity. The EFTA countries now have free access to the EEC market for lumber, wood panels and other wood products; by 1984 there will also be free trade in paper and paper products. The dislocations engendered by the current recession, combined with the much larger volumes of wood now becoming available to Irish processors provide an excellent opportunity to structure our wood processing capacity with an eye to maximising our comparative advantage in this free-trade context.

CHAPTER 5

THE POLICY CONTEXT

5.1 The following overlapping phases of Irish forest policy, starting with the commencement of native government in 1922, can be recognised:

1. **1922–1950. The Era of Consolidation**
During this time state forestry in Ireland was a small scale operation, directed at the technical level for the most part by overseas foresters. Afforestation was concentrated largely on relatively good sites in the East. The work of this period demonstrated the feasibility of tree growing in Ireland with a diversity of species on a wide range of sites. A body of experience and expertise was developed which facilitated entry into the next phase.

2. **1950–1970. The Westward Expansion**
State forestry in this period at the technical level has been under native control. This, combined with the technological developments noted earlier and enthusiastic political support resulted in a rapid increase in the rate of afforestation, much of it taking place in the West.

3. **1970–Present. The Age of Amenity**
Coinciding with European Conservation Year in 1970, a policy of encouraging public recreational use of the State forests was expanded. Initiatives with regard to natural area preservation and wildlife management were also undertaken which have since been given statutory recognition in the Wildlife Act (1977).

5.2 The above classifications are concerned entirely with State forestry. This is a recognition of the State's predominant role in both the development and implementation of Irish forest policy throughout this period. The institutional vehicle used by the government for this effort was a Forestry Division (later called the Forest and Wildlife Service) located initially in the Department of Agriculture, then moved in 1933 to the Department of Lands and then in 1976 placed in the newly-established Department of Fisheries, now re-named the Department of Fisheries and Forestry. The 1946 Forestry Act, which replaced Acts of 1919 and 1928, provides the chief legislative mandate for the Service's forestry operations. It provides authority for the establishment and management of forest plantations, including powers of compulsory land acquisition; it includes power to regulate tree felling on private land. It provides for payment to private landowners who undertake afforestation and re-forestation. The powers of compulsory acquisition were consolidated in the Forestry Act, 1956, while the Wildlife Act, 1977 laid out the responsibilities and powers of the Service (acting for the Minister) in the wildlife area. The 1946 Act is extremely comprehensive and wide-ranging, and it provides Ministerial powers which have not yet been acted upon. For example, the Minister is empowered to establish and carry on or aid in the establishment of woodland industries.[1] It also allows for the setting up of a Consultative Committee to give advice and assistance to the Minister in the exercise of his powers under the Act.

5.3 In reviewing this legislation one is struck by the preoccupation throughout with the facilitation of land acquisition. Sixty-six pages—out of a total of 165—of the 1946 Act deal with this issue, while this topic was the central theme of the 1956 Act. In part, this reflects the legal complexities involved and the emotional element which attends the issue of land ownership in Ireland. However, it also highlights what has been the predominant policy implementation pre-occupation over the years, especially since the end of the Second World War; how to acquire sufficient land each year to meet the annual planting targets.

[1]However, a few small sawmills are operated by the service, while, since this report was written, a decision to provide financial assistance to woodland industries has been taken.

5.4 Policy goals beyond annual planting targets have not, for the most part, been clearly expressed. The aim in the early years was to achieve self-sufficiency in timber products. In 1948 a survey was conducted by the Forest and Wildlife Service which indicated that there remained about 1.2 million acres (0.486 million hectares) which could be successfully afforested without significant adverse effect on agricultural output. In 1950 Roy Cameron, who at the time was director of FAO's European forestry group, conducted a review of planting opportunities and concluded that a planting programme of 470,000 acres (190,000 hectares) could be justified on commercial grounds which would meet Ireland's likely domestic wood needs. He recommended that this plan be embarked upon, while he also suggested that an equally large area of sub-marginal land, largely in the West, be planted for social reasons—provision of employment and the like. Commercial criteria would not be applied in this latter case, the object being "to produce sufficient forest produce to pay operating costs, but not capital investment charges" (Cameron, 1951). Presumably the output from this latter planting would be available for export. The bifurcation of effort suggested by Cameron was never formally endorsed by the government. However, the westward expansion (which he identified as "Social Forestry") did take place, and we are moving quickly towards the total plantation acreage which he suggested.[2] Moreover, the employment provided in depressed rural areas by the Forest and Wildlife Service has been a source of consistent political support for State forestry, judged on the basis of successive Dáil reports.

5.5 However, the favourable political treatment of forestry over the years depended in a more fundamental way on the fact that from the very beginning land judged to be suitable for agricultural use was precluded from consideration for State afforestation purposes. This ensured that potential hostility towards the programme on the part of

[2]However, the western forests which are being established are for the most part highly productive.

farmers was neutralised. Thus we read in the 1925-26 *Annual Report of the Minister for Agriculture:*

> "The Department does not desire to acquire for afforestation land fit for agricultural purposes which might be capable of being used to form 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 transaction."

This policy has endured to the present. Because of the difficulty of adequately adjusting the "maximum price" to reflect market realities—it was fixed at £10 per acre for several years in the 1950s and early 'sixties—a new valuation system was introduced in 1967 based on expected productivity and costs. However, from the land acquisition and expenditure data below, it can be seen that average land price is still substantially below prevailing rates for agricultural land.

5.6 In addition to the precluding effect of price, Land Commission inspectors can refer cases to the Land Commission. If it is decided that the land in question could be used effectively for agriculture, the Commission can decide to acquire it.

Year	Plantable Land Acquired Hectare (acres)	Total Expenditure £	Expenditure per Hectare (acre)
1976	9,093 (22,496)	450,230	50 (20)
1977	9,000 (22,239)	513,000	57 (23)
1978	9,000 (22,239)*	1,000,000*	111 (45)

*Estimate

Sources: Area Acquisition data from Forest and Wildlife Service (1978) p. 11; Expenditure data for 1975 and 1976 from successive *Appropriations Accounts*. Expenditure data for 1977 were provided by the Forest and Wildlife Service, while the 1978 estimate is from *Estimates for Public Services 1978*, p. 116.

5.7 Since land quality is the most crucial variable influencing the rate of return, confining the State forestry effort to the poorest sites has adversely affected profitability. In 1956 an analysis of expected costs and revenues of the State forestry enterprise concluded that a compound annual rate of return on all outgoings of about 2.5% could be expected, using 1956 prices. An active campaign to reduce costs was initiated in this year, involving among other things the application of work study methods combined with the use of an incentive bonus scheme. On the basis of the improved cost structure another analysis was undertaken in 1958 which indicated that a compound annual rate of return of 5.25% could now be achieved on all outgoings and that revenues could exceed expenditures for the first time (by £286,000) in 1974-75 (Gray, 1964). This latter analysis was used in outlining the role of forestry in the first *Programme for Economic Expansion*, with background analysis published in *Economic Development* (both printed by the Stationery Office, Dublin in 1958). Although, as we shall see in the next chapter, the rate of return expectations are still largely valid, the financial break-even point has yet to be reached (in fact a deficit on commercial expenditure of £8.41 million was recorded in 1975). This outcome may explain the fact that no further predictions have been made regarding the year when income is likely to exceed outgoings. The economics of State afforestation was examined in a cost-benefit framework in a comprehensive and rigorous manner under the direction of an interdepartmental committee embracing personnel from the Departments of Fisheries (Forest and Wildlife Service) and Finance. An interim report was put together in 1974. This report of the study has been classified as confidential, but the method and conclusions can be summarised. A number of recently planted sites were selected at random and a detailed financial analysis of actual costs and expected returns was undertaken. It was found that using present costs and prices, and assuming a rotation age of miximum mean annual increment, the investment in these sites would yield a compound annual average rate of return (internal rate of return) of 3.8%. If wood prices relative to costs increase at average annual compound rates of 0.5, 1.0, or 1.5%, the respective internal rates of return would be 4.5, 5.0, and 5.6%. Reducing rotation age below age of maximum mean annual increment will normally increase the internal rate of return, but this effect was not calculated. At constant prices it was found that the

internal rate of return ranged from 3.1% on yield class 10-12 sites to 4.75% on yield class 18-20 sites. If wood prices grow at 1.5% per annum relative to costs, these rates of return increase to 4.9% and 6.5% respectively.

5.8 In addition to the financial analysis, a cost-benefit study was done which adjusted prices of labour etc. to reflect social rather than money costs. This increased the average internal rate of return at constant prices to 5.25%. The reader should note that these are real (net of inflation) rates of return; to convert them into money rates would require adding on the expected rate of inflation.

5.9 While no publicly stated total planting output, employment or rate of return targets have been set, the policy view seems to be that so long as public investment in State forestry can be expected to yield a real financial rate of return in the range of 3–6%, while at the same time providing needed rural employment and creating a raw material base for the future, then it will be supported at about the existing level, as long at it is confined for the most part to land marginal for agriculture.

5.10 It is interesting to note the increase per unit area in wood output from State forests over time. In 1917 a minimum productivity standard of 40 cubic feet/Ac/Annum (2.8 M^3/Ha/Annum) was recommended by the Forestry Sub-Committee of the British Reconstruction Committee for State afforestation; in 1951 Cameron assumed an average annual productivity of 69 cubic feet hoppus/Ac (6.2 M^3/Ha) in making his case for "commercial" State forestry; in 1973 a comprehensive survey indicated that the State coniferous forests were of average yield class 12, i.e., would produce an average annual output of 12 M^3/Ha/Year.

5.11 In formulating and implementing forest policy, the Forest and Wildlife Service has played, and continues to play, the central role. However, within government there are also other important centres of influence. Of these perhaps the most important is the Department of Finance, which exerts a crucial effect by influencing how much may be paid for land. The control exerted by the Department of the Public

Service on personnel policy—promotion, pay, hiring and the like—and by the Civil Service Commission on methods of recruitment can influence the Services' ability to respond to new circumstances. The Land Commission, as already noted, has *de facto* veto power on acquisitions. While there is as yet no EEC forest policy, the level of EEC and domestic support for agricultural programmes, and the manner of their implementation, do significantly affect the financial attractiveness of tree growing.

5.12 Under the provisions of the Wildlife Act, 1977, the Minister, acting (at present) through the Forest and Wildlife Service, has substantial powers regarding (among other things) the regulation of hunting and the protection of flora and fauna. He is authorised to create nature reserves, wildlife refuges and areas of special importance for wildlife on public and private lands, subject, in the latter case, to provisions aimed at protecting the rights of owners. In implementing its manifold responsibilities under the Act, the Forest and Wildlife Service must interact with the Local Authorities, the Department of the Environment and An Foras Forbartha concerning the implementation of the wildlife (flora and fauna) conservation provisions of the Planning Acts. The Office of Public Works (OPW), through its National Parks and Monuments Branch, has in recent years been increasing its involvement in the conservation area. In addition to its traditional role as overseer of the Bourn Vincent Memorial Park, now incorporated into the Killarney National Park, the Office of Public Works has during the past decade been acquiring land with the intention of establishing a network of National Parks, with nature conservation as the primary aim. The Burren in Clare, Connemara in County Galway and the Glenveagh Estate in County Donegal are among the areas where the agency has been active in this regard. Since this activity could also be undertaken by the Forest and Wildlife Service under the provisions of the Wildlife Act, there is scope in this area for co-operation (and conflict).

5.13 Of the non-governmental centres of influence on forest policy, the Home Grown Timber Merchants' Association is among the most long established and active. It represents the overall industry view and makes representations to the Department regarding matters of interest,

such as the method of selling State timber. There is also a more loosely organised Pulpwood Users' Association. Recently, the Irish Timber Growers' Association has been formed to represent the interests of growers. The various non-hunting outdoor recreation interests are represented by an umbrella organisation—the Association for Adventure Sports (AFAS)—while the Regional Game Councils represent the interests of hunters. Frequent meetings between senior civil servants and representatives of these and other organisations comprise the principal means whereby the latter's views and information are injected into the policy process. Occasional meetings with the Minister, the establishment of joint committees and the use of the press to highlight issues are also means whereby outside views can be brought to bear. The recently established Wildlife Advisory Council may also exert some influence; the extent to which it will do so remains to be seen.

5.14 More removed from day-to-day concerns but still important in the overall policy picture is the Society of Irish Foresters—an all-Ireland organisation of 600 members, formed to foster a deeper understanding of forestry—and the Department of Forestry in University College, Dublin, a centre for undergraduate and graduate forestry training and research.

Private Forestry

5.15 Until recently private tree growers were unorganised and therefore lacked a single, well articulated view on policy issues of interest. The planting grant combined with free technical advice have been and remain, the primary means of support by the State for the private sector. In 1960 the responsible Minister (O'Morain) clarified this policy by pointing out that if the Forestry Division considered a proposed planting project as inimical to the extension of State ownership, e.g., land near State forest boundaries, then the planting grant would be withheld; the grant was to encourage the planting of small areas of wasteland on agricultural holdings, and not for the support of non-agricultural interests (cited in Durand, 1969, p. 325). The North Connacht Farmers' Co-op Society Ltd. has recently made proposals concerning the introduction of an annuity scheme whereby farmers would be paid for the use of their land for tree growing. The

financial feasibility of this proposal has been examined by Rea of the Forest and Wildlife Service; the results of this analysis and their policy implications, will be discussed in Section III. Mr. T. J. Maher president of the Irish Agricultural Organisation Society Ltd. (and former president of the Irish Farmers' Association) has completed and presented to the Economic and Social Committee of the EEC a comprehensive report on the future of forestry in the Community. This report has received committee approval. This activity indicates that private forestry is achieving more prominence than heretofore in forest policy debate.

SECTION II

THE EXISTING FOREST ESTATE

In this section I will first discuss policy issues relating to the management of the forests which are under the jurisdiction of the Forest and Wildlife Service. This will be followed by an examination of the private forestry estate. Finally, present and prospective estimates of the employment generated by the public and private forests are provided.

CHAPTER 6

THE FOREST AND WILDLIFE SERVICE: FINANCIAL EFFICIENCY AND EMPLOYMENT

6.1 The Forest and Wildlife Service has been the principal driving force in Irish forestry since the founding of the State. Many criteria could be used to evaluate its performance; a consideration of financial efficiency and employment provide useful starting points.

Financial Efficiency

6.2 When evaluating the return on an investment which generates costs (C) and revenues (PQ) over time (n years), it is conventional to discount the net revenue stream over time back to the present, using as the interest rate (i) the highest rate of return which, other things being equal, could be earned if the money were invested otherwise. This procedure yields the present net worth (PNW) of the investment; if this is positive, this means that, other things being equal, and assuming that maximisation of net financial return is the goal, the investment should be undertaken, since it yields a return larger than the best alternative available. Conversely, if it is negative, the best alternative will yield a higher rate of return, and the investment should therefore not be undertaken. The interest rate which equates discounted costs and revenues, i.e., yields a PNW of zero, is termed the return on the investment, often also called the internal rate of return.

Symbolically: $$PNW = \sum_{t=o}^{n} \frac{P_t Q_t - C_t}{(1+i)^t}$$

and i = Internal Rate of Return when PNW = 0

6.3 As noted earlier, the late Henry Gray, then Principal Officer with responsibility for forestry in the Department of Lands, estimated in 1959 that a compound annual rate of return of 5.25% could be achieved on all outgoings for State afforestation, and that revenue would exceed expenditure in 1974/75 (Gray, 1964). In fact, a deficit of almost £10 million was recorded in 1974/75. This latter outcome was largely a result of the relatively rapid (compared to the 1950s) price inflation of the 1960s and 1970s which inflated both costs and wood prices. However, since the former took the form of actual outlays, while the latter accrued to as yet unrealised inventory, the cash flow deficit actually widened instead of narrowing. Gray was also working at that time with poor timber inventory and harvest projection data.

6.4 Working with very complete data, a detailed financial analysis of actual costs and expected returns on a number of randomly selected sites was completed in 1974 by an interdepartmental committee embracing personnel of the Department of Finance and Department of Lands (which then had responsibility for the Forest and Wildlife Service), hereafter referred to simply as the Interdepartmental Committee. It was concluded that, using present costs and wood prices, the investment on these sites would earn a compound average annual real (net of inflation) rate of return of 3.8% (internal rate of return). If wood prices increased in real terms relative to costs at rates of 0.5%, 1.0% or 1.5%, the respective average compound annual rate of return would be 4.5%, 5.0% or 5.6%. At constant prices it was found that the internal rate of return ranged from 3.1% on Yield Class 10-12 sites, to 4.75% on Yield Class 18-20 sites. These rates increase to 4.9% and 6.5% respectively with a real annual average growth of 1.5% in wood prices relative to costs.

6.5 As another means of assessing the financial return to the State investment in forestry, we can estimate the value of the existing forest estate, and compare this with the outlays which were required to produce this capital stock. At the end of 1975 there was a standing volume of 13.605 million cubic metres of softwood on State forest lands, producing an annual growth increment of 1.637 million cubic metres (see Table 2). The area of land held amounted to 335,000 hectares, of which 260,000 were forested. Since trees less than 15

years old have virtually no measureable volume, the standing volume listed has been generated by afforestation which took place in the 1923-1959/60 period. A very crude but interesting test can be posed as follows: if the annual outlays in this period were borrowed at a fixed annual rate of interest of 5% (quite high for those years) would the current value of the timber and land now on hand be sufficient to pay back the capital and accumulated interest? In Appendix Table 4 the cumulative debt which would have accrued up to 1975 has been computed by compounding forward expenditures in the 1923-1959/60 period up to 1975 at a 5% rate of interest. It amounts to £58.409 million (compared to a total of £17.701 million of cash outlay—no wonder foresters don't like compound interest!).

6.6 To value the accumulated capital we need to put a market price (1976 pounds) on the stumpage (standing volume) and the land and associated artifacts. On the basis of the age class distribution and the average yield class, I estimate that the standing measurable volume at the end of 1976 was comprised roughly of 3 equal parts of pulpwood, boxwood and sawnwood. The value of this standing timber at the beginning of 1976 was as follows:

	Volume 000M³	Unit Value[1] (£)	Total Value 000£
Pulpwood	4,530	3.66	16,580
Boxwood	4,530	5.10	23,103
Sawlog	4,530	8.57	38,822
Total	13,590		78,505

[1]Average price received in January-June 1976 per M³.

6.7 Thus, if the entire measurable wood capital could have been disposed of at the average prices prevailing in the first 6 months of 1976, the loan and accumulated interest could be paid off, and still have a cash balance of £20.096 million on hand, in addition to 170,118 hectares of land, comprising 123,788 hectares of forest, 23,134 hectares of plantable reserve and 23,196 hectares of unplantable land. If this

land is valued at an average price of £150 per hectare (£61/acre), this yields a total land value of £25.518 million. It is true that from a social efficiency point of view, part of this land value is simply a transfer from the original owners, and not a net increase in the social capital stock, as in the case of wood. However, as a result of road and trail construction, land drainage, etc., the Forest and Wildlife Service does add substantially to the original value. The total value of forest capital accumulated at the end of 1975 as a result of the expenditures in the 1923-1959 period is estimated at £104.023 million, comprising £78.505 (wood) + £25.518 (land). This compares with the accumulated indebtedness at a 5% rate of interest amounting to £58.409 million.

6.8 There are several difficulties with a crude analysis of this sort. Given the enormous share of the wood market held by the Forest and Wildlife Service, initially liquidating inventory would glut the market and cause a price collapse. On the other hand, the prices used to value inventory (average for January-June 1976), were in real terms abnormally low, being less than half the price obtaining in January-June 1974, and also well below 1977 prices. Another distortion arises because the costs are compounded forward at a constant annual rate of interest, while the money value of the capital stock, being valued at 1976 prices, reflects the rapid price inflation of recent years. This is the mirror image of Henry Gray's prediction problem, where costs inflated but revenues, being in the future, did not. Nevertheless, the fact is that in the 1923-59 period, the government could readily borrow long-term at a fixed rate of interest of 5% or less, which, if invested in tree growing, would allow the loan plus accumulated interest to be repaid and still leave a very substantial surplus.

6.9 In spite of the countervailing caveats, I conclude, on the basis of the above crude analysis, and the more rigorously conducted analytic study, that the State forestry investment has been and is financially in the social interest, showing a real rate of return in the range of 3 to 6%. To say this implies that this return is at least as good as the best alternative uses of government funds. If one assumes that the social or non-priced net benefits of public forestry are at least of the same order per £ of expenditure as those of other public programmes, a comparative review of the real financial rate of return in other

government programmes would probably show forestry investment in a relatively favourable light.

6.10 *The Interest Rate:* Because the bulk of the costs are incurred in the present, while revenues are long deferred, the financial viability of investment in tree growing is very sensitive to the rate of discount applied. The opportunity cost (what is being given up) of public expenditure in Ireland has not been estimated; we do not know what is being sacrificed, in real terms, by private consumers and investors, in order to finance the government's programmes. The Department of Finance suggests the use of 5% as a central rate of discount, with higher and lower values being also used to test the sensitivity of the results to such changes.

6.11 *Wood Price:* The internal rate of return is sensitive to changes in wood price. The data which are available in those countries with long-time series of average standing wood prices indicate that unit prices have grown in real terms over time. Thus Irland (1974) shows that, in the US, real softwood sawlog stumpage (standing trees) prices of wood sold from National Forests grew at an average annual compound rate of about 3.5% between 1910 and 1971. This has not been a steady rise; long periods of stable or even slightly declining real prices occur, interrupted by sharp increases, associated with a rapidly expanding economy, after which a stable pattern re-appears, but at a higher level. The trend in pulpwood prices is not so clear, with pine pulpwood in the 1950-71 period growing in real terms at an average annual compound rate of almost 3%, while real spruce pulpwood prices show a slight decline over the same period.

6.12 In the UK, over the 1958-1977 period there has been a 40% to 50% increase in the real price of imported sawn softwood and hardwood (logs + sawn wood), while imported woodpulp price has increased by 27%. Conversely, the average real price received for standing trees by the Forestry Commission declined slightly over this period (Forestry Commission, 1977).

6.13 In Ireland, the time series price data available—standing sales of Forest and Wildlife Service timber—only go back as for as 1972 (Table 13 and Figure 1). All wood prices increased sharply from

TABLE 13

Standing Timber Wood Prices in Current and Constant (1968) £, Forest and Wildlife Service.

	Pulpwood		Boxwood		Sawlog		Consumer Price Index
	£	Constant £	£	Constant £	£	Constant £	Base: 1968 = 100
1972							
Jan.-June	2.29	1.72	3.19	2.39	4.68	3.51	133.5
July-Dec.	2.16	1.55	3.17	2.28	5.20	3.74	(May) 139.2 (Nov.)
1973							
Jan.-June	2.38	1.60	3.34	2.24	5.50	3.69	149.1
July-Dec.	3.46	2.21	5.25	3.35	9.35	5.96	156.8
1974							
Jan.-June	4.36	2.52	7.89	4.56	13.42	7.74	173.3
July-Dec.	4.49	2.39	6.89	3.66	8.56	4.55	188.2
1975							
Jan.-June	2.98	1.38	3.94	1.83	6.74	3.13	215.7
July-Dec.	3.39	1.54	4.37	1.99	7.53	3.42	219.9
1976							
Jan.-June	3.66	1.46	5.10	2.03	8.57	3.42	250.7
July-Dec.	3.65	1.38	6.57	2.48	13.37	5.04	265.2
1977							
Jan.-June	4.48	1.57	8.03	2.81	17.05	5.97	285.7
July-Dec.	5.00	1.70	6.83	2.32	15.99	5.44	293.8

Source: Table 13.

FIGURE 1

Average Price (1968 £) per M³ for Standing Timber Sales, Forest and Wildlife Service, 1972-1977, Half Yearly.

January-June 1972 to the same period in 1974; over this period pulpwood, boxwood and sawlog prices rose in real terms by 47%, 91% and 121% respectively. As the recession developed, real prices fell substantially, dropping to below the 1972 level in 1975. By the end of 1977 there had been some recovery, with pulpwood and boxwood prices achieving about the 1972 levels, and sawlog prices reaching about 50% above 1972 levels, but still well below the peak achieved in the first six months of 1974. Thus, over this admittedly very short time-period, wood prices overall appear to have kept slightly ahead of the overall level of price inflation, as judged by movements in the consumer price index.

6.14 With regard to the future, standing wood price will depend on the interaction of the forces of demand and supply over time. Stumpage price is a residual—the rent that is "left over" after all costs (including profit) have been netted out of the end product price. Thus a stable end-product price combined with cost reductions in harvesting, transportation and processing should result, other things being equal, in a rising stumpage price, since wood is the input whose substitutability is lowest. Developments which produce a rapid increase in wood supply or in the supply of low cost substitute products will tend to reduce wood price.

6.15 The possibility of substitutes appearing which would make wood obsolete and therefore worthless is a commonly voiced concern when investment in tree growing is being discussed. This is certainly a possibility, but the demonstrated flexibility of wood augurs well for the future; the huge wood based paper industry only developed in this century, while the production of two new wood-based products which have exhibited dramatic growth in consumption—fibre board and particle board—began after the Second World War. The utilisation of wood as a furnish for the chemical and energy industries, and even as a source of food, is now being tested. The reader is referred to a series of articles in a volume edited by Ableson and Hammond (1976) for background in this general area.

6.16 Given this history of constant technical innovation and adaptation, which seems to be continuing, combined with the supply

and consumption projections discussed in an earlier section, it seems reasonable to assume that standing wood prices will at least keep pace with general price inflation, and may well show some real growth. The final variable to be considered which influences the rate of return on the public forestry investment is land quality.

6.17 *Land Quality:* The Interdepartmental Committee estimated that, at constant prices, the real rate of return ranged from 3.1% on Yield Class 10-12 sites to 4.75% on Yield Class 18-20 sites. These returns are based on a full accounting of costs and returns, including the cost of the land. The quality of the land acquired for tree growing, therefore, will have a very significant effect on the overall rate of return achieved. As noted earlier, the Forest and Wildlife Service is generally restricted, because of the price which can be offered and by the working of the Land Commission, to the poorer quality forest land. Therefore, the estimated rate of return on investment is being achieved by the Forest and Wildlife Service with one-and-a-half hands tied behind its back. I will discuss issues relating to land acquisition later on.

6.18 More generally, I have been impressed with both the calibre of the financial analyses which have been undertaken by the Service, and by the receptivity of policymakers and management to their implications. Given the good analysis, the receptive management and the competent implementation, through the application of work study methods and incentive schemes (which have been in operation in all forests since 1961), which prevails, I felt that there was little point in examining specific in-forest investment proposals.

6.19 My only recommendation in this area is that an expansion of the analytic team would probably more than pay for itself. I estimated earlier that the land and timber capital stock accumulated up to 1960 was worth about £104 million at the end of 1975. Since 1960, the land area under Forest and Wildlife jurisdiction has almost doubled; since 1975 further growth has accumulated on the pre-1960 planted area, and wood and land prices generally have advanced. Adding in the value of housing and equipment, the current capital value of the State forest holding is probably in excess of £200 million. A doubling of the analytic effort (at present comprising 2-4 individuals, depending on

how one allocates personnel) in the management of this rapidly appreciating asset, would surely be worthwhile.

6.20 A comprehensive financial analysis of the forest investment would require detailed projections of costs and revenues. While these are not available, there are good projection estimates available of the wood output which is expected over time, to which we can apply current prices, to derive revenue estimates. Before doing so, a look at the trend in net expenditure will help provide background (Table 14 and Figure 2). It can be seen that real total expenditure grew steadily until 1970, and since then has remained stable, with a small drop in 1977. Net expenditure likewise peaked in 1970, and has since declined, with a sharp fall in 1977. The data for 1974 are not included in this discussion, they only apply to a 9-month period; in that year a switch was made from the financial to the calendar year, for record-keeping purposes.

6.21 If the non-commercial outlays—expenditure on wildlife, amenity, private forestry, etc.—which grew substantially in the early 1970s—were excluded, the net revenue picture would improve substantially. The extent of non-commercial expenditure in recent years is outlined below:

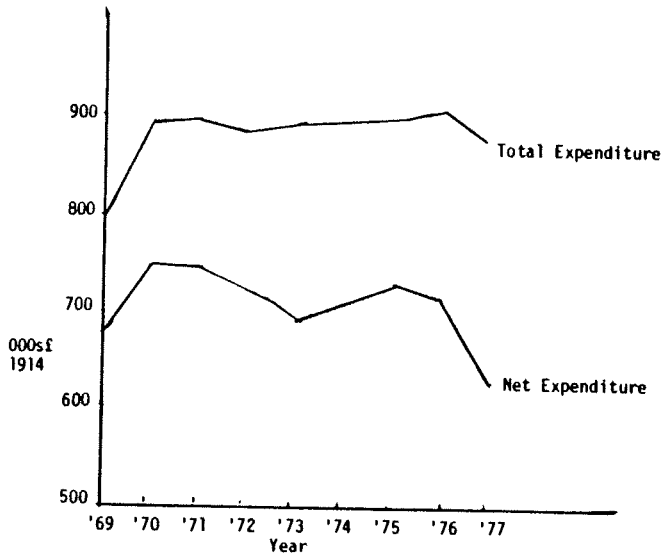
Year	Expenditure (000s£) Current	Constant (£ 1914)
1973	1,070	110
1974 (9 months)	910	80
1975	1,460	106
1976	1,690	104
1977	1,810	98

Source: Forest and Wildlife Service.

6.22 The Forest and Wildlife Service has maintained its planting programme while expanding its efforts in the non-commercial area and increasing its harvesting activity, from 1970 to 1977. This has been done while costs in real terms have been held constant. It seems

Figure 2

Real (1914 £) Total and Net Expenditure, Forest and Wildlife Service, 1969-1977.



Source: Table 14.

TABLE 14

Net Expenditure, Current and Constant (1914) £. Forest and Wildlife Service

Year	Current (000s £)			Consumer Price Index 1914=100	Constant (000s £)		
	Expenditure	Receipts	Net Expenditure		Expenditure	Receipts	Net Expenditure
1933	75	4	71	151	50	3	47
1938	192	10	181	173	111	6	105
1948	497	104	393	317	157	33	124
1952	1,164	179	985	378	308	47	261
1956	1,928	280	1,648	427	452	66	386
1960	2,723	457	2,265	466	584	98	486
1964	3,998	627	3,370	545	734	115	618
1968	4,639	818	3,820	638	727	128	599
1969	5,436	811	4,624	685	794	118	675
1970	6,610	1,061	5,548	741	892	143	749
1971	7,243	1,218	6,025	807	898	151	747
1972	7,734	1,384	6,350	877	882	158	724
1973	8,705	1,923	6,781	977	891	197	694
1974[1]	7,608	1,906	5,702	1,142	666	167	499
1975	12,441	2,576	9,865	1,381	900	187	714
1976	14,821	3,295	11,525	1,629	910	202	707
1977	16,250	4,542	11,709	1,851	878	245	633

[1] 9 months only.

Note: Discrepancies in subtraction due to rounding errors.

Source: Appendix Table 5.

reasonable, therefore, to assume that, given that the existing programme levels are maintained, real annual costs in the future will stay at about the 1977 level. The following average prices for July-December 1977 can be applied to the anticipated wood output:

	Average Price/M³ (1977 £)
Pulpwood	5.00
Boxwood	6.83
Sawlog	15.99

6.23 The total revenue which would result is listed in Table 15 and shown in Figure 3. If it is assumed that costs can be held at their 1977 level in real terms, then revenues can be expected to exceed total outgoings in 1993; if non-commercial expenditure is excluded, then revenues will exceed commercial expenditure within about 10 years. Of course, if there is real wood price growth, or costs can be reduced, then the cross-over date becomes closer.

Employment

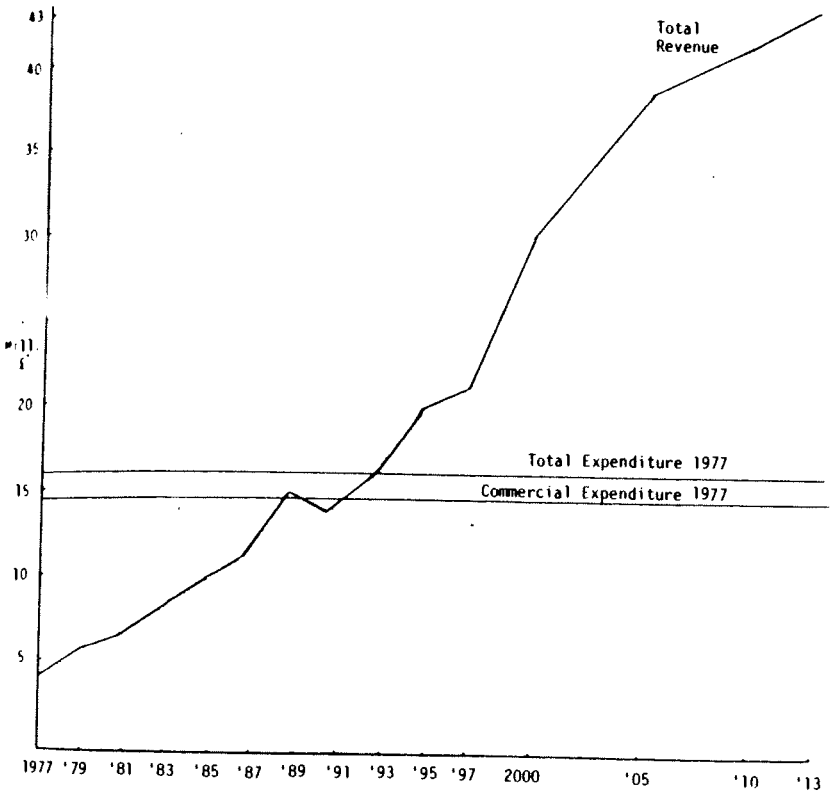
6.24 In the discussion on forestry in the government's Second Programme for Economic Expansion, covering the years 1964-70, it is pointed out that there were 5,600 persons employed in the State forestry undertaking on 31 March, 1964. The report goes on to say that:

> "Employment is expected to rise with the continued increase in forest area and the development of existing plantations; the total number directly employed is expected to be about 6,400 in 1970, an increase of about 17% over the decade."

6.25 Although the Forest and Wildlife Service's planting and development programme proceeded more or less as planned, employment, far from increasing, fell to 4,296 in 1970, and has

FIGURE 3

Total Expenditure, Total Commercial Expenditure, and Total Wood-based Revenue, 1977-2013 (1977 Constant Prices).



Source: Table 15.

TABLE 15

Wood Output Projections, 1979-2013, Volume (000s M³) and Value (000s £).

Year	Output							
	Pulp		Boxwood		Sawlog		Total	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
								1977 £
1979	315	1,575	190	1,298	192	3,070	696	5,943
1981	345	1,725	196	1,339	222	3,550	763	6,614
1983	456	2,280	251	1,714	248	3,966	955	7,960
1985	523	2,615	275	1,878	289	4,621	1,086	9,114
1987	602	3,010	315	2,151	368	5,884	1,286	11,045
1989	725	3,625	431	2,944	518	8,283	1,675	14,852
1991	706	3,530	399	2,725	437	6,988	1,543	13,243
1993	786	3,930	482	3,292	548	8,763	1,816	15,985
1995	836	4,180	577	3,941	675	10,793	*2,088*	*18,914*
1997	881	4,405	615	*4,200*	*770*	*12,313*	*2,266*	*20,918*
2000	974	4,870	814	5,560	1,237	19,780	3,026	30,210
2005	1,092	5,460	1,061	7,247	1,624	25,968	3,776	38,675
2010	1,136	5,680	1,109	7,574	1,707	27,295	3,952	40,549
2013	1,134	5,670	1,108	7,568	1,848	29,550	4,089	42,788

Source: Appendix Table 7.

Note: This output scenario is one of several possibilities. It is assumed that all logs with a top diameter of 20 cm. or greater and a minimum log length of 3 metres go to sawlog, wood in the top diameter range 14 cms. to 20 cms. goes to boxwood, with the balance going to pulpwood. It is assumed that all Sitka Spruce and Norway Spruce will be felled at age of Maximum Mean Annual Increment (MMAI) less 20%, while Lodgepole Pine (Coastal) is felled at age of MMAI less 30%.

continued to drop, reaching 3,611 in 1977 (Table 16). However, the reduction in the 1975-77 period has been negligible. This may be a result of the recent increasing involvement of the Service in harvesting wood; this would allow productivity increases to continue while maintaining a constant labour force.

6.26 The reduction in labour requirements was an inevitable result of the drive to increase productivity: if the annual production goal (acres

TABLE 16.

Employment Provided by the Forest and Wildlife Service in Selected Years.

Year	Direct Employment	Administrative and Technical Employment	Total
1951	3,420	267	3,687
1956	5,048	361	5,409
1961	4,803	556	5,359
1964	4,812	653	5,465
1966	4,134	720	4,854
1968	3,677	773	4,480
1970	3,382	914	4,296
1972	2,910	964	3,874
1975	2,659	1,061	3,720
1976	2,592	1,061	3,653
1977	2,546	1,065	3,611

Source: Appendix Table 5, and Forest and Wildlife Service.

planted, etc.) remains fairly steady over time while output per unit of labour input continues to increase, then labour requirements will diminish.

6.27 The Interdepartmental Committee report includes an excellent analysis of the social, as opposed to the financial, costs of the State forestry programme. It was concluded that the opportunity cost—what was being given up by the State in terms of reduced net output—of employing most State forest labour was close to zero. If this price—called the shadow price in cost-benefit jargon—rather than the money cost, were to be used when decisions concerning the optimum mix of resources—equipment, materials, and labour—were being made, it is certain that more labour would be employed than is now the case, where financial criteria are employed. Should the Forest and Wildlife Service adopt a shadow pricing policy, and make its resource allocation policies on this basis? Other government forest organisations—for example, the US Forest Service and the Northern Ireland Forest Service—have a long-standing tradition of employing labour which would not be engaged if commercial criteria were applied.

6.28 My reaction to the idea is two-fold: First, I am inclined to think that the actual opportunity cost of rural labour is much closer to the going financial price than the estimate developed by the Committee; the opportunities for part-time farm work, construction work and the like now seem to be quite plentiful. In this regard it would be interesting to trace a random sample of the holders of the 2,266 positions eliminated between 1964 and 1977, to see how many of those not retired have emigrated or are "permanently" unemployed. Secondly, assuming that the shadow pricing can be correctly done, I am in favour of enthusiastic participation by the Service, *if* this system is implemented on a government-wide basis. Given the implications for efficient management, unilateral action in this area by the Forest and Wildlife Service is not recommended.

6.29 I turn now to a brief consideration of acquisition, amenity and wood marketing policies, followed by a discussion of policies towards forest industry. Organisational issues are then addressed.

CHAPTER 7

LAND ACQUISITION POLICY

The Present System

7.1 The Forestry and Wildlife Service has an annual planting goal of 10,000 hectares. A substantial portion of the Service's technical manpower — 29 forestry inspectors, out of a total of 116 (this total excludes 34 officers in research) — are engaged full-time in acquiring land. In addition, there are 7 Land Commission Inspectors seconded to the Service with the task of giving, or withholding, the Commission's imprimatur on each acquisition. There is also a complete administrative section dealing with acquisition and lettings.

7.2 When the owner approaches the Forest and Wildlife Service with a view to having his or her land purchased, the area in question is visited by an acquisition inspector, who files a report. In this report the access conditions and boundaries are identified, and buildings, plantations, etc., on the land are described and valued. Elevation, aspect, exposure and site type (soil and vegetation) are determined; on this basis the land is partitioned according to yield class. The land is then priced, using a formula (which is classified as confidential) which involves attributing a value based on yield class, which is then adjusted downward on the basis of expected variable costs. The estimated value of buildings, plantations, etc., are then added to the land value to yield a total price. If the Land Commission inspector has no reservations, and the Forest and Wildlife Service decides to acquire, this then becomes the asking maximum price. If the seller requires a higher price than the "formula" price, then, beyond a very narrow variance, approval of the Department of Finance must be sought, and received, before the higher amount can be paid.

7.3 If the formula price in fact represented the present net worth of the sites, using current prices, then this approach would be a logical way to proceed. In fact, the prices which can be paid do not in many cases (and especially on the higher site classes) come close to the present net worth values. The most recent basic present worth estimates relating net worth to yield class for acquisition purposes was done in 1972; these values have since been updated in 1975 and increased across the board by 60% in 1978.

7.4 Given that the average price paid per acre by the Forest and Wildlife Service in 1977 was £23, it is remarkable that the acquisitions' programme continues at the current level (about 9,000 hectares per year). That it does so is a tribute to the calibre of the acquisitions staff. Land purchase has also been facilitated by the ability of the Service to purchase commonages, and by the fact that occasionally vendors are anxious not to sell to neighbours and, for this reason, find the Forest and Wildlife Service a convenient outlet. In addition, technological advances continue to allow poorer and poorer land to be successfully afforested. However, the acquisition opportunities resulting from these causes are diminishing, and there is a serious danger that the entire state afforestation effort will wither for lack of land. This has happened in Northern Ireland, where afforestation by the State Forest Service fell from 1,752 hectares in 1971/72 to 998 hectares in 1976, because sufficient land could not be acquired to maintain the 1971/72 level.

7.5 Of course, a particular level of State afforestation cannot be justified for its own sake. But if:

—there are willing sellers;
—the Land Commission does not feel the need to intervene, i.e., the land is not judged to be of importance for agricultural development;
—the negotiated price, if paid, will still show a net return to the taxpayers on their forestry investment which is at least as good as the return which would be achieved in the best alternative use of these resources;

then every effort should be made to facilitate acquisition.

Limitations of the Present System

7.6 In the post-EEC membership environment, land prices have increased substantially, and they change rapidly (usually upwards), sometimes from week-to-week. Using an "average-price" formula based on historic data which is not updated on at least a monthly basis will result in an increasing divergence between the formula price and the actual current worth of the land for afforestation.

7.7 Since timing — the ability to make a deal at the right time, and to be able to stand over it — is of the essence in land acquisition, the inflexibility of the present system is also a major problem. By the time a letter is sent to the Department of Finance requesting permission (which is usually granted) to offer a price higher than that allowed by the formula, and a reply has been received, the vendor may have already sold to a third party, or has changed his mind, or has increased the asking price.

7.8 Another difficulty results from the fact that while the price determination formula is based ostensibly on the land's productivity for commercial tree growth, under the provisions of the Wildlife Act (1977), the Forest and Wildlife Service has substantial powers to acquire and lease land for amenity, conservation, wildlife and recreation purposes. For areas which are of some uniqueness and scientific interest, it is important that the Service act on its powers as soon as possible. This is so because, once these lands have been substantially modified, they lose much of their scientific and historic-cultural value, and, judged in terms of human time scales, this loss is usually irreversible; once the relatively unmodified raised bog has been drained, fertilised, ploughed, cut-over or whatever, it is not possible by definition to recover its virgin status once more.

7.9 The pace of agricultural development and construction in rural Ireland is now such that probably most of the potential candidate areas for a natural areas system will, by the year 2000, no longer qualify for inclusion. The present acquisition procedure means that the Service is pressed to the very limit to purchase sufficient land to meet its annual planting target. Since a comparable target does not exist for the development of a natural areas system, it is difficult to give sufficient

priority to this area. It is true that the Parks and Monuments Branch of the Office of Public Works is continuing to acquire some relatively undisturbed natural areas as part of its programme to put together a system of National Parks. However, the statutory responsibility in this area appears to rest with the Forest and Wildlife Service.

7.10 Another peculiarity of the present land acquisition system is that, while the price which may be paid for land is rigidly controlled, once the land is in State hands, the Service can spend money relatively freely on bringing the land into production. For example, if land were purchased at a cost of £50 per acre, a further £250 per acre could be spent on it (a total of £300), while the Service was at the same time precluded from purchasing land at £100 per acre which would only cost a further £100, let us say (a total of £200), to bring it to a level of production comparable to that achieved by the "cheaper" land once the £250 per acre had been spent on it.

Suggested Modifications

7.11 In a Utopian world, the government would have a rural land-use plan wherein the use-mix which came closest to meeting its goal concerning efficiency, community stability, employment, etc., would be identified, and incentives and acquisition policy would be designed to achieve the desired land-use pattern. However, goals tend to conflict — more financial efficiency may mean less employment — and the information and co-ordination costs of implementing such a system may be inordinately high. Further, given the incremental nature of decision-making in the public arena, even if land-use planning of the type envisaged could be technically implemented, it is unlikely that it ever would in fact be undertaken. The following ideas, therefore, are in the nature of "second best" suggestions.

(1) At present, when the Land Commission inspector has reservations concerning a proposed acquisition, the case is forwarded to the Land Commission; if it wishes to, the Commission can then decide to acquire the land. This mechanism (or whatever agricultural land re-structuring system takes its place) should be depended upon as the primary means of ensuring that acquisition by the Forest and Wildlife Service is not

inconsistent with agricultural policy. If necessary, the staff of seven inspectors which now monitors acquisition should be augmented for this purpose. This would remove the residual notion that land price payable *per se* by the Forest and Wildlife Service is the important controlling variable, *vis-à-vis* agriculture.

(2) The acquisition staff should prepare a land acquisition plan (i) outlining how much land remains which might realistically become part of the Forest and Wildlife estate, (ii) establishing priorities for purchase, e.g., adding in-holdings might be given high priority, (iii) containing a programme of proposed action. Clearly, given the likely land price response to any very specific proposals, this plan should be confined to aggregate data and general priorities and procedures.

(3) A small interdepartmental overview committee — embracing personnel from the Departments of Finance, Fisheries and Forestry, and perhaps Economic Planning and Development, chaired by a member from the Department of Finance — should be set up to monitor the land acquisition procedures (but not individual purchases) used by the Forest and Wildlife Service. This mechanism would allow the Department of Finance to discharge its sanctioning responsibilities under the provisions of Section 2 (4) of the Ministers and Secretaries Act, 1924.

(4) Within the constraints outlined in (1) above, and guided by the procedures resulting from the implementation of (2) and (3), the Forest and Wildlife Service should be free to spend the land acquisitions budget as it sees fit. Under this system, once operating procedures have been worked out with the overview committee, an annual acquisition budget would be decided upon, and then the Service could proceed to allocate these funds among its various acquisition opportunities. All potential purchases would, of course, first have to be reviewed by the Land Commission staff, or by the staff of whichever regulating and land restructuring body takes its place. This approach would help eliminate the problem of missed opportunities because the price was not quite sufficient, or/and there was a lack of timeliness in making acceptable offers. It would also permit the Service to take

a comprehensive, long-term approach to the acquisitions programme.

(5) A separate plan of action, dealing, again in a general way, with acquisition needs, opportunities, and procedures, should be developed for the conservation programme. This should be co-ordinated if possible with the efforts of the Office of Public Works. The overview committee would also monitor this effort, which would, however, have a separate budget. It is important that this component of the Service's activities be separately identified, if progress is to be evaluated.

7.12 Regarding the desirable overall acquisitions budgeting level, I note that the acquisitions budget estimates for 1978 show an increase of almost 100% — from £523,000 (actual) to £1,000,000 (estimate) — between 1977 and 1978 (Estimates for Public Services 1978). This latter level still only allows an average of £45 per acre for a 9,000 hectare acquisition programme. A more reasonable annual total would be £1,250,000 (1978 £) for commercial forest land purchase and £250,000 for purchases related primarily to wildlife and natural area conservation. Since implementation of the changes in acquisition policy outlined above, together with the increase in the budget, should allow for more cost-effective plantation establishment and management, a portion of this budgetary increase should be compensated for to some extent by reduced costs elsewhere in the system. Plans for private tree farming will be discussed extensively in a later section. Co-ordinating the State acquisition programme with these plans will be examined at that stage.

CHAPTER 8

AMENITY POLICY

Introduction

8.1 We can divide activity in this general area into four categories:

(1) General Recreation — hiking, touring, picnicking, camping, etc. — requires no special skills, equipment or physique to participate.

(2) Specialised Recreation — orienteering, mountaineering, back-packing, canoeing, scrambling (motor cycles) etc. — requires special skills, physique and/or equipment to fully participate.

(3) Directly Wildlife Related Recreation—viewing and photographing wildlife; hunting of deer and wild fowl.

(4) Preservation of Relatively Undisturbed Ecosystem Processes — ecosystems which are rare or endangered, or provide a unique role in the biological system.

8.2 The Forest and Wildlife Service has undertaken a very comprehensive role in the amenity area. Six major forest parks have been developed which are designed to accommodate primarily the general recreationist. Lough Key, developed in co-operation with Bord Fáilte, is perhaps the most "developed" of these, with a visitor centre, restaurant, shops, camp site, etc. Camping is not provided at any of the other parks. In addition to the usual facilities, John F. Kennedy Park in Wexford includes an arboretum and forest garden, while Portumna Forest Park in Galway provides facilities for viewing deer and wildfowl. A comprehensive set of trails and picnic facilities have also been developed and can be found in every county of the nation. Visitor use of

forest parks has expanded substantially in recent years, growing from 392,000 visits in 1973 to 550,000 visitors in 1976 (Table 17), a compound annual growth rate of 12%, which if it persists, will result in a six-year doubling time.

8.3 Looking at the visitation pattern in more detail, we find that use at John F. Kennedy (Wexford) and Gouganne Barra (Cork) has stabilised, use at Dun a' Rí (Cavan) shows modest growth, while visitation at Ards (Donegal), Lough Key (Roscommon) and Avondale (Wicklow) continues to grow rapidly.

8.4 There are only fragmentary data available concerning trail use, while for the specialised uses there is no information available. However, the Service does co-operate fully with specialist recreation groups, such as orienteers. There is not any explicit provision of roadless area "wilderness" recreation, and camping is likewise, with the exception of Lough Key, not yet available. There are signs that these deficiencies in the outdoor recreation menu will be rectified in time. Interestingly, most of this progress was made in a legislative vacuum, since recreation is not even mentioned in the 1946 Forestry Act, which provided, and to some extent still provides, the principal legislative mandate for State forestry in Ireland. Indeed, even in the

TABLE 17

Number of Visits to Forest Parks, 1972-1976

Location	1972	1973	1974	1975	1976
Ards	—	27,845	26,066	33,840	51,708
Avondale	—	18,000	23,640	27,000	36,000
Dún a' Rí	38,460	52,475	34,675	36,831	60,742
Goughanne Barra	71,000	56,000	43,950	50,000	58,000
Lough Key	125,000	147,836	175,000	220,000	264,000
J. F. K.	115,300	90,000	100,000	80,000	80,000
Total	349,760	392,156	403,331	447,671	550,450

Source: Forest and Wildlife Service.

Wildlife Act (1977) it is only mentioned in Section 56, which outlines the uses to which State forest land may be put. After listing forest crops, wildlife conservation, hunting and fishing, we find:

> "Other purposes *ancillary* (italics added) to any of the foregoing, including the promotion of scientific knowledge, amenity, or recreational or educational purposes."

8.5 Pricing policy for admission to outdoor recreation is straightforward; £0.30 per car per visit at forest parks and a few other areas, and this is only collected when costs of collection are expected to be less than revenues generated. A £1.00 season ticket for any one park is also available, to cater to the local users.

8.6 The roles and authorities of the Minister concerning wildlife and ecosystem preservation, as listed in the Wildlife Act (1977), are substantial and comprehensive. The Act provides for the protection of individual species (flora and fauna), the establishment on both State and private lands of nature reserves, and of wildlife refuges (in less critical circumstances), and the regulation of hunting. It provides the Minister with a wide variety of powers, ranging from the police power (fines, compulsory acquisition powers, etc.) to the provision of financial incentives for landowners. It is for the most part enabling legislation; it *permits* the Minister to undertake activity in a variety of areas, but it *requires* him to do relatively little, a reflection of the government-executive dominated, as opposed to a legislature dominated system of governing.

8.7 It is widely acknowledged that the Forest and Wildlife Service has been very successful in its efforts to provide a wide range of well patronised forest-related outdoor recreation opportunities. A survey of forest users by Bagnall, Gillmor and Phipps (1978) indicated considerable satisfaction on the part of visitors with the quality of the experience provided. This is primarily a function of the excellent product offered, but it is perhaps also a consequence of the fact that forest users are availing of a highly subsidised service; revenues amount to only a small fraction of the more than £1.5 million now spent annually on conservation and amenity services.

Pricing of Amenity Outputs

8.8 As noted above, pricing policy is to charge zero or nominal entry fees to Forest and Wildlife Service facilities. As long as there is no congestion, and the incremental costs of servicing an additional visitor are zero or close to it (i.e., almost all the costs are fixed), then this approach will maximise social welfare evaluated using the conventional cost-benefit analysis criterion; since the costs are already incurred (fixed), the greatest use possible will yield the highest benefit over cost ignoring who pays the costs and who reaps the benefits. If this latter aspect — the equity question — is introduced, alternative policy prescriptions might be favoured. If we knew, for example, that attendance at a given forest park was comprised almost exclusively of individuals whose annual income exceeded £10,000 (an unlikely situation, to be sure) would we still favour free admission, even though the bulk of the park costs were provided (from taxes) by individuals of lower income? We do not, in fact, have any information on the income level, age, and socio-economic status of users, nor do we know the origins of users. Without this information, we can make no judgment regarding ability to pay, and recreation-use projections based on anticipated demographic and income trends likewise cannot be made with any assurance.

8.9 Pricing policy for deer and wildfowl hunting also tends to be administratively based, rather than consciously designed to recover some portion or all of costs, to achieve a rationing objective, etc. Deer hunting is in its infancy in Ireland, and basic data regarding total herd size and allowable harvest (guesstimated at 15-20 thousand and 3-4 thousand respectively) is unavailable. Until the restrictions on the calibre of weapon which can be used and the companion requirement of a police officer's presence when the calibre limit is exceeded have been sufficiently modified, deer hunting on any scale will not be a viable proposition. If and when these stultifying restrictions are removed, it should be possible to market hunting opportunities at a price which at least covers variable costs. Publicly owned wildfowl hunting rights on Forest and Wildlife Service lands are presently leased to individuals and clubs, who bid for them by sealed tender. Notwithstanding the competitive format for bidding, the "winning" bids are generally for rather nominal amounts, on the order of a few pence

per acre per year. It is not clear to me whether this represents the actual competitive price for hunting rights, or whether there is an informal but effective arrangement among the hunting clubs which in effect restricts competition and ensures that local clubs "win" the hunting rights in their area.

Suggestions

8.10 Among State Forest Services in the western world, the Irish Forest and Wildlife Service is unique in the breadth of its responsibilities. It is statutorily responsible for wood production, wildlife and natural areas preservation; it is the *de facto* primary source of land-based outdoor recreation. With such a wide mandate, difficulties in reconciling these, sometimes conflicting, purposes are inevitable. At the aggregate level, there is the matter of allocating scarce resources; the issue of dividing the acquisitions budget between land for commercial tree growing, on the one hand, and amenity purposes, on the other, has already been raised. At the level of within-forest land use, there is the potential for conflict between incompatible land uses; beyond a certain point more deer can be had only at the expense of some wood production loss; recreationists may disturb wildlife and damage areas of ecological and scientific significance.

8.11 Skilful management, involving the full use of the complementarities among land uses that do exist, has helped avoid any significant conflict up to this point. However, there is every indication that use pressures are going to intensify, and that the user groups will become increasingly organised and effective at presenting their case. The following suggestions are proffered in this context:

(1) *Pricing.* The pressure to expand access, facilities and services will tend to increase to the maximum possible extent as long as there is no, or only a nominal, charge for their use. Furthermore, once a user group has got accustomed to receiving a good or service without charge, this condition assumes the character of a right, and it becomes difficult, both practically and politically, to introduce and enforce a reasonable fee schedule.

I recommend therefore that a general policy be adopted to the effect that where it is feasible and financially worth while to do so, a charge sufficient to cover at least variable (mainly operating

and some maintenance) costs be imposed for amenity services. For some developments it may be felt desirable that revenues should cover total costs. In Northern Ireland, the Forest Service attempts to recoup from fees the direct costs of its amenity programmes. In 1976/77 receipts for game management came to £13,252 while direct costs amounted to £6,107. For other recreation, however, direct costs came to £94,241, while income only amounted to £51,317 (published in the Northern Ireland Trading and Other Accounts for 1976/77). This compares with £14,634 collected at Forest Parks in the Republic in 1976, and sales of venison in that year fetching £3,409 (Government Publications, 1977). The Forestry Commission in Great Britain has a policy that any new camp-site development must be able to show a return on capital invested of 7.5% before it will be approved; camping fees at present fall in the range of £1.60 — £1.10 per pitch per night. A realistic pricing scheme will have the advantage of dampening the constant pressure to expand facilities and services at the expense of the general taxpayer rather than the primary beneficiaries, namely, the users. It will also help make the amenity uses involved more "competitive" when budgetary and/or land use conflicts arise.

(2) *Recreation Development.* Subject to the pricing proviso outlined above, I recommend that a planning-coordinating unit with responsibility for developing wildland related outdoor recreation be established. The Forest and Wildlife Service, as the largest land-owner and principal provider of this type of facility in the country will have a central role to play. However, the participation of Bord Fáilte, the Office of Public Works, the Department of Education, the Local Authorities and others will also be necessary. Such a unit would monitor the overall outdoor recreation scene, identify trends and gaps in the recreational menu, and develop programmes to make up deficiencies. As use increases, and as farming intensifies, land owners will become increasingly reluctant to allow the free access which up to now has been a very fortuitous feature of upland recreation in Ireland. The public lands will then become vital for hill climbers and others as "lungs" to the higher ground.

There is need for a network of campsites in a forest environment to complement private efforts. Deer hunting, once the restrictions noted earlier have been removed, has considerable potential; the Forestry Commission earned almost £300,000 from deer hunting in Scotland in 1976/77, and it provides direct employment for about 160 men (Bancroft, 1978).

(3) *Ecosystem Preservation.* The Forest and Wildlife Service, the Parks and Monuments Branch of the Office of Public Works, and in a smaller way, An Taisce, are all engaged in the acquisition and protection of natural areas, etc. There is a need here also for a planning-co-ordinating unit embracing the interested parties, along the lines suggested for outdoor recreation. The earlier recommendations, *vis-à-vis* land acquisition policy, can be integrated into this larger planning context.

CHAPTER 9.

WOOD MARKETING

Introduction

9.1 In 1976, 85% of the wood sold by the Forest and Wildlife Service was sold standing, the balance being sold at roadside, having been harvested by Service staff. Sale is by sealed tender; the lot is advertised, specifying the location of the sale, the number of trees, the total volume, and the time allowed for removal. Sealed bids are then submitted to the department, and the highest bid generally wins the wood. This sale system is easy to administer and has the advantage of maximising competition — it is the sale system which is least susceptible to collusion on the part of buyers. It is also fair in the sense that no one is precluded from participating, while price, rather than some more subjective criterion, is the basis for deciding who gets the wood.

9.2 It also suffers from a number of disadvantages. Wood processing firms have substantial capital invested, which must be operated at or near full capacity to minimise unit production costs. They must, therefore, have a constant throughput of wood. The sealed tender sale system means that the buyer is never sure, when he bids, of getting any particular lot. This has two undesirable consequences. First, since he cannot make a reaction bid, the buyer cannot ensure that he gets the wood near his mill, thereby minimising the high unit volume wood transport costs. Second, a firm may be unexpectedly successful, and win more lots than can be financed. Alternatively, lack of bidding success may leave the firm unexpectedly short of wood.

Alternative Sale Methods

9.3 There are a number of different sale methods which can be used as alternatives to the sealed tender system:

(1) *Negotiated Price Sale:* A price is negotiated between the seller and the buyer. The negotiated price is often part of a medium, or long-term timber supply contract, in which case the sale price is adjusted periodically, using an agreed formula. Alternatively, the contract price may simply be re-negotiated periodically, e.g., at one-year intervals.

In Great Britain, the Forestry Commission sells about 30-35% of its wood standing; 55% of these standing sales are sold competitively, and the remaining 45% are disposed of by negotiation. The majority of these negotiated sales are on a short-term (one year or less) basis.

The Commission fells 65-70% of its wood, and either delivers it to the customer, or sells it at roadside. Sawnwood is usually sold competitively, while for small roundwood a negotiated price, often combined with a contract, is the norm (Fletcher, 1978).

The following is an example of a price adjustment formula, to be applied at six-monthly intervals.

$$P = BP \left[0.5 \frac{La}{Lb} + 0.5 \frac{Sc}{Sd} \right] \text{, where}$$

P is the new price
BP is the initial purchase price
L is an index of logs sold competitively in the UK by the Forestry Commission.
a is the index for the six-months immediately prior to the review.
b is the index for the six-months immediately after the operative date of the contract.
S is the average of the index numbers of the price of imported softwood delivered to customer.
c is the average of the index numbers for the six months immediately prior to the review.
d is the average of the index numbers for the six months immediately after the operative date of the contract.

The extent to which the negotiated contract price approximates the price which would be paid under competitive conditions is a function of the initial price, and the precision with which both the Forestry Commission and imported softwood indices capture movements in

native timber prices. The negotiated price system has a number of advantages, especially when combined with a contract. It provides surety of supply to the purchaser at a reasonably predictable price. Once the price has been negotiated and the contract signed, the buyer only needs to devote supervisory attention to the wood intake programme. Management skills can be concentrated on production and marketing of plant output. The main disadvantages are that it is difficult to develop a price appraisal system which accurately reflects contemporary market conditions, while the price adjustment factors are often likewise flawed in this respect. In addition, if a contract is signed with an operator who subsequently turns out to be unable or unwilling to comply with its terms, it may prove politically impossible to re-allocate the wood, because of the local employment and payroll associated with the initial assignment. The negotiated contract price arrangement also precludes access to this wood by new entrants, who, if they are more efficient than the existing users, will be able to pay more for the wood.

(2) *Oral Auction:* This has the important advantage that reaction bids are possible; a buyer can ensure access to specific lots by outbidding the competition. If the market is competitive, oral auction will also result in the full market price being paid to the wood owner. An important disadvantage is that if competition is weak, a collusive arrangement by the participants can be policed by them during the bidding. If only one bidder is present, he will bid the minimum, whereas, under the tender system, a higher offer would probably be forthcoming, since the bid will be made on the presumption that other bids will also be placed. Oral auctions also require that a fairly high level of expertise on the part of the buyer be present at the sale.

(3) *Wholesale Log Market:* This sale method has been described by Mead (1976). The seller harvests the wood and transports it to a sorting yard, where logs are sorted into inventory items, as demanded by the market. The Forest and Wildlife Service would commit itself to a given level of throughput over a period of years. If the inventory in particular lines was increasing, then the price would be lowered until demand and supply came into balance. Likewise, if inventory were falling, price would be increased until equilibrium had been restored.

This is the standard supermarket pricing policy, where normal inventories are maintained and supply and demand are equated by price. This is the log marketing system employed in the western US, in several sorting yards, by Crown Zellerbach and Weyerhaeuser, two major forest owning firms.

This approach provides surety of supply to whoever is prepared to pay the going rate. It ensures access to new and perhaps more efficient entrants. It frees the purchaser from the necessity of purchasing a diversity of species and sizes, and then disposing of the material that does not meet mill specifications. The system results in a competitively priced output to the grower. On the negative side, to make the system work there would need to be a substantial throughput volume of wood at each location; the combined costs of getting the wood from dispersed forest locations to the central yard, and from there to the processing facilities may be higher than for alternative sale systems. For pulpwood-using mills, which tend to have very high fixed costs and need therefore to work close to full capacity, their wood intake reguirements tend to be fixed in the short-run. However, where wood residues can be used, and other sources of wood supply are available, there is some substitutability even in the short-run.

The Harvesting and Delivery System

9.4 Most of the 85% of the wood which is sold standing is harvested and loaded on a piece-work basis, i.e., the workers are paid per ton of wood loaded on a lorry. The crews who do the harvesting are organised either by timber merchants, or by the mills themselves. In each case the organiser buys the standing wood, assigns a crew to harvest and load it at an agreed rate per ton, and then arranges for collection and transportation to mill. Although the harvest crews operate in theory as free agents, in fact they are often employed year-round by the same merchant or mill, and the latter will frequently provide low or interest-free loans to buy equipment such as horses, tractors and chainsaws, and also proffer advice on scheduling, harvesting methods and so on.

9.5 Given the tender sale system, this approach to harvesting and delivery appears to be highly efficient. The per tonnage method of

payment maximises the individuals' incentive to produce, while at the same time giving them the flexibility to devote their time to other endeavours as the need arises. This is very important when a substantial portion of the workforce is comprised of small farmers, as appears to be the case.

9.6 One disadvantage of the system is that there is relatively little incentive for any one merchant or mill to devote much resources to technical innovation in this area. This is so because any advances made will soon be copied by the others, and, in a competitive system, most of the revenue advantage will ultimately accrue to the grower. It is, therefore, very much in the Forest and Wildlife Service's interest to encourage progress in this area. The harvesting of the 15% of sales which are felled by the Service itself provides an excellent development and testing ground for such innovations. The dissemination of advances should be given special attention. The lack of institutional permanence among the workforce may make re-training difficult. The incentive to produce may result in less attention being paid to safety and health considerations than is desirable.

Suggestions

9.7 *Harvesting and Delivery:* I recommend that the Forest and Wildlife Service maintain a harvesting programme by its own staff at the present, or perhaps a slightly higher level, i.e., 15/20% of total sales, and that this continue to be used explicitly, in part, to test innovations. A means of disseminating the results of such work, through short courses and the like, should be devised There is a natural tendency for the direct harvesting effort by the Forest and Wildlife Service to increase. It facilitates the employment of Service workers who would otherwise be made redundant, it allows the Service to claim direct credit for this employment, and it means that the managerial difficulties involved in organising the more loosely structured private harvesting scheme are avoided. However, I feel that such expansion should only be undertaken with reluctance. Even with the full application of the incentive bonus scheme, it is unlikely that

State forest workers will have the same incentive to produce, and therefore, other things being equal, that they will be as cost effective as those working under the contract system. If the latter can be successfully combined with a good back-up research and development service, with proper provision for the health and safety of workers, then it should be maintained.

9.8 *Sale Method:* Since the Irish timber industries must compete directly in a free-trade world market for forest products, we need a pricing system that gives them the best possible chance of competing successfully, while at the same time giving the Irish taxpayers a fair return on their forestry investment. The present tender (sealed bid) system has much to recommend it, and is supported enthusiastically by the wood processing firms in Northern Ireland, possibly, in part, because it allows them to compete with local firms, on an equal footing, for wood in the Republic. Firms in the South, on the other hand, are almost unanimous in their vehement condemnation of this sale method, claiming that it is wasteful, encourages the fly-by-night operator over the highly capitalised quality conscious processor, etc. In Britain, we have seen that the Forestry Commission favours a mix of sale methods.

9.9 I too favour a mix of sale methods, but a somewhat different combination than that used in Britain. The reader is cautioned that I advance these ideas rather tentatively. I have not been able to conduct the type of exhaustive investigation which would warrant more definitive suggestions The negotiated price long-term contract sale method gives the processor the best purchasing system, but, if there is not also a competitive market with which to compare and adjust the negotiated price, the taxpayers' interests may suffer. I recommend, therefore, that, for the pulpwood-using industries, up to one-third of their total intake should be on the basis of a negotiated price for wood delivered to mill. The Forest and Wildlife Service would arrange with the timber merchants for timber harvest and delivery. At present pulpwood users have the option of negotiating a price for a percentage of their wood supply, but this offer only applies to standing timber of the Service's choosing.

9.10 Of the non-negotiated sales, they should be divided into those which are likely to be competitive (more attractive lots, likely to attract a number of bidders) and those that are not. The competitive lots should be disposed of at oral auction; if it works properly it will result in both surety of supply to users and a fair price to the producer(s).

9.11 For those sales classed as not fully competitive, the wood should be disposed of through a network of wholesale log yards. One should be set up initially, in a promising location, to test the idea. The candidate areas can readily be identified by examining the county production forecasts. The following county production estimates for 1986 prepared by O'Flanagan (1973) are suggestive, given that total sales in 1975 amounted to 287,000 M^3:—

	Production in 1986 000s M^3
Cork	166
Donegal	60
Galway	83
Kerry	29
Leitrim	30
Mayo	34
Tipperary	101
Waterford	84
Wicklow	169

9.12 If the wholesale log market concept is not feasible, the sealed tender sale method can be used to dispose of the wood for which there is not likely to be great competition.

CHAPTER 10.

POLICIES FOR FOREST INDUSTRY.

Introduction

10.1 The Forest and Wildlife Service provides the following services to the industry:

(1) Projections of annual wood availability, by county, are provided beyond the year 2000. The first comprehensive effort along this line was the path-breaking study by O'Flanagan (1973). This has been updated to incorporate more recent information on growth rates and changes in management strategy. These forecasts provide an excellent basis for industrial planning, but are limited for this purpose in two ways. They do not incorporate a prediction of likely harvests from private forests, and they do not indicate the availability of residues.

(2) Research into the quality of Irish timber is sponsored at the Institute for Industrial Research and Standards (IIRS).

(3) The Service co-sponsors and/or participates in the preparation of consultancy reports on future industrial developments. Examples of this type include the recently completed study of the Irish Softwood Sawmilling Industry, done by the staff of IIRS under the direction of a working group including the IIRS, the Forest and Wildlife Service and trade representatives, and the IDA study of the overall wood processing opportunities which is now underway.

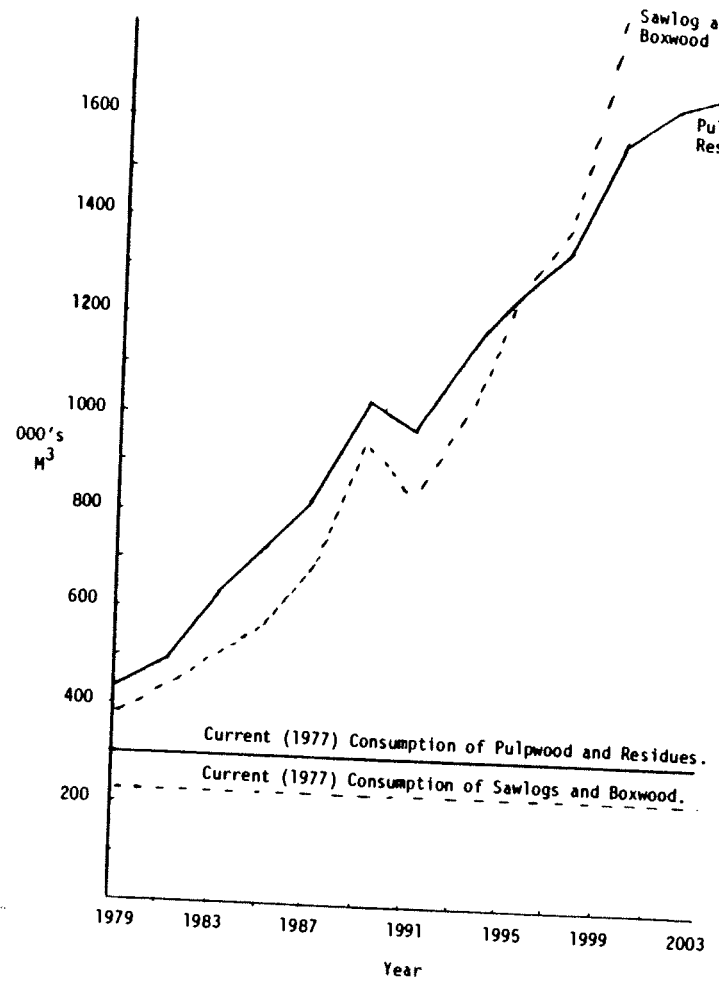
10.2 How adequate have these services been in terms of

encouraging a thriving Irish forest products industry? Up to the early 1970s, the measures taken seemed sufficient. Although there was widespread and continuous dissatisfaction expressed on the part of the trade with the method of selling State-owned wood, processing capacity continued to expand in line with expanding wood supplies; indeed a major preoccupation during the 1960s was to prevent capacity from exceeding the available wood supply. However, as noted in Section 1, the present post-recessionary environment is quite different. The three board mills are all now depending on the State rescue company — An Foir Teo. — to stay in business, and there are daily press reports of imminent closures. There is a backlog of thinnings, amounting to about 280,000 M^3, which must be left in the forest because of lack of markets, and, because of the growth of the forest, the surplus of available thinnings in excess of consumption is going to grow rapidly in the coming years. Wood intake by the four pulpwood-using mills in 1977 amounted to 295,000 M^3, comprising 247,000 M^3 of roundwood with the balance — 48,000 M^3 — consisting of wood residues. About the same level of consumption can be expected in 1978. It can be seen from Figure 4 that as we enter 1979, wood available from State lands exceeds consumption by 139,000 M^3, and that by 1983 the annual wood available is more than double the existing consumption. These estimates are based on particular assumptions regarding growth and management which are thought to be realistic, but could be altered. In addition, the estimate of residue availability (33% of total sawlog and boxwood volume) is extremely crude. At present only 21% of such volume is used by the panel industries.

10.3 It is unlikely that any new pulpwood using capacity can be added before the end of 1983. Assuming that consumption is maintained at the current level, a substantial surplus will have accumulated between 1979 and the end of 1983, comprised of 280,000 M^3 of existing excess, plus an accumulated "new" surplus of 1,020,000 M^3 together with a total of 170,000 M^3 (34,000 x 5) available from private lands, to yield a total excess of 1,470,000 M^3. In fact, not all of this will be available at the end of 1983, because for some thinnings, if they are not removed when they are called for silviculturally, they can never be taken out, for fear of destabilising the

FIGURE 4

Pulp and Residue Volume, and Sawlog and Boxwood Volume Available Annually from State Forests, 1979–2003, 000s M³



Source: Appendix Table 7.

stand, and making it more susceptible to wind-blow. In addition, assuming that the sawlog industry continues to expand independently of pulpwood using capacity, much of the residue material will be lost in the process. Also a small portion of this wood will be used in the round for fence posts, etc. Nevertheless, it is probably reasonable to assume that close to 1 million M³ will be available for utilisation in 1983, and that the annual additions to this amount will be in the order of 500,000-700,000 M³ in the 1983-1993 period.

10.4 On the sawmilling side, it is clear from Figure 4 that there will be sufficient wood to sustain a doubling of production between now and 1985, and that the 1985 level can be doubled by 1995, with a further doubling of the 1995 level being achieveable by 2005. This potential expansion is based only on the output from State forests. If the potential output from private forests (currently amounting to about 56,000 M³ of sawlog annually) is added in, the expansionary opportunity is correspondingly larger.

10.5 The sharp increase in wood availability in the Republic is also expected to be a feature of forestry development in Northern Ireland; total annual production from State forests is forecast to grow almost eight-fold from 75,000 M³ in 1980 to 587,000 M³ in 2004 (Savill and McEwen, 1978).

10.6 The options available for utilising these very large increases in the native wood supply are being explored in great detail by the Industrial Development Authority. Some of the types of plants which are under consideration are listed in Table 18. The IDA report will contain a comprehensive examination of alternatives. I turn now to a consideration of the economic and marketing environment in which the Irish forest products industry, whatever its composition, will operate; this is followed by an evaluation of the existing forest industry planning system. I conclude with some suggestions for the future.

The Economic and Marketing Environment

10.7 The following circumstances are a feature of the Irish forest products industry.

(1) The Irish market is so small, relative to the amount of wood available and the minimum-cost plant size, that the

TABLE 18.

Typical New Plants and Their Requirements, 1978.

Process	Plant Capacity Range	Assumed Plant Capacity	Capital Costs[1] £m Current	Labour Requirements[1]	Raw Material Requirement[1] 000m³ roundwood equivalent
(1)	(2)	(3)	(4)	(5)	(6)
BOARDS					
Hardboard	60-160,000 tonnes	66,000 tonnes	17.0	138	150,000
Medium Density Fibreboard	50-200,000m³	150,000m³	15.0	186	240,000
Particleboard	100-250,000m³	150,000m³	12.2	174	210,000
SAWMILLS					
Single Band Sawmill	5-12,000m³	up to 12,000m³	0.44	14	22,000
Twin Band Sawmill	7-45,000m³	up to 45,000m³	0.86	31	75,000
Profile Chipper	7-30,000m³	up to 30,000m³	1.10	13	55,000
PULPING PROCESSES					
Mechanical Pulp	33-250,000 tonnes	100,000 tonnes	12.3	96	250,000
Thermo Mechanical Pulp	33-250,000 tonnes	100,000 tonnes	17.0	106	240,000
Chemical Pulp	100-500,000 tonnes	200,000 tonnes	76.7	280	960,000

[1]Capital costs, labour requirements and raw material requirements are based on the Assumed Plant Capacity (Column 3).

Source: Industrial Development Authority, 1978.

industry will necessarily depend heavily on export markets for viability. This is already obvious perhaps in relation to board and pulp mills, but it holds equally true for sawn timber. While domestic production in the latter case at present only accounts for 27% of total Irish consumption, it is clear from Figure 4 (given that the "white deal" market which native wood can service comprises 68% of the Irish sawn softwood market (Knaggs, 1977) that within 10 years the Irish sawmilling industry too will have to be a major exporter if all of the wood becoming available is to be utilised.

In this respect (export dependency) we differ from the native forest products industry in Britain, where, if there is price and quality competiveness with imports, the domestic market can absorb all of the present or projected outputs of most wood-based products.

(2) The export market for forest products is for the most part a free-trade world market. Irish exports will compete without tariff or other protection with forest products from North America, the USSR, Scandinavia, etc.

(3) The major wood products exporting countries are characterised by a substantial level of integration in the producing units from forest to final product. Thus, in Sweden and in the US, some of the major timber products industries have large land holdings which supply a substantial proportion of their wood intake. In Canada the forest products firms manage the Crown lands on lease; in Sweden there is a State Forest Industries (Assi) body which is a major wood processor. Assi shares common statutorily defined objectives with the Swedish Forest Service. The Boards of both organisations have a number of members in common, including their respective managing directors (Swedish Forest Service, 1970).

Vertical integration allows the most economic "fit" between harvesting and processing; harvesting, wood, specification, scheduling, plant location, etc., can all be arranged so as to maximise advantage to the unit as a whole. All forest operations can be conducted in the context of an overall wood growth and processing plan.

(4) Export firms tend also to be horizontally integrated, producing lumber, panel products and pulp. This allows for maximum efficiency in wood utilisation. The slabs from the sawmill can be fed directly into the pulping unit, while the firms can quickly respond to changing end product prices, by adjusting the proportion of the wood intake going into the different processes. This structure can also help maintain overall stability, if a fall in demand for one product line is balanced by expansion of demand for another.

(5) The horizontally integrated firm can offer a wide range of products and services to the consumer: if the particular commodity on offer does not suit, perhaps another product of the firm may meet the requirements. A reputation for providing a quality product and service in one product line will enhance the firm's prospects in its other lines: the units are mutually reinforcing.

(6) The volume of business is such that the firm can support a significant research and development programme.

10.8 While the reader may, with some justification, feel that the points made above are self-evident, nevertheless the conclusion I draw, that we should plan immediately for a horizontally and vertically integrated forest industry structure, has not been widely debated.

Evaluation of Existing Forest Industry Planning

10.9 As noted earlier, the services now provided to the existing industry by the Forest and Wildlife Service consist of projections of wood supplies becoming available, and the timber testing and evaluation work sponsored at the IIRS. In addition, the IDA has provided capital grants, and An Coras Trachtala provides marketing expertise. In view of the fact that this is a fledgling industry which must compete in the world market with the highly efficient, seasoned campaigners from Sweden and elsewhere, I feel that the support system is not adequate for the task at hand. Since the value of the Forest and Wildlife Service's wood is directly related to the success with which it is processed and marketed, the Service has a very practical stake in this matter.

10.10 With regard to the planning of processing capacity, a Canadian survey team which reviewed the utilisation of pulpwood in Ireland between 1967 and 1969 (their report has been classified as confidential) recommended that a further review should take place in the early 'seventies, which would report on developments after 1975. This "early 'seventies" study was never commissioned. This may have been because the existing pulpwood users were projecting wood requirements which were never realised: also the extent of the contribution of both the private forests and sawmilling residues to the future wood supply was not estimated. Whatever the reasons, the hiatus in the planning cycle finds us with very large and rapidly growing pulpwood supplies which are already causing severe management difficulties in-forest. Given the fact that there will probably be at least a five-year lag before the recommendations of the IDA (whenever they are made) can be acted upon, these difficulties are going to be accentuated in the years ahead.

10.11 Adversity is a great teacher. While the current problems are largely the result of extremely difficult market conditions, it is now clear that our present approach is not adequate to maintain a viable forest industry in the worst of times.

Suggestions

10.12 I suggest that a Forest Products Development Board (FPDB) be set up, with the following authorities and responsibilities:

(1) *Planning.* A long-range plan for the utilisation of the wood — public and private — expected to be coming-on-stream over the next two decades is needed. The IDA analysis will clearly be of vital importance for this purpose. However, advertising the volume of wood becoming available, its size, location, etc., and inviting proposals for its processing from a wide range of sources, including Irish industrialists and the major integrated forest products companies in North America and Europe (Weyerhauser, International Paper Company, Svenska, Cellulosa AB, etc.) is another way of developing market information. Specifications concerning the extent of required local and State participation, employment, timing of investment, etc., would be included with

the invitation to present proposals. The wood volumes becoming available are now such that it should be worth while for interested companies to prepare detailed plans.

The key criterion for selecting a particular utilisation plan should be the ability of the forest enterprise to compete profitably in the world market even under the most adverse of circumstances.

(2) *Initiate Plan Implementation.* This means giving the Board powers to: (a) decide on industry structure and location, (b) determine the method of wood sale, (c) invest, alone or in partnership, in the processing units.

(3) *Product Development.* There are at present 34 inspectors employed in the Research Branch of the Forest and Wildlife Service; with the exception of a little work in harvesting, their research focus is entirely at the forest level. In contrast, the Forest Products Department at IIRS has only five individuals at a comparable professional level engaged in research, while an additional three are involved primarily in advisory work. The private firms do a little product development work, but it is primarily as a by-product of their involvement in quality control. The FPDB would undertake to expand research and development (R and D). The basic research on Irish wood properties that is now being conducted at IIRS would be continued and perhaps expanded and a substantial commercially oriented effort at product development would be mounted. It is absolutely vital that product R and D in Irish forestry at least keep abreast of, and if possible, get ahead of, developments by our competitors in the world market.

(4) *Market Development.* Identifying and servicing markets would also be a major function. Here, the Board would have to have authority to impose minimum quality requirements on all major Irish forest products. Even if this policy imposes short-run losses, it is vital that Irish lumber, pulp, chipboard, etc., be of consistently high quality, and attract a market premium thereby. Firms must not be allowed to undermine the overall reputation of

Irish forest products by selling a poor quality product, or providing inadequate service. This is especially true for sawntimber, which will have to sell in the highly competitive British market which, like the Irish market, has a residual antipathy towards home-grown wood.

10.13 How would this Board fit into the existing structure? It will clearly have to be linked closely with the Forest and Wildlife Service. Since the whole point of establishing the FPDB is that the contribution of forests to the economy as a whole be maximised, the very essence of the idea is that the on-the-ground forest operations be integrated with the processing operations. This means that both the Board and the Service will be under a single directorate with an agreed plan of action and an overall management board, which has in its membership senior personnel from Forestry and Wildlife and FPDB. Alternatively, the Board could become a management division within the Service, but this would involve radically restructuring the latter. Whatever the structure chosen, to facilitate integration, staff mobility between the two units should be encouraged.

10.14 While the FPDB will have a stake in some of the processing capacity — for example, some of the Foir Teo. indebtedness might be converted into State equity and transferred to FPDB, but this should only be done as part of an overall plan — it is envisaged that there will also be a substantial private sector processing effort, supported by the product and market development work of FPDB. The processing units with State equity should not be favourably treated compared with private units when wood allocations, etc., are being made.

10.15 As noted earlier, the IDA is already engaged in the development of a long-range forest products development plan. To begin plan implementation, proposals for wood utilisation will be invited in accordance with agreed specifications. In the future, as I envision it, this responsibility would be shared jointly by the FPDB and the IDA. However, the Board's role would also include the co-ordination of wood availability forecasting with investment planning and forest products development and marketing services on a continuous basis. It is in these latter respects that the wood utilisation system is most deficient at present.

CHAPTER 11

ORGANISATIONAL ISSUES

The Present FWS Structure

11.1 In the last section, some organisational changes were suggested concerning the development and servicing of the forest industry base. I would now like to expand a little on this issue, by looking at it in a broader context. With the time at my disposal, a full investigation of the advantages and disadvantages of alternative institutional arrangements was not possible. Therefore the proposals outlined here should be regarded as tentative. However, I did draw some conclusions and I feel that the issues involved are sufficiently important to warrant some observations, however cautiously they must be advanced.

11.2 It is certainly true that even the most adverse of institutional arrangements can be made to work effectively if the individuals involved are sufficiently capable and committed, while an excellent organisational structure with the wrong personnel will be ineffective. Nevertheless, it is worth asking whether the present Civil Service structure of the Forest and Wildlife Service is the most effective arrangement with which to face the future. It is clear from the production forecasts discussed earlier that there will be a fundamental change in the preoccupations of the Service over the next decade. The establishment of plantations has been the dominant concern up to this point, while the harvesting and processing functions have received relatively little attention. However, by 1990, the harvest from Forest and Wildlife Service lands—at 1.6 million M^3 — will make the organisation one of the biggest single timber producers in Europe. To put this in context, Stora Kopparberg, which is one of the major fully vertically integrated forest products firms in Sweden, owns 422,000

hectares of forest land, employs 1,200 workers in the forest and 4,300 in processing (total of 5,700) and has an annual harvest of 1.5 million M^3 (Stora Kopparberg, 1975). By the year 2000 the Service will be harvesting over 3 Million M^3 annually, which is about half of the 1978/79 harvest of the Swedish Forest Service. It was also noted earlier that the Forest and Wildlife Service can expect to "break-even" financially over the next 10 - 15 years, and thereafter to generate large and growing surpluses. The predominant tasks and the financial situation in the future then will be quite different from the past.

11.3 Are there changes which the Forest and Wildlife Service might usefully make in its management structure, to better cope with the new era? In looking at the present organisation, the following points seem important:

(1) The outside observer is struck immediately by the high level of competence and enthusiasm possessed by the Service staff at all levels.

(2) The Service, like most Civil Service units, has a dual management structure, with parallel administrative and technical arms. To the extent that this system was necessary to give Irish State forestry development a broad, policy-oriented perspective, rather than a predominantly technical focus, it has been quite successful. Although I have not conducted an exhaustive examination, the Irish Forest and Wildlife Service seems to be unique among State forestry organisations in having this dual management structure. It does not necessarily follow that we are ahead of the rest of the world on this score.

11.4 The dual structure may well have compelling advantages as a means of managing Irish government departments in general; I am not qualified to speak to that general issue. I am convinced that it is not the best structure with which to handle State forestry in Ireland in the coming decade. The two-tier system exacerbates the natural "territorial imperative" instincts which are a feature of all organisations. Whenever new personnel are to be hired or new initiatives taken, the matters of who will do what, and on which side of the fence the authority will rest, will be recurrent issues. To the extent that a stalemate exists, otherwise desirable initiatives will be thwarted. Information flows become

unnecessarily complicated. For example, the interpretation of policy-relevant technical data at the administrative level will suffer if the technical personnel who developed the information are not involved in the deliberations. Routine decision-making is slowed down, since documents, etc., must be checked, signed and counter-signed at both sides of the divide.

11.5 The reader should not conclude from these remarks that demarcation disputes are the norm in the Service. On the contrary, the administrative and technical personnel appear to have arrived at reasonably harmonious operating procedures which are as efficient as they can be in the circumstances. However, the fact is that tension is inherent in the system as it now stands, regardless of the skill and goodwill of the individuals involved, and this in turn leads to less than maximum attainable efficiency. The issue should always be, not who is on top and who is on tap (to use a phrase coined by a former Departmental Secretary) but what is the most effective way of establishing priorities and getting the job done.

Suggestions

11.6 The Service should adopt a unified management structure. By this I mean that the Service should have a single director, as should each division within the organisation. All senior positions would be open to both administrative and technical personnel. Perhaps a diploma qualification in forestry and public administration/management should be required respectively of administrative and technical candidates for the senior posts. The most valuable feature of the existing dual system is that individuals without technical forestry training participate in policy-making. Up to a point this is an extremely healthy aspect; the new unified structure should be designed so that this will continue.

11.7 There are two types of models which should be examined in developing the new organisation.

(a) State Forest Service Models. The Swedish Forest Service provides an excellent model of how to organise an integrated management structure on business-like lines. The present system is based on new principles for Forest Service operations laid

down by the Riksdag (Parliament) in 1968. Closer to home, the Northern Ireland Forest Service developed and implemented an integrated management structure in the early 1970s. Following on the recommendations of the Fulton Committee on government reorganisation, the Service in Northern Ireland volunteered to act as a case study unit for the implementation of a unified policy analysis — management system. Their experience, which appears to have been very successful, would be worth examining in detail.

(b) Vertically Integrated Forest Industry Firms. The management systems used by such firms as Weyerhaeuser, International Paper Co. (both US) and Svensa Cellulosa AB and Stora Kopparberg (Sweden) are also worth analysing.

11.8 If a unified management structure existed, this would facilitate integrating forward with the Forest Products Development Board. We might therefore think of an umbrella Forest Authority, under which served a Forest and Wildlife Service and a Forest Products Development Board, each with a similar integrated management structure. As discussed earlier, a joint policy would be developed, and integration would be encouraged by facilitating staff mobility between the two units.

11.9 Consistent with the above approach, a goal-oriented budgeting system should be introduced, so that progress in wood production, wildlife, recreation, private forestry, etc., can be evaluated. In particular, the costs, revenues, activities, etc., of commercial forestry should be identified. This will allow commercial programmes to be evaluated without the use of an amenity smokescreen which could be used to mask inefficiencies. It will also facilitate the evaluation of progress in the non-commercial areas. It should perhaps be added that the author encountered no evidence indicating that the amenity programme has been used to shelter inefficiencies. Goal budgeting was a feature of the Programme Budgeting System (PBS) which for a few years was applied to Irish government programmes, but which now seems to have been abandoned. I envision the reorganisation taking place with maximum feasible participation by staff at all levels. Generous provision such as transfers, early retirement, etc., would of course have

to be made for those who preferred not to participate in the changed organisation.

11.10 Clearly, an organisational shift of this magnitude will require Cabinet approval. The proposal deserves consideration on its own merits, but it could also be viewed as a case study, providing pointers on how to evolve from the existing Civil Service framework to a more modern, integrated and effective management system.

CHAPTER 12

THE EXISTING PRIVATE FORESTRY ESTATE

Description

12.1 The area and volume of the private forest estate is presented in Table 19. In contrast to the State Forests, one finds that on these estates hardwoods predominate. The very large area of scrub in private hands, comprising 40% of the total private forest area, is also striking, especially since trees in hedgerows, and forest areas less of than 0.5 acres, were not included in the survey on which these data are based.

TABLE 19

Area and Volume of Private Forests in Ireland, 1973

	Area Hectares (Acres)	Volume M^3 O.B.
High Forest		
Conifer	15,060 (37,213)	1,949,404
Hardwood	32,853 (81,180)	2,360,492
	47,913 (118,393)	4,309,896
Scrub	33,088 (81,760)	113,259
Others	960 (2,372)	2,572
Total	81,961 (202,525)	4,425,727

Source: G. J. Gallagher, and T. J. Purcell (1976).

12.2 The most recent previous inventory of private woodlands was undertaken in 1944. Between this and 1973 (the year of the last census), the area of high forest increased from 44,000 to 48,000 hectares, while standing timber volume grew by 63%, from 2.7 million M^3 to 4.4 million M^3. In addition, firewood volume increased over the period from 1.5 million to 4.2 million tonnes. This increase in area and volume bespoke a surprising and welcome vitality in the private forestry sphere: it had generally been assumed that both the non-public woodland area and volume were in decline. However, it may simply be a result of the better data gathering technique, used for the 1978 census.

12.3 In the overview of the existing forest estate presented at the beginning of this report, I noted the predominance of old trees on private woodlands: 45% of the total high forest area is more than 70 years old, and only 8% falls in the 1-10 years age class (see Table 4 for full details). Since much of this mature forest is past the age of maximum mean annual increment, it is hardly surprising that the annual volume increment is low. From the data below (summarised from Table 2) it can be seen that while private forests account for 24% of the standing volume, they only contribute 5% of the annual growth and 13% of the harvest.

	State Forests	Private Forests	Total	Private as % of Total
Standing Volume 000's M^3	13,605	4,400	18,005	24
Annual Growth 000's M^3	1,637	82	1,710	5
Annual Harvest 000's M^3	483	70	553	13

12.4 This disparity is partly explainable by the predominance of slower growing hardwoods on private woodlands, but the age-class distribution is certainly a major contributory factor. The large area of

scrub does not significantly influence this analysis, since it only contributes 2.5% of the total standing volume. The annual rate of growth (growth/total volume) on the private forests is 1.9%, while the harvest rate is 1.6%. The equivalents on State forests are 12.0% and 3.6% respectively.

The Owners

12.5 The owners can be divided into those who own 40 hectares (100 acres) or more, and those who own less. There are 151 of the large (40 hectares or more) estates, with a total forest area of 17,500 hectares (43,200 acres). The balance of 64,500 hectares (159,300 acres) is in small ownerships. Almost half of this latter area — 30,500 hectares — is scrub. Only 2,600 hectares of scrub are found on the large estates, comprising 15% of this woodland area.

12.6 Although no data are available, the large woodland estates appear to belong primarily to the descendants of the old Ascendancy landlord class. These owners have survived depressions, land wars, the implementation of the Land Acts, the workings of the Land Commission and the imposition of inheritance taxes. Tenacity, an enduring commitment to the land and, in some cases, considerable frugality, characterise this group. Trees are important as both symbols of good stewardship and as links with the past; they represent a patrimony and a tradition to be handed on to one's heirs. While return on investment considerations *per se* are not predominant concerns with these owners, they nevertheless have sufficient business acumen to ensure that the forest yields some revenue. Aesthetic, amenity and wildlife considerations will typically have an important bearing on woodland management.

12.7 In addition to those who have inherited their woodlands, in recent years there have been a few individuals who have established substantial areas of tree plantations on land not previously (in recent times) afforested. While they may share many or all of the attitudes described above, they tend to be much more keenly aware of the financial implications of their investment, and to direct their management accordingly.

12.8 With almost half of the small private forest areas comprised of scrub, it is clear that many of the owners of these woodlands are involuntary tree growers; the land is too expensive and/or troublesome to reclaim, and so it is left in its "afforested" condition. They have little if any interest in establishing and/or managing woodlands, beyond using the trees as a windbreak for their homes and stock. The reasons for this attitude will be examined when the extension of the forest estate is being considered. I turn now to a review of available services for the private owner, followed by a discussion of policy issues and suggestions.

Services for the Private Woodland Owner

12.9 For about 50 years, the principal forms of State support for private forestry have been a planting grant and free technical assistance. The planting grant will be discussed later on. The technical assistance has primarily taken the form of visits, and advice from inspectors of the Forest and Wildlife Service to owners who request help. However, some important advances have recently been made. As an outcome of the 1973 survey of private woodlands, all 151 owners of large estates were furnished with woodland maps and stand records. The Forest and Wildlife Service now periodically publishes average wood price received, per M^3, by size class. This helps to give the owner a basis for evaluating purchase offers and timber investments. Two short courses for private woodland owners have been conducted and a small technical unit concerned exclusively with the promotion of private forestry has been established by the Forest and Wildlife Service. Not entirely coincidentally, some of this progress has been achieved since the successful launching of the Irish Timber Growers' Association (ITGA), a co-ordinating-sponsoring-lobbying organisation representing the interests of private woodland owners.

Policy Issues and Suggestions

12.10 *Taxation:* Rates due on forested land are identical to the payments which would be made if the land were used for agriculture, i.e., payments depend on the rateable valuation, subject to the usual exclusions, deductions etc., and not on production. Since some form of agriculture will usually be the alternative land-use to tree growing, it will be helpful when evaluating various measures to assay their

neutrality *vis-a-vis* agriculture and forestry. Other things being equal, those measures which do not favour one land-use over another will be preferred. On this basis, there are no grounds for suggesting that rates should be lower on forest than on agricultural lands. To do so would be to imply that forestry was in some sense a more worthwhile land-use than agriculture, and that this value was not reflected in the price signals being received by the owner.

12.11 While there is ample evidence that the rateable valuation of land bears little if any relation to its current productivity — the situation in this regard is well summarised by Copeland and Walsh (1975) — this peculiarity is irrelevant to the present issue, since rates, where payable, are essentially fixed costs. The payment of rates may cause cash-flow problems for the owner of young plantations, since disbursements must be made without any income coming in. Two solutions are theoretically possible: the taxing authority could allow the owner to defer payment until some of the forest was liquidated, and then the payment, plus accumulated interest charges, could be made. The second approach would be for the owner to obtain bridging finance from a financial institution, with repayment of the loans plus accumulated interest being made at the time of harvest. Unless it were done on a large scale, with a near normal distribution of forest age classes, the first method could result in high administrative and/or cash flow problems for the local authority. In addition, in times of inflation, the accumulated tax plus interest charges due might well become less, in real terms, with the passage of time. This would encourage the woodland owner to defer harvest, as the longer he or she waits, the less onerous the tax burden will be in real terms. If the time span between the required tax payment and tree harvest falls within the normal lending horizon of banks, then the use of loans to bridge the cash flow gap would be satisfactory. All-in-all, it seems to me that there is no case at present for giving forestry special treatment *vis-à-vis* rates. It should, however, qualify on an equal footing, with whatever exemptions etc. are allowed for other land uses.

12.12 The growing trees and underwood (but not the land) are exempt from capital gains tax, and profits from timber growing are exempt from both income and corporate taxation (Judge, 1976). At

present the income tax revenue yield from farming is so small that any bias on this account in favour of forestry is negligible. However, if taxation based on farming income becomes significant then income from trees should be treated in exactly the same way as other farm income.

12.13 Capital acquisitions tax (CAT) which replaced death duties, is applicable at every transfer of ownership. The tax is progressive above a threshold value of £150,000 given or bequeathed by the donor/testator to the spouse and each of his/her children. CAT is chargeable on market value but "agricultural value" may be substituted for market value in respect of the trees and underwood. Agricultural value is the market value of the relevant property reduced by 50%, up to a maximum of £100,000. If indeed this tax is applied to the market value (less 50% in the case of agricultural value), then it will discriminate against forestry in important instances. Take the case of a land-owner who established 150 acres of plantations 35 years ago, and now transfers the woodlands to his or her heir. If the wood standing, and bare land are worth £3,000 and £400 per acre respectively, then the total market value of the holding is equal to:

£450,000 (wood) + £60,000 (land) = £510,000

If the land had been farmed, then no CAT would have been payable. While the agriculturist each year harvests his crop the tree farmer allows his annual growth to accumulate. At the transfer, the latter has an asset which is more than ten times as valuable as the farmer's and the tree farmer's beneficiary is therefore liable to pay the CAT. For many landowners, this situation is likely to skew their decisions away from tree farming. I propose that for estimating the CAT on forest land, the present net worth of the land under the most financially efficient silvicultural system be used for valuation purposes, regardless as to whether it is a newly established or a mature plantation.* As will be illustrated in a later section, on the drumlin soils this valuation approach will yield values for taxation purposes in the range of £850-£250/Ac. If this system is adopted, then income from tree growing

*This valuation estimate could be provided routinely to the Revenue Commissioners by the Forest and Wildlife Service, using agreed present net worth estimating procedures.

should be taxed, exactly as other farming income is taxed, with perhaps some provision for income averaging if this is not already available. On the other hand, if the market values of wood and land are used in assessing the CAT which is payable, then, as a means of partially balancing this inequity, income from wood sale should not be subject to income tax.

12.14 *Felling of Old Growth:* The low growth rate, and even lower rate of harvest, of the private woodlands has already been noted. If the rate of harvest were increased from the current 1.6% to 3.0%, it would have a number of advantages. Annual harvest would increase from 70,000M^3 to 132,000M^3, a rise of 62,000M^3 annually. Since this addition will for the most part be high quality sawlog material, it will provide the type of product which is most in demand by the sawmilling trade, and allow this industry to expand proportionately to the growth in wood supply. It will provide additional income to the woodland owners and enable them to both replace the old growth with rapidly growing young stock and allow the remaining trees in a thinned stand to grow more rapidly. This means that the increased rate of harvest can be maintained without doing violence to the concept of sustained yield; the increased growth on the replacement plantations and the remaining trees will allow the new rate of harvest to be sustained indefinitely.

12.15 The reader may be inclined to enquire if there are such obvious sustainable benefits to be had, by both forest owners and sawmillers from an increase in the cut, why have they not got together and accomplished it themselves? The first and most obvious reason is that many owners simply do not want to cut their trees. They prefer to leave them untouched for sentimental, amenity or wildlife conservation reasons. It also seems that some owners take the view that the felling of trees on their property will be perceived as a sign that they are in straitened circumstances, and resist harvesting for this reason. Because any individual owner will typically not make more than a few sales in the course of a lifetime, he or she will often have little idea how to measure and value the timber, how to draw up a sale contract, supervise the harvesting and clean-up etc. As a result, many owners will be reluctant to get involved in a deal where so much is unknown,

and where what information is available comes from the much more knowledgeable but not disinterested potential purchaser. This reluctance is reinforced in many cases by knowledge, either direct or second hand, of experiences where the buyer paid very low prices, or did not pay at all, or substantially understated the volume removed, and/or left the woods in a derelict state. These reasons are gleaned from discussions with owners, and with others knowledgeable in this area. The extent to which they affect harvest is not known. However, an effort to bring the harvest closer to its potential is worthwhile; if we apply the average price received per M^3 for Sitka Spruce sawlogs sold standing from State forests in 1977 — £20.73 — to the 62,000M^3 suggested increase in harvest, we find the private woodland owners annual net revenue would grow by more than £1.25 million if the additional wood were sold, and there was no price effect as a result of the increased supply.

12.16 The following steps would help bring this change about:

(a) A widely advertised service needs to be available to the owners, in which they can have absolute faith and which, on request, will measure their timber and provide estimates of volume and value. This organisation should also be able to provide information on taxation confidentially and recommend a method of sale. Evaluations of the reliability of timber merchants, and the quality of their work, should also be supplied.

(b) Information on various selection, felling and management methods which are not destructive of amenity or other values, and which enhance the long-term productivity of the stand, needs to be widely available.

(c) Programmes of increased felling-replanting obviously should be co-ordinated with and proceed in tandem with the Forest and Wildlife Service's programmes for establishing nature reserves and wildlife refuges, protecting wildlife etc. To illustrate; there are presently 8,110 hectares of oak high forest in private hands. Obviously some of this area should be included in the nation's system of protected semi-natural woodland. It is essential that the procedures for identifying these areas, for achieving the owner's co-operation in protecting them, through

easement purchase or whatever, etc. should be well in hand before a timber harvesting/replanting programme is launched, and this applies also to the other functions listed in the Wildlife Act. Otherwise a timber production policy could be cancelling out or negating conservation or other non-timber policies. This highlights again the very challenging multi-objective functions which have been given to the Forest and Wildlife Service, and the real difficulties which the agency (or any agency) faces in complying adequately with them.

12.17 Who should provide this comprehensive service to the private woodland owner? A number of options are available. The Forest and Wildlife Service could extend the excellent but modest amount of work they are already doing in this area. The woodland owners themselves could organise a technical/advisory service as an off shoot of the Irish Timber Growers' Association (ITGA). The equivalent group in Scotland has a highly successful management/advisory service in the Scottish Woodland Owners' Association (Commercial) Ltd. — which now is involved with the management of about 50% of Scotland's private forest area. This organisation is a self-supporting, fee charging (commission on sales, in the case of harvest) non-profit making unit. A third alternative would be for the agricultural advisers to have training in, and to provide advice on, forestry.

12.18 The scale of private forestry in Ireland is such that it would be difficult initially to sustain a self-supporting service along the lines proposed. However, I feel that the Scottish experience demonstrates that this is an excellent way in which to proceed, and suggest that the ITGA be given a five-year grant to get such a programme underway, this to be complemented by the expansion of the research and information dissemination efforts of the Forest and Wildlife Service in this area. The existing farm advisory service is already over-extended with its present responsibilities; options in this regard will be discussed when the extension of the private forestry estate is being examined.

12.19 *Scrub Clearance and Re-Planting:* The area of scrub — 82,000 acres — is substantial, and provides an obvious opportunity for conversion to productive forest. However, much of this area is probably economically unreclaimable. A high level of reclamation grant is

available — 40 or 50% of total costs, depending on farmer classification — if the clearance is undertaken as part of an agricultural land improvement scheme. Obviously, it has not proved attractive to clear the land in question, even with this generous level of support. The Forest and Wildlife Service offers up to £50 per acre for scrub clearance for purposes of afforestation. In line with the principle of parity among forestry and agricultural production incentives outlined earlier, I suggest that the scrub clearance grant for forestry be £50 per acre *or* 40-50% of total costs.

12.20 *The Tree Felling Permit System:* With a few minor exceptions, for all tree felling on private land, a notice of intent to fell must be lodged not less than 21 days, and not more than 2 years, before the cutting takes place. Unless a prohibition order is issued by the Minister for Fisheries and Forestry within 21 days of filing, the proposed felling can proceed. The administrative procedure is as follows: A felling notice (intention to cut) is lodged with the local Garda Station. This is forwarded to the Department of Fisheries and Forestry, who routinely send out a Prohibition Order, forbidding cutting. A forestry inspector then visits the area of the proposed cut and sends in his recommendations. In the event of approval, stipulations, such as re-planting requirement, may be appended.

12.21 Silvicultural criteria are the predominant factors influencing the recommendations. If the trees are mature, or if it is a silviculturally justifiable felling, e.g., a thinning, then felling approval is usually granted. Approval cannot be denied on amenity grounds alone, unless the local planning authority has consented to such refusal. If the area in question has been approved for a reclamation grant by the Department of Agriculture, then no re-planting is generally required. General felling licences issued for five years with annual checks, are given to those for whom forestry is a major source of livelihood.

12.22 The volume harvested under the felling licence system in 1977 are presented in Table 20. It was noted earlier that about 70,000M³ per annum which comes from private lands is used industrially. Making allowance for the fact that there are some exemptions, and that some of the firewood-type material (listed as

TABLE 20

Volumes Felled Under the Felling Licence System, 1977

	Conifers		Hardwoods		Total	
	Volume (M^3)	Tonnes	Volume (M^3)	Tonnes	Volume (M^3)	Tonnes
Limited Felling Licences						
With Inspection	30,950	222	6,802	18,481	37,752	18,703
Without Inspection	2,551	—	6,457	—	9,008	—
Total	33,501	222	13,259	18,481	46,760	18,703
General Felling Licences	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Grand Total					55,641	18,887

Source: Forest and Wildlife Service.

tonnes in Table 20) was probably used for industrial purposes, the 56,000 M^3 harvest volume estimated for industrial wood under the felling permit system seems to indicate that it "picks up" most of the timber cutting that takes place.

12.23 In terms of completeness of coverage, the system seems to work quite well; the Forest and Wildlife Service gets to review most of the proposals to fell on private land. The following issues require clarrification:

(a) Beyond the rather elastic concepts of biological maturity and silvicultural correctness, it is not clear what are the criteria used for evaluating felling proposals. In particular, there is ambiguity concerning the manner in which decisions are made concerning agricultural development proposals which require extensive woodland clearance. This is at present an important issue, because the improved returns to agriculture, combined with the substantial input subsidies, are making the clearance and reclamation for farming of the old woodland estates an attactive proposition.

(b) The Wildlife Act (1977) gives the Forest and Wildlife Service substantial powers to influence land use, through the purchase of easements, the designation of nature reserves, species protection orders etc. Assuming that a coherent policy and programme for these functions is in hand, the felling permit system provides an ideal means for evaluating proposed changes in land-use in this context.

(c) While the system is administratively effective, in its operation it conveys a rather negative impression on the land-owner. The felling notice must be lodged with the Sergeant-in-Charge of the Garda Síochána station nearest to the tree. The owner will then typically be sent a one-page Prohibition Order, forbidding the felling of the trees specified in the felling notice; this is to allow the forestry inspector sufficient time to examine the trees and make a recommendation. This procedure does not convey the image of a dynamic partnership in forestry between the State and the private sector.

12.24 I suggest that a working party be set up (including some agricultural representation) to develop a publicly available set of criteria and guidelines for deciding on tree-felling requests, and the conditions to be appended in given circumstances. This would help remove the element of arbitrariness which is inevitably a feature of the present system. The evaluation system should be an integral part of State policy on conservation and private forestry development. There also seems to be a strong case for increasing the penalties for non-compliance; at present penalties not exceeding £5 in respect of every tree illegally felled, and a fine not exceeding £5 on first conviction, are provided for in the Forestry Act (1946).

12.25 Having kicked to touch on the felling permit issue, I turn now to provide rough estimates of current and potential forest-based employment in Ireland.

CHAPTER 13

PRESENT AND POTENTIAL FOREST-BASED EMPLOYMENT

13.1 To estimate prospective forest-based employment in Ireland, a number of approaches might be used. Projections based on past performance and productivity trends, combined with a survey of processors, was the combination of methods used by Murphy, O'Connell and Sheehy (1977) in NESC Report No. 34 to estimate potential agriculture-based employment. Both the nature of the data, and the time available to me, resulted in the use of a less comprehensive and sophisticated projection methodology for forest-based employment.

13.2 It was assumed that all the employment provided by forestry — on the land, in harvesting, transportation, processing and marketing — is a net gain, in the sense that if the forests did not exist, national employment would fall by the total amount. This is clearly an over-simplification which exaggerates forestry's employment contribution. However, the distortion is not believed to be significant; the type of low intensity, extensive agriculture which would be practised on the lands now afforested would add little employment either on farm or downstream; if the native wood were not processed and marketed in Ireland, most of the formerly domestically produced wood requirement would be imported, although there would probably be a small increase in the consumption of home produced substitute products such as concrete. The larger question of what employment the funds invested in forestry over the years would generate in alternative uses, is too complex to tackle in this paper.

13.3 Current (1977) employment was first estimated in the forest, harvesting, transportation, and wood processing sectors; since the

annual wood intake is known, the average wood "required" per man-year of employment generated in the downstream activities was then determined. This information, combined with the annual wood availability forecast, provided the basic data for the downstream employment projections estimated, once an assumption concerning the rate of change in employment per unit of wood intake has been made. Future in-forest employment was estimated on the basis of expected work-load and productivity change. If the I.D.A.'s wood utilisation plan were available, this would provide specific information on which to base downstream employment estimates, but this plan is not yet to hand. At the time of writing (August 1978) there are press reports that two of the pulpwood using plants are about to close. While this, if it occurs, will reduce the current employment and wood intake estimates, it should not affect the projections, assuming that forest products development is handled in an appropriate manner. Finally, the reasonableness of the forecasts is checked against employment and productivity data from Sweden and elsewhere.

13.4 Except for State in-forest employment, published data are not available regarding forest-based employment in Ireland. Estimates of employment currently generated in harvesting, processing and transport are provided in Appendix Table 8; these results are summarised in Table 21, together with employment projections to the year 2000. The estimated average employment for 1,000 M^3 in harvesting (1.5), transport (0.15), pulpwood processing (2.75) and sawmilling (3.19) is very similar to the employment generated for 1000 M^3 in the UK (Forestry Commission 1977). The corresponding productivity estimates for the UK are 1.75, 0.27, 3.1 and 2.9 respectively.

13.5 The assumption has been made for projection purposes that labour productivity per unit of wood intake will increase at a compound annual rate of 2% over the 23-year period, so that, for example, while sawlog volume is expected to grow almost eight-fold, employment in sawmilling is expected to increase five-fold by the year 2000. In-forest employment is expected to fall to 63% of its current level. The net effects of these trends would be a more than doubling of employment, from more than 6,000 at present to in excess of 13,000 in the year 2000.

TABLE 21

Forest Based Employment in Ireland, 1977 and 2000

In Forests	1977			2000		
	Pulpwood	Sawlog	Total	Pulpwood	Sawlog	Total
	—	—	4,041	—	—	2,546
Harvesting						
Wood Volume (000 M³)	275	278	553	1,014[1]	2,163[2]	3,177
Employment (E)	500	327	827	1,156	1,646	2,780
E/1,000M³	1.8	1.2	1.5	1.14	0.76	0.88
Transportation						
Wood Volume (000'sM³)	246	225	471	1,014	2,163	3,177
Employment (E)	38	35	73	96	216	312
E/1,000M³	0.15	0.16	0.15	0.095	0.10	0.098
Processing						
Wood Volume (000'sM³)	295	225	520	1,728[3]	2,163	3,891
Employment (E)	812	718	1,530	3,007	4,432	7,376
E1,000M³	2.75	3.19	3.25	1.74	2.05	1.90
Total (Harvesting Transportation and Processing)[4]						
Wood Volume (000 sM²)	275	278	553	1,014	2,163	3,177
Employment (E)	1,350	1,080	2,430	4,259	6,294	10,553
E 1,000M³ Harvested	4.9	3.9	4.4	4.2	2.91	3.32
In-Forest Employment			4,041			2,546
Grand Total Employment			6,471			13,099

[1] Comprised of 974,000M³ from State forests and 40,000M³ from private forests.

[2] Comprised of 2,051,000M³ from State forests and 112,000M³ from private forests.

[3] Comprised of 1,651,000M³ of pulpwood + residues from State forests and 40,000M³ pulpwood and 37,000M³ residues (112,000 · 0.33) from private forests.

[4] The difference between E/1,000M³ in 1977 and 2000 is less than one might expect, because while some of the harvest in 1977 was exported, it is assumed that the entire harvest in the year 2000 will be domestically processed.

Sources: Appendix Tables 7 and 8.

13.6 It is likely that adding value in processing will counter the trend towards less labour per unit of wood intake. On the other hand, the wood using structure in Ireland at present is small scale, disaggregated and relatively labour intensive, so that substantial rises in productivity per unit of wood intake are inevitable.

13.7 In interpreting total employment generated per 1,000M³ by pulpwood and sawlogs in Table 21, the reader is cautioned that the results overstate the employment generated by the former and understate the latter; this is because residues (mainly from sawlogs) provide the raw material (over 33% of the total in the year 2000) for much of the employment which is classified in Table 21 under pulpwood.

We can check the estimated productivities in 2000 against contemporary "advanced" industrial forestry experience. The following ex-forest employment is generated by the Scottish Pulp and Paper Mills Ltd. bleached pulp and paper mill in Fort William, Scotland, which has an annual wood intake of 439,000M³, and is the major pulp and paper making complex in these islands using native wood (Mackay, 1978):

	Employment	Employment 1,000M³ (Scotland)	Employment projected 1,000M³ (Ireland)
Harvesting	750	1.71	1.14
Transport	100	0.23	0.095
Pulp + Paper Mill	916	2.09	1.74
	1,766	4.03	2.875

In this case, projected employment per 1,000M³ in the year 2000 is significantly lower than current employment at Fortwilliam.

13.8 In Sweden, we find the following (Swedish Institute, 1977):

(Ireland)	Wood intake 000'sM³	Employment (E)	E/1,000M³ (Sweden)	E projected 1,000M³ (Ireland)
Sawmills	29,375	28,000	0.95	2.05
Pulp Mills	47,000	46,000	0.98	1.74
Panel Mills	3,525	6,000	1.7	1.74

This illustrates the extraordinary productivity of contemporary Swedish forest industry. Their sawmills at present employ, on the average, fewer than half the number of employees per M³ of intake which I have projected for this sector in Ireland in the year 2000, having assumed a 2% growth in annual productivity. The productivity at the fully vertically and horizontally integrated Stora Kopparberg firm in Sweden is of the same order; 4,300 persons are employed processing an intake of 3.6 million M³, an average of 1.19 employees/1,000M³ (Stora Kopparberg, 1975). Applying Swedish productivities to expected output in the year 2000 results in employment in the range of 7-9,000. It is probably realistic to assume that actual employment will approach this lower range. The ratio of downstream to in-forest jobs is striking. At present it is less than one-for-one; in the year 2000 it will fall in the range of 4/1 — 7/1.

Wood for Electricity Generation

13.9 There is one utilisation possibility which would completely negate the above estimates of employment. This is the option of large scale use of wood as fuel for the generation of electricity. If 500,000M³ were allocated annually for this purpose, then (with 50% moisture content) 250,000M³ of dry matter = 216,413 tonnes = 477,104, 100 lbs would be available. 477,104, 100 × 8,500 = 4,055, 384, 850 × 10^3 BTU.

Assuming a plant efficiency of 30%, then:
4,055, 384, 850 × 10^3 × 0.3 = 1,216, 615, 455 × 10^3 BTU of Thermal Output. To convert to Kilowatt hours (electrical units), divide by 3,415:
1,216, 615, 455 × 10^3 ÷ 3,415 = 356, 256, 356 Kilowatt hours. Therefore, 1 M³ can generate 356, 256, 356/500,000 = 713 Kilowatt

hours (electrical units). Current (1977) consumption amounts to 6,783 million units, so that 0.5 million M^3 of wood-producing 356 million units — would meet 5.2% of total current consumption. A doubling — to 1 million M^3 — of wood used annually for this purpose would absorb all of the pulp wood and residue available from State lands in the later 1980s and early 1990s, and increase wood based power generation to 10.4% of the current level of consumption.

13.10 Since there would be an energy cost in terms of harvesting, transporting and preparing the wood for conversion, the net energy impact would be less than that indicated. It also seems that at the present state of conversion technology and alternative fuel prices, power plants could only pay about £7.5/ton for wood delivered, versus a current pulpwood delivered price per ton of £12 (Forestry Commission, 1977). If the standing wood were given away free, then the wood could be delivered at a competitive price.

13.11 The energy conversion wood using option does not appear to be very attractive; to make a significant contribution to the nation's consumption of electrical energy, all of the available pulpwood and residues would need to be allocated for this purpose, while the price which this use could pay, and the employment it would generate appear to be significantly lower than alternative uses.[1] However, it still deserves serious consideration, because, since any type of biomass can theoretically be converted to electricity, the amount of raw material actually available — branches, needles, scrub etc. — is much larger than the roundwood and residue volumes listed above. In addition, a 10-15% contribution by biomass might alter the complexion of the nuclear energy issue. Finally, the scale of the conventional pulpwood using industries, and Ireland's current lack of processing capacity, means that we are going to have close to 500,000M^3 of pulpwood and residues available annually without any outlet for a number of years. If an energy conversion option were chosen for the country's pulpwood

[1]However, if fuel prices were to increase significantly relative to the price of wood for industrial use (a not unlikely prospect) this would enhance the economic attractiveness of the "wood for energy" option. I did not analyse the economics of tree growing specifically designed to produce biomass for energy generation. A major study of the options in this regard is now under way under the direction of the National Board for Science and Technology.

and residues, the Forest and Wildlife Service should be paid the "going rate", and the extra cost passed on to the consumer of electricity; this was the approach used to pay Bord na Mona before the oil price rise made turf prices competitive with fossil fuels for generating electricity.

13.12 I recommend that the small scale biomass conversion pilot projects at present underway in co-operation with the ESB., the National Board of Science and Technology and the Agricultural Institute be expanded, and that the work be accelerated.

Distribution of Forest-Based Employment

13.13 The low value/volume ratio for wood means that it is usually more cost-effective to process it near the forest. Thus nearly all of the in-forest, harvesting and processing employment is typically found in rural areas. Since much of the future growth in Ireland's forests will occur in the West, we can expect a substantial proportion of the 7-12,000 forest-based jobs to be located in this region. Much of this employment, in turn, can be arranged so as to facilitate the participation of small farmers.

SECTION III

EXTENDING THE FOREST ESTATE

Many of the issues involved in extending the State forestry estate have already been discussed implicitly in the examination of land acquisition and returns to State afforestation. I will confine my attention in this general area to a brief consideration of the policy issues, *vis-a-vis* forestry, concerning the use of the State-owned cutaway bogs. Most of this section will be devoted to an analysis of the potential for private afforestation in Ireland.

CHAPTER 14

FORESTRY AND THE USE OF CUTAWAY BOGS

Introduction

14.1 Bord na Mona is developing or planning to develop 71,000 hectares (175,000 acres) of bogland for fuel production. Two extraction processes are used. Sod peat is produced by excavating one metre wide strips; when extraction is complete, an average depth of peat of 1.5 metres remains. Milled peat involves the production of peat in crumb or powder form; when extraction is complete, an average depth of 0.5 metres remains. It is now the Board's intention that all sod peat cutaway bog will be used for milled peat production before being developed for grassland or other agricultural use. Thus in future "all Bord na Mona cutaway bogland will be as a result of the milled peat operation and will have an average of 0.5 metres of peat remaining" (Healy, 1978). The issue of depth remaining is important; while grassland requires only 0.5 metres of peat remaining, arable cropping and vegetable production require greater depths. For forest crops O'Muirgheasa (1978) reports that for best results 1.0-1.3 metres of undisturbed peat should remain, but that on certain types, prospects are excellent when the peat layer is down to 0.6 metres. Healy (1978) notes that the Board's policy is reversible if research indicates that a convincing case can be made for an alternative.

Returns from Forestry on Cutaway Bog

14.2 Among the alternative land-uses, only for forestry is there experimental data available spanning decades regarding production on cutaway bog. At Trench 14 at Clonsast bog, Co. Offaly, experimental tree planting was initiated in 1955; replicated trials indicate that this cutaway site can support Sitka Spruce of Yield Class 26, i.e., it will

produce an average of 26 cubic metres of wood per hectare per annum. This is an exceptionally rapid rate of production. Using present costs and prices, and reducing the yield class to 22, afforestation of 2182 hectares of cutaway bog in Clonsast with Sitka Spruce would show a real net rate of return (Internal Rate of Return) of 10.7% (Rea, 1978). From the papers presented at the Irish Society of Agronomy and Land-Use Symposium — Future Use of Midland Bogs (see the Healy and O'Muirgheasa citations) — held in February 1978, it does not seem that the other uses being tested can approach this rate of return. If social factors, such as employment are critical, this aspect should be examined carefully for each use. Current employment at or generated by the 4,343 hectares of bog at Clonsast is comprised of 330 workers in the bog and 100 at the power station at Portarlington.

14.3 If this entire area were afforested, assuming that one person is employed per 400 acres (assuming a substantial productivity jump from the present Forest and Wildlife Service average of one job per 269 acres), in-forest employment would be provided for 27 persons. Making a 15% reduction for losses from yield class 22 results in actual output of 18.7M^3/Ha/Annum. At full production, sustained annual output will be 81,214M^3 (18.7 x 4343). It was estimated earlier that average employment per 1000M^3 in harvesting, transportation and processing would amount to 3.32 in the year 2000. However, it was also noticed that Swedish experience indicated that this may be too high. Making an arbitrary reduction of 25% results in a downstream employment estimate of 2.5/1000M^3. Applying this to the sustained yield output results in a total employment in harvesting, transportation and processing of 203, for a total workforce of 230.

14.4 Since the cut-over bog is becoming available gradually, it may well be sensible for Bord na Mona to evolve over its 40-50 year remaining life into Bord na gCrann.

If the entire 71,000 hectares (175,000 acres) of State owned cutaway bog were afforested, and the Clonsast production, cost and revenue experience were typical, these woodlands would:

—show a real (net of inflation) rate of return in excess of 10%.

—Employ 438 persons (175,000/400) in the forest.

—Employ 3,319 persons (71 x 18.7 x 2.5) in wood harvesting, transport and processing for a total long-term sustained employment of 3,757 persons.

Suggestions

14.5 When one examines the discussions concerned with the development of a utilisation plan for the State cutaway bogs, one is immediately struck by the absence of any entirely disinterested but knowledgeable participants in the debate. The Board itself clearly has a stake in the outcome, while the foresters, farmers, workers etc., who contribute all have vested interests in the issue. I feel that an examination of this entire matter would be an ideal and important project for the NESC to undertake. I recommend that it commission an independent study to clarify the policy options *vis-à-vis* financial efficiency, employment, community stability etc., involved in the utilisation of the State cutaway bogs. This technical report would provide a very helpful companion document to the investigation conducted by an Interdepartmental Committee appointed by the Minister for Industry, Commerce and Energy.

CHAPTER 15

Extending the Private Forest Estate

Introduction

15.1 Since the extensive tree planting on the great estates in the 1800s, there has not been any considerable private afforestation in Ireland. However, as can be seen in Table 22, some planting, albeit on a modest scale, has continued since the 1930s.

15.2 The only data available on private planting relate to grant-supported afforestation. However, it seems likely that this accounts for most of the tree planting which has taken place. The level of the per acre planting grant in money and in constant (1914£) terms is listed in Table 22. In real terms the grant was at its peak in the 1959-68 period, and reached its nadir in 1977. However, the grant in 1978 was increased from £35 to £90 per acre, which in real (1914£) terms comes to £4.7, the highest level so far achieved. However, if allowance is made for the fact that part of the payment is lagged — £50 is paid on successful crop establishment, and then the remaining £40 is paid out in £20 instalments, 5 and 10 years after establishment — the 1978 grant level is at about the 1959 level.

15.3 The rate of planting does seem to respond positively to increases in the real level of grant; the relatively high rate of planting in the 1959-68 period was no doubt in part a response to the grant level, and partly a consequence of the more aggressive promotional work undertaken by the Forest and Wildlife Service. However, the resources which have been applied to private forestry — about 0.25% of total annual State forestry outlays — are trifling, and planting, even at its peak, is far below what could be achieved. A number of factors have combined to produce this lack of progress:

TABLE 22

State Expenditure on Private Forestry, in Current and Constant (1914) Pounds, and State supported Acreage Planted Annually.

Year	Expenditure (Pounds)			Planting Grant per Acre (£)		Acreage Planted
	Current	Consumer Price Index (1914 £)	Constant (1914 £)	Current	Constant	'/ Acres
1930	240	171	140	4	2.3	120
1935	417	155	304	4	2.6	158
1940	485	205	236	4	2.0	106
1945	418	294	142	10	3.4	83
1950	711	322	220	10	3.1	105
1953	2,885	398	725	10	2.5	377
1956	4,155	427	973	10	2.3	632
1959	13,871	464	2,989	20	4.3	1,294
1962	15,125	499	3,031	20	4.0	1,307
1965	17,595	573	3,070	20	3.5	1,054
1968	15,351	638	2,406	20	3.1	1,751
1970	18,164	741	2,541	20	2.7	847
1972	14,441	876	1,649	35	4.0	743
1975	18,384	1,381	1,331	35	2.5	536
1977	15,210	1,870	813	35	1.9	385

Source: Appendix Table 6.

(1) *Low income on the part of most landowners.* As long as the level of income is sufficient only to meet day-to-day requirements, the opportunity cost of saving will be very high: an investment with long deferred returns, such as forestry, even if it provides an excellent rate of return, will have limited appeal. While farmers' incomes in the pre-Common Market era were certainly low, there is evidence both that there was considerable saving on their part, and that they were willing to make substantial pecuniary sacrifices to secure a future for their offspring. Other factors therefore must also have militated against tree growing.

(2) *Cultural Factors.* It was noted earlier that, for various reasons, private forestry in Ireland is associated with the gentry and the old landlord class. Beyond occasional shelterbelt planting, farmers have no tradition of forestry, and farming is a profession where tradition influences behaviour. Since the foundation of the State, forestry has been primarily a government activity. Thus in the popular mind, tree growing in general is associated with acquisition and planting of land by the State, while private forestry is seen as a manifestation of the demesne mentality, and not as a commercial land use option for the practical farmer.

(3) *Social and Structural Factors.* The same social factors — age, education, marital status, etc. — which inhibit agricultural development also militate against forestry. The final report of the Inter-Departmental Committee on Land Structure Reform (1978) provides a useful distillate of the pertinent data available. It is noted that farmers, as distinct from landowners, occupied 1.15 million acres less in 1971 than in 1961. One-third of the farm land in the country consists of farms of less than 50 acres on which all the males are over 45 years old, without children, and with less than one labour unit per farm. Over 23% of the active agricultural population is over 65 years of age, and there is a growing number of part-time farm operators; approximately one-third of Irish "landholders" classify themselves for census purposes as having occupations other than farming.

(4) *State Policy.* Since State policy has been expressly designed and implemented to encourage "the planting of small areas of wasteland on agricultural holdings", to repeat the statement of Mr. Ó Morain when he was Minister for Lands, it is hardly surprising that private forestry as a serious endeavour has made little progress. Extensive advertising, distribution of brochures and an excellent booklet (now unfortunately out of date but being revised) called *Planting for Profit* (issued by the Trees for Ireland Committee), have been the chief means of interesting farmers in tree planting. An important inhibiting factor has been the precedence which the State afforestation programme takes in determining eligibility. Thus in the "Grants for Private Planting" brochure (revised in February 1978) published by the Forest and Wildlife Service we find:

> "In areas where State forests have already been established the Minister will not normally be prepared to pay a Grant in respect of lands which, in his opinion, should more appropriately be incorporated in the State forests."

Thus the planting grant is not an entitlement in the sense that agricultural grant payments are; eligibility depends in part on the propinquity of the applicant to State forests, and on the Forest and Wildlife Service's acquisition plans and aspirations. However, it should be added that in recent years grants have been paid to some landowners in spite of the fact that they proposed planting areas adjacent to State forests.

(5) *Lack of Data.* As will be demonstrated, the one million hectares of drumlin and related soils in Leitrim, Monaghan, Cavan, Longford, Roscommon, West Limerick, North Kerry and Clare are highly productive for tree growing, and can yield very high financial rates of return if used for this purpose. However, it is only in the past five years that it has proved possible to rigorously demonstrate, document and quantify the size of the costs and returns which a farmer can expect from afforesting some of his land of this type. Therefore, on the most promising sites for forestry, there was not, up to recently, sufficient evidence to make a convincing case for tree growing to the understandably sceptical landowner. However, the documented performance of

some private plantations — notably A. O'Rahilly's in Co. Leitrim and R. Tottenham's in Co. Clare — combined with the measurement of State forests, now provides a sound basis for decision-makers, although, as we shall see, there are still some gaps in the data.

(6) With a few notable exceptions, the agricultural advisers have little knowledge of, or interest in, forestry: tree growing therefore is rarely suggested for inclusion in farm management plans, etc.

Afforesting the Drumlin Soils: An Economic Appraisal

15.4 *Productivity:* As part of the County Leitrim Resource Survey carried out by the Agricultural Institute, a rigorous effort was made by Bulfin, Gallagher and Dillon (1973) to determine the productivity of the land for tree growing. They measured 406 sample forest plots, representative of 72.5% of the county. They estimated that Leitrim's land area could be assigned Yield Class ratings for Sitka Spruce as follows:

Yield Class	Area Hectares (Acres)	% of County In Yield Class
26	48,948 (120,950)	31
24	18,898 (46,697)	12
22	13,592 (33,586)	9
20	30,888 (76,324)	19
18	9,210 (22,758)	6
16	1,954 (4,828)	1
14	13,458 (33,255)	8
Unplantable	12,666 (31,298)	8
Water	—	6
	149,614 (369,696)	100

The average weighted Yield Class for all the county's land area, exclusive of unplantable areas, is 22; almost one-third is classified as Yield Class 26, while over half of the area falls in the Yield Class 22-26 range. Under fully stocked conditions, then, the average acre in County

Leitrim planted with Sitka Spruce will produce 22 M^3/Hectare/Year. However, there are a number of factors which tend to reduce output. These include (in order of significance):

(1) *Climatic Damage (Windblow and Frost):* Windblow (trees felled by gale force winds) is potentially the most serious productivity reducing factor facing the drumlin tree farmer, since these soils tend to inhibit deep rooting. The evidence is as yet incomplete, but it seems that if: (a) conventional agricultural or mole ploughing is used, (b) the crop is thinned early to allow the remaining trees to extend their roots, and (c) clearfelling takes place at an early age, then the chance of windblow will be significantly reduced, and may be almost eliminated. Data are not available on the areas and volumes of forest adversely affected by windblow in Ireland. In view of its significance for the drumlin area, it is an aspect of management which should be accorded high priority if tree farming in this area increases in significance. Frost affects young trees primarily. Since damaged trees will usually be replaced, the loss is comprised of the replacement cost and the postponement of growth. Although locally significant, this is not regarded on a region-wide basis as an important production reducing factor.

(2) *Mammals, Diseases and Insects:* The feeding of deer on the bark and vegetation of young trees comprises the most serious mammal damage to forest trees in Ireland. Damage by domestic livestock can also be significant. However, Sitka Spruce is a browse "of last resort", and is not favoured if there is other browse available. Three fungi infections — Fomes Annosus, Armillaria Mella (Honey Fungus) and Rhizina Undulata — are among the most important diseases affecting Sitka Spruce in Ireland, while the large Pine Weevil and the Green Spruce Aphid are at present the only insect pests of any significance (de Brit and McAree, 1977). It has been estimated that losses from *Fomes Annosus* amount to about 5% of total production; losses from the other insects and diseases are still very modest. More worrying for the future perhaps are those insects and diseases which are known to attack Sitka Spruce but which are not yet

found in Ireland. These include the European Spruce Sawfly, the Spruce Budworm, the Englemann Spruce Beetle and various rust fungi. Our Sitka Spruce monoculture has not had an opportunity to develop "natural" resistence mechanisms to these insects and diseases, and the uniformity of the forest would facilitate their transmission if they were introduced. It is therefore essential that the import control regulations now in force, and the EEC directive on plant health coming into force on the 1st January 1979, be rigidly enforced; the Forest and Wildlife Service should allocate whatever resources and personnel are required to ensure complete compliance, because the viability of the entire Irish forestry enterprise depends upon it.

(3) *Fire:* This is a major source of forest losses in many countries. Fortunately, in Ireland it is not a serious problem; the area of State plantations burned annually in 1973-76 ranged from 295 to 521 hectares, comprising 0.001-0.002% of the total area. Over a 50-year period we might expect a total of 0.05-0.1% of the forest to be burned. Moreover, it is generally the young plantations in relatively low rainfall areas, near centres of population, which are most susceptible. Since most private planting is likely to be in high rainfall areas, removed from centres of population, the incidence of serious fire in these forests will be very low.

15.5 The data are such that it is not possible to quantify the average level of production losses which could be expected to result from drumlin forestry. This comprises the weakest element in the data base available for making investment decisions. I allow a 15% reduction of output for losses from fire, disease, windblow, etc., fully cognisant of the fact that the reality may be higher or lower than this.

Costs and Revenues

15.6 One of the many encouraging developments regarding private forestry in recent years has been the interest expressed in the potential of tree farming by the North Connacht Farmers' Co-op. Society Ltd. (NCF). The society established a forestry sub-committee to explore the possibilities, and F. O'Rourke, an economist at the Sligo Regional

Technical College, analysed the financial implications of various alternatives. Since published data on costs and revenues were not available to him, Mr. O'Rourke's analyses were of necessity rather general in nature. The Minister for Fisheries and Forestry, Mr. B. Lenihan, then met with some members of the sub-committee, and on February 10, 1978 he appointed a joint NCF — Forest and Wildlife Service committee to test in a rigorous manner the financial attractiveness of the various proposals suggested by the initial work of the Co-op.

15.7 The NCF identified six farmers in County Leitrim who agreed to allow the use of their land for the study. While these case-study farms were not selected at random, there is no evidence of bias in the choices made; the results can, I believe, be reasonably generalised to the drumlin area as a whole. The analysis of these areas, provided the cost revenue and rate of return estimates which follow. All of the original work, on which my discussion is based, was done in an exemplary fashion by T. Rea, analyst, Forest and Wildlife Service. The purpose of the study was to identify the cash flow which would result if the farms in question were afforested, and to determine the income which could be paid to the landowner as a result.

15.8 After inspection by acquisition inspectors of the Forest and Wildlife Service, each site was assigned a yield class. Four of the sites visited were classified as Yield Class 24; the remaining two were considered to be Yield Class 22. The plantation establishment and management costs (1977 prices) for each site were estimated by work-study officers of the Service, and then the average standing prices per M^3 received by the Forest and Wildlife Service in 1977 for Sitka Spruce were applied to the estimated outputs. The prices used per M^3 were as follows:

	£
Pulpwood	4.79
Boxwood	9.18
Sawlog	20.73

The outputs were reduced by 15% to account for anticipated production losses. In each case it is assumed that first thinning begins

in year 15; for the four Yield Class 24 sites, clear felling is assumed to take place 35 years after crop establishment, while for the two Yield Class 22 sites, 40 years is the assumed rotation age. The anticipated cash flow for one of the Yield Class 24 sites is presented in Appendix Table 9.

15.9 In Table 23, the present net worth and annual equivalent payments are presented at interest rates of 4 and 7%.

The Present Net Worth (PNW) is simply the discounted value of the net cash flow, i.e., as noted earlier,

$$PNW \quad \sum_{t=o}^{n} \frac{P_t Q_t - C_t}{(1+i)^t}$$

where n represents the rotation age, PQ is the revenue, C the costs, i is the interest rate and t is the year of occurrence. The present net worth can be converted into annual equivalent (A) terms as follows:

$$A \quad PNW\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

Equal annual payments of amount A, continuing for n years, are equivalent to having a lump sum totalling PNW in hand now at the specified interest rate. They are equivalent because, if the lump sum PNW were invested now at the given interest rate, payment A could be made from this fund each year for n years; the final payment in year n would exhaust the account.

15.10 Current input and output prices have been used, and it is assumed that they will both change proportionately with changes in the price level. The interest rate used therefore is a real (net of inflation) rate. This differs significantly from the annual rate which one would be quoted from a lending institution, since this latter rate will incorporate expectations regarding inflation. Thus, for example, the rate of price inflation in Ireland in 1977 was 13.6% and it is expected to be about

TABLE 23

Present Worth, Annual Equivalent and Internal Rates of Return, Co. Leitrim, Case Study Areas, 1978.

Site No.	Area (Acres)	Yield Class	Rotation Age	Present Worth per Acre (£)						Net Annual Equivalent per Acre £		Internal Rate of Return (%)
				Revenue		Costs		Net Worth				
				4%	7%	4%	7%	4%	7%	4%	7%	
1	80.5	22	40	1,033	384	296	245	737	139	37	10	9
2	27	22	40	1,033	384	253	207	780	177	39	13	9.5
3	16.35	24	35	1,076	441	260	217	816	224	44	17	10
4	24	24	35	1,076	441	241	200	835	241	45	19	10.5
5	23	24	35	1,076	441	241	201	835	240	45	19	10.5
6	22	24	35	1,076	441	254	211	822	230	44	18	10.5

Source: Forest and Wildlife Service.

8% in 1978. If money had been borrowed at the beginning of 1977 at 13.6%, the real rate of interest paid over the year would be zero, since the inflation rate equalled the borrowing rate. If the rate paid were 17.6%, then the real rate would be 4%. Unfortunately, as noted earlier, estimates of the long-term marginal real rate of return on domestic investment in Ireland have not been developed. However, it is thought to be in the range of 3-7%.

15.11 The cost of the land itself is the only outlay which has not been included in the analysis. The present net worth estimates can be interpreted as the amount one could afford to pay for the land, at the real interest rate specified, and still just meet all outgoings, including accumulated interest charges, from the receipts. Thus, on Site 1, if money could be borrowed at 4%, the investor could pay £737 per acre for the land, pay all of the other costs, together with the accumulated interest charges, and cover all of these costs from the revenues, without any surplus remaining at the end of rotation.

15.12 The annual equivalent is the amount which an investor could afford to pay annually in real terms for the use of the land for tree growing over the rotation, and still cover all costs, including interest charges. Thus at a real rate of interest of 4%, £45/acre/annum could be paid as rental for the use of Sites 4 and/or 5 for tree growing, and still cover all costs. Note that this amount is specified in real terms. This means that it should be adjusted periodically (consumer price indexed) to keep pace with inflation (deflation) so that its purchasing value remains constant.

15.13 The discussion thus far has been in terms of what an investor could afford to pay a land-owner for the use of his land for tree growing, when the investor incurs all of the non-land related costs. What annual rental could be paid if the land-owner incurred all of the crop establishment costs? The annual equivalents of the present worth of the revenue stream (called gross annual equivalents) provide the answer. Gross and net annual equivalents for the six sites are tabulated below:

Annual Equivalents (£)/Acre

Site	4%		7%	
	Gross	Net	Gross	Net
1	52	37	29	10
2	52	39	29	13
3	58	44	34	17
4	58	45	34	19
5	58	45	34	19
6	58	44	34	18

At 4%, when the landowner incurs all the costs, but the investor owns the wood, the annual rental payment per acre which can be made to the landowner increases by £13-15. At 7% the increase falls in the £15 to £19 per acre range.

15.14 The possibility of the land owner incurring establishment and management costs is of interest because of the nature of the costs and the amount of the planting grant. The average direct costs (no overheads included) of crop establishment on the 6 holdings is £116 per acre, comprising £58 for labour, £17 for machines and £41 for materials, i.e., £58 for labour and £58 for machines and materials. Since the machinery primarily involved is an agricultural tractor and plough which many farmers will in any event have on hand for their farm work, some of the £17 allocated to machinery (maintenance, etc.) is for many farmers a fixed cost. Therefore, the £50 planting grant now payable on crop establishment would cover almost all non-labour costs. The follow-up payments of £20 in years 5 and 10 will certainly be sufficient to meet susbequent non-labour costs. The internal rates of return fall in the 9-10.5% range; if the real rate of interest is at this level, then the present net worth falls to zero and there is no "surplus" to distribute.

Sensitivity Analysis

15.15 The analysis shows clearly how sensitive the results of forestry investment appraisals are to changes in the interest rate; increasing the interest rate by 75% (from 4 to 7%) results in an almost 4-fold drop in PNW, reducing it in each case to little more than a quarter of its former value. This is, of course, a consequence of the heavy discounting of forestry's relatively long deferred returns. The results are also sensitive to Yield Class; increasing from Yield Class 22 to 24 increases the net rental payable by £6-9 per acre. The significance of the higher yield class grows as the interest rate increases.

15.16 In the original analysis by Rea, the sensitivity of the results to changes of yield class was determined. The gross and net annual equivalents estimated for Yield Class 26 and 20 are presented below:

ANNUAL EQUIVALENT

i	Yield Class	Site No.	Gross	Net
4%	26	5	66	54
7%	26	5	40	25
4%	20	1	45	31
7%	20	1	24	7

15.17 Thus, if the one-third of County Leitrim with Yield Class 26 is assumed to be similar to Site No. 1, depending on the real interest rate assumed, the owners of this land could be paid £40-66 per acre in real terms, per year, for allowing the investor to use his land for tree growing, assuming that the landowner incurs the crop establishment and management costs. If the investor incurs these costs, the landowner could be paid £25-54 per acre per annum in real terms.

15.18 No allowance has been incorporated in the above estimates for profit beyond that included in the interest charges, while management costs on the part of the investor are also not allowed for. The returns apply to land actually afforested, i.e., the equivalent of adjusted acres in agriculture.

State and Private (Drumlin) Costs Compared

15.19 It is instructive to compare the crop establishment costs on these sites with the average costs incurred in the routine State afforestation programme. The latter data were developed by taking 10 randomly selected sites from those sites which had been analysed in considerable detail for the interdepartmental benefit-cost study which was completed in 1974. Costs on those 10 sites were then updated to express them in 1977 terms. The average direct costs per acre incurred on those areas amount to £189, compared with an average of £116 per acre on the six case-study areas. The nature of the substantial difference is clear from the breakdown of the individual costs per acre (£) of the main establishment operations (cleaning, ploughing, fencing, planting, manuring and drainage) presented below:

	Cleaning	Ploughing	Fencing	Planting	Manuring	Drainage
State Forestry Sites	39	19	21	63	20	17 5
Case-Study Sites	17	13	12	62	3	4 4
Difference	22	6	9	1	17	13 1

15.20 In cleaning, manuring and drainage, the cost advantage of the six sites is especially pronounced. These data reinforce the arguments made earlier, *vis-à-vis* State land acquisition; given the type of land which is acquired, the expenditure required to accomplish the productivity achieved is far in excess of what needs to be spent on the better sites, which are also much more inherently productive. It has been shown that tree farming on the drumlin solis can provide a reasonable return on the investment involved. The extent to which this would be attractive to landowners will depend in part on the opportunity costs — what they would have to sacrifice if they devoted their land to tree growing.

The Opportunity Costs

15.21 From the Farm Management Surveys conducted annually by An Foras Talúntais using a sample of Irish farms, information on family

farm income and management and investment income per adjusted acre is developed, for all farms and full-time farms, by soil group, system of farming and farm size. The average returns per adjusted acre for 1976 and 1977 in Connacht and Ulster are presented in Appendix Table 10. A few sample results for full-time farms in Connacht are presented below:

	Average (per Adjusted Acre)			
	Family Farm Income (£)		Management and Investment Income (£)	
	1976	1977	1976	1977
Soil Group 2 (includes drumlin soils)	58.3	37.5	-19.7	-24.4
Mainly Drystock	50.2	37.5	-19.7	-24.4
Hill Sheep and Cattle	34.7	31.8	-53.6	-71.5
Mainly Creamery Milk	74.6	77.3	-12.2	7.8

15.22 Family farm income is defined as gross output less total net expenses. It represents the total return to the family labour, management and capital investment in the farm business. Although the comparison is not exact, the gross annual equivalent provides the most comparable value for tree growing. The range of the pertinent returns to tree growing per adjusted area is presented below:

	Yield Class 26	*Yield Class 20*
4%	66	45
7%	40	24

15.23 Since the returns for farming are averages, half of the actual values will be less than, and half of them will be greater than, the amounts listed. There is probably a fairly wide dispersion about the mean. In tree farming, once the trees have been properly planted, if weed control in the first few years is accomplished and fences are maintained, then the returns above will be achieved, i.e., fairly passive

management after successful crop establishment is all that is required. For a given yield class, very little dispersion about the average return to tree farming will occur, i.e., the values listed and the marginal returns which any farmer could expect as a result of getting into tree farming will be very close. The values derived from tree farming assume that the farmer sells his wood standing. If instead he were to harvest it himself and sell it at roadside, this would add considerably to the per adjusted acre returns; if he were to transport it to the processing facility, this could add still more to the value.

15.24 Comparing the average family farm incomes for agriculture and tree farming, it appears that it would be to the financial advantage of a significant number of farmers to allocate some of their land to tree growing; however, for many it would only be attractive if they could get some money immediately, in the nature of rental payments, for doing so. The tree farming option looks significantly more attractive when all costs are included. The net annual payments are the equivalent on the forestry side to the management and investment income accruing under agriculture. For tree farming, these values, per adjusted acre per annum, are as follows:

	Yield Class 26	*Yield Class 20*
4%	54	31
7%	25	7

In developing these estimates, it has been assumed that all costs are incurred by the investor. If the planting grant at its present level were included on the revenue side, this would increase the net annual rental payable for tree growing by £4.29, at 4% over 35 years.

15.25 In the Farm Management Survey, management and investment income is defined as family farm income less the value of family labour; labour and all other costs have been deducted in deriving the amounts payable per adjusted acre per annum for tree growing listed above. Comparing these latter revenues to the (mostly negative) average returns to management and investment under agriculture, it seems that many landowners could enhance the returns to their overall

investment by allocating some of their resources to tree farming. The following caveats and comments should however be added:

(1) The above returns for agriculture are *average* values. There are many farmers who are showing much better returns than those listed: there is great scope for improvement, with existing technology, on many holdings. Clearly, tree farming should be regarded as one of a number of income increasing options for the less productive farms.

(2) There is an element of irreversibility in the decision to become a tree farmer. The costs involved in switching from tree growing to another land-use will typically be much higher than those incurred in changing, say, from drystock to dairying.

(3) In this paper, the present net worths, and gross and annual equivalent values derived therefrom, for tree farming, apply to adjusted forest acres, i.e., to the total effective acreage tree-farmed (net of roads, building areas, etc.). I allowed a 15% reduction for losses from insects, diseases and fire. The Forest and Wildlife Service routinely makes a 15% reduction from the gross forest area (unadjusted acres) to allow for roads, fire lines, etc. Since agricultural lands are already well roaded, and the woodlands would be interspersed with farmland, the reduction required to convert from gross area to adjusted forest acres in the drumlin area would be less, probably in the range of 5-10%.

(4) The financial attractiveness of tree farming will be enhanced if it is combined with agriculture, because this allows the spreading of overhead on equipment — plough, tractor, chainsaw — over a wider base and facilitates more complete equipment utilisation.

Policy Options

15.26 (1) *Tree Farmer as Owner:* The landowner gradually afforests part or all of his holding, and harvests the wood and sells it at roadside. Example: Take the case of a landowner who decides to allocate 21 acres to forestry, which has an average Yield Class of 24. He plants three acres annually, so that the entire area is afforested after seven years. He plans to start thinning early — at age 11 — and to do

so every two years; he will do the felling and extraction himself. He will clear-fell in year 29 and replant. This cycle is, of course, much too short in terms of maximising present net worth — commencing thinning at year 15 and clear-felling at year 35 would be more appropriate if this were the purpose — but the schedule outlined fits more satisfactorily into his overall farm development plan. If it can be assumed that the

TABLE 24

Revenue Generated Annually by Planting 21 Acres of Yield Class 24 Sitka Spruce in 3 Acre Annual Increments, 1977 £.

Year	Revenue return to		Total	Revenue per Acre
	Stumpage	Harvesting		
0-10	—	—	—	—
11	60	120	180	9
12	60	120	180	9
13	140	240	380	18
14	140	240	380	18
15	288	360	648	31
16	288	360	648	31
17	524	524	1,048	50
18	420	420	840	40
19	580	580	1,160	55
20	528	480	1,008	48
21	704	625	1,329	63
22	528	480	1,008	48
23	768	512	1,280	61
24	768	384	1,152	55
25	1,280	512	1,792	85
26	1,152	384	1,536	73
27	1,792	288	2,080	99
28	1,344	288	1,632	206
29	8,041	946	8,967	428
30-36	5,865	690	6,555	312
37-39	—	—	—	—
40	60	120	180	9
41	60	120	180	9
42	60	120	180	9

Source: Appendix Table 11.

planting grant and the follow-up payments will cover all of his out of pocket expenses, then he can expect the returns to his labour which are presented in Table 24.

15.27 While the conventional yield tables do provide an estimate of the total volume of wood which can be harvested under the thinning clearfelling system outlined, they do not indicate what size the material is; the prices used to value the thinnings and final harvest are, therefore, more speculative than they would be if a break-down of the material, by size class, were available, to which current (1977) prices could be applied. The detailed development of the data in Table 24 is presented in Appendix Table 11. Annual income grows gradually from £180 in year 11 to £1,500-£2,000 in years 25-28, and then, in years 29-36, once clearfelling begins, it jumps sharply to £6,500-£9,000; from years 37 to 39 there is no income, and then the cycle re-commences again in year 40. The per acre revenue ranges from £9 at the first thinning to £428 at the commencement of clearfelling. At the early thinning stage, the importance of the returns to labour in harvest (66% of the total) is striking.

15.28 Any of several planting-thinning-clearfelling scenarios might have been displayed. The one chosen is simply illustrative of the type of tree farming cycle that might be embarked upon. To what type of landowners might this type of tree farming be attractive? The following categories can be identified:

(a) Young (25-35 years old) farmers who have sufficient land and means that they can allocate, in annual increments, some of their land for tree growing, without any immediate return. The large, inflation proofed returns which will accrue when they are 55-65 they regard as a security for their old age, or as a patrimony for their children. This system might be especially useful for land-owning pig farmers.

(b) Landowners whose main occupation is not farming. They do not depend on farming to earn a living, and they do not have the time to get involved with any land-use which requires much of their time or attention. This category of landowner is large and growing, and tree farming appears to be ideally suited to their

circumstances. The labour requirements, both in-forest and in harvesting, as a result of undertaking the 21 acre afforestation scheme outlined, are presented in Appendix Table 14. For the first 16 years the annual labour requirement is less than 10% of a man-year. After that it increases because of the harvesting employment, but even when the clearfelling is underway, annual employment needed is only about 25% of a man-year.

(c) Older farmers wishing to endow their offspring with a rapidly appreciating, inflation-proof capital asset.

15.29 (2) *Tree Farmer as Renter:* The farmer allows the investor to grow trees on his land, and receives payment in return for providing this facility. The discussion earlier was in terms of an annual payment equal to the annual equivalent (either gross or net, depending on whether the farmer established and managed the crop or not) of the present net worth of one rotation.

15.30 Of course, there are any number of ways in which the present net worth value might be divided up. For example, instead of an equal annual amount for the duration of the rotation, a larger initial payment might be made as a "sweetener" to get the landowner into the scheme, followed by smaller annual rental payments. A P.N.W. for example, of £850 could either support annual net payments over 35 years at 4% of £46/Ac/An, or the landowner could be paid £150 initially followed by payments of £38/Ac/An for the 35 years.

15.31 Alternatively, instead of having an equal annual payment over the length of the rotation, the pay-out period could be shortened, and the annual rental amount increased. If this approach were combined with life expectancy data, then older landowners could be paid the larger annual amount, on the understanding that the payments for that rotation would cease on the death of the landowner. Using the case just cited, if the payout period were reduced from 35 to 20 years, then the annual payment could be increased from £46/Ac/An to £63/Ac/An.

Policy Implementation

15.32 *Information:* In order to implement these schemes, the first prerequisite is that the landowners be fully appraised of the possibilities

— the costs of tree planting, the skills required to afforest, and the returns to be expected and their timing. For example, for the drumlin soils, a variety of up-to-date tables should be readily available outlining the costs and returns to be expected on various sites using alternative silvicultural management techniques and rates of afforestation. These scenarios could range from a no thinning system to the early-and frequent thinning regime suggested earlier in the example. Since landowners have a diversity of goals, every effort should be made to accommodate their needs, within reason; the condition — stated in "Grants for Private Planting (Feb. 1978)" — that most of the commercial tree species be planted at not more than two metre spacing in order to qualify for the planting grant, seems unnecessarily restrictive. The agricultural advisers, in particular, should be fully aware of the possibilities. A Yield Class classification service, analogous to a soil testing service, should be available so that the landowners can easily get a short hand index of the productivity of their land for tree growing. The information on costs, revenues, etc., can all be related to yield class.

15.33 *Research:* There is need for a research programme which addresses issues of specific concern to landowners. The following are examples of the types of issues which might be tackled:

—Costs and revenues of short rotations, frequent thinning, no thinning.

—Impact of afforestation on the productivity of adjacent land, e.g., as a result of improving drainage, providing a wind break, providing habitat for predators, etc.

—Adaptation of agricultural machinery for forest use.

—Integrating farm and woodlands work requirements.

15.34 *Parity with Agriculture:* The planting grant and free advice are the major incentives which are now provided to the landowner to undertake afforestation. The attractiveness or otherwise of tree-farming will depend in large part on the incentives provided to encourage other land-uses. Agriculture benefits considerably from the EEC price support system, while forest product prices are determined in

a free-trade world market. However, in terms of analysing land-use alternatives in Ireland, the fact that one set of uses has the benefit of EEC price support mechanisms, while the other does not, is not germane to the allocation issue; whether it is logical or not, these are the price signals coming to Irish farmers, and they should be taken as given. Input subsidies, on the other hand, should not discriminate among land-uses, unless there is a particular reason or reasons for doing so, such as the existence of externalities. Although the present planting grant is, viewed in historical terms, very generous, this subsidy for tree farming does not compare with the wide array of input subsidies, ranging from capital grants for land improvement to per acre premia payments for beef production, which are available for agriculture. (The aids available to farmers are described in detail in [illegible] *for the Farmer*, Department of Agriculture, 1978.) Tree farming should attract a level of subsidy support which is comparable to that provided to other farming land uses. This would include payments under the small-holder unemployment assistance programme and the like.

15.35 *Taxation:* The case for uniformity of tax treatment between tree farming and other farming enterprises has already been made *vis-à-vis* existing woodland owners; the same principle should apply to extensions of the woodland area. The very impressive rate of private planting in Great Britain — amounting to about 50,000 acres annually in the 1970-75 period — is attributed in large part to the favourable tax treatment enjoyed by forestry investment, notably the provision that allows the remission of income tax on a sum equal to the tree crop establishment costs, under Schedule D. However, since such a provision will be of most value to individuals paying the highest marginal tax rates, much of the tree-growing investment generated thereby will come to be viewed as a tax shelter for the wealthy; the more successful the incentive is, the more likely it is to eventually attract the odium of the average taxpayer and the politicians. To the extent that the provisions are peculiar to forestry, they will divert investment into tree growing, which, unless tree growing can be shown to produce net social benfits over and above other investments, would be from society's point of view, better devoted to other uses. The inherent instability of the tax incentive approach is illustrated by the

current situation in Britain, where uncertainty regarding the application of the Capital Transfer Tax (introduced in 1975) to forest investment seems to have been a major factor in the precipitous decline in private tree planting which has taken place; the area privately afforested annually fell from 46,000 acres in 1975 to 19,000 acres in 1977. In Ireland, unlike Britain, outlays on tree crop establishment cannot be claimed as a loss against other income for tax purposes. I support the continuation of this situation, if the input subsidies and tax provisions for tree farming are on a par with those applying to other land-using farm enterprises.

Financing the Rental Scheme

15.36 In the discussion of the tree farmer as a renter of his land for tree growing, reference was made to the amount an "investor" could afford to pay the landowner annually and still cover his costs. Who is this mythical investor likely to be, bearing in mind that 35 years must elapse before the bulk of the revenues accrue? The following choices can be identified:

15.37 A. Owners of capital, either individually or collectively, contract with the landowners to rent the land for tree growing. The terms of payment would be negotiated with each owner, and could be of several forms; rental might be an annual price index-linked annuity, or a lump sum payment, followed by a smaller annual payment, or part or all of the payment could be in the form of a share of the revenue. The role of the government would be limited to paying the planting grant to the landowner on the successful establishment of the crop, and providing yield class assessments and general advisory services.

15.38 The difficulty with this approach appears to be that, almost regardless of the overall attractiveness of the rate of return, financial institutions are not at present geared to handle a payout period of 15-20 years during which the rental would have to be paid without any significant revenues accruing. To illustrate the problem, let us take one of the Yield Class 24 case-study areas, assume that the owner incurs the planting and management costs, that the real rate of interest is 4% and that all of the rental is paid in the form of an index-linked annuity. Then, in 1977 £, the per acre cash-flow of the investor would be as is shown in Table 25.

TABLE 25

Costs, Revenue, Cash Flow and Accumulated Cash Deficit from Planting one Adjusted Acre of Yield Class 24 Sitka Spruce, Gross Annual Equavalent Rental of £44/Ac/An paid, 1977 £.

Year	Cost	Revenue	Cash Flow	Accumulated Cash Deficit[1]
0-14	616[2]		616	616
15	44	75	31	585
16-19	176[3]		176	761
	44	170	126	635
21-24	176		176	811
25	44	233	189	622
26-29	176	-	176	798
30	44	343	299	499
31-34	176	-	-176	675
35	44	3,015	2,971	2,296

[1]Interest charges are not included.
[2]44 x 14.
[3]44 x 4.

Source: Appendix Table 9.

15.39 With the exception of a small positive return in year 15, the investor must pay-out annually up to year 20; after that income meets current outgoings. This problem could be surmounted in a number of ways:

(a) A market in immature plantations could develop, i.e., the price of a 7-year-old stand of Sitka Spruce would reflect the fact

that it was that much closer to maturity and revenue producing than a newly established crop. One, therefore, would not have to wait for thinnings and clearfelling to realise a return from the investment. Getting to a scale such that there would be sufficient transactions and knowledge for a properly functioning market to develop would be one difficulty with this approach; protecting the interests of the landowner, i.e., ensuring the continued and timely payment of the rental, could be a problem, although the landowner would presumably have a lien on the trees in the event that the investor did not comply with the terms of the rental agreement.

(b) Government could provide funds at the beginning of the rotation, e.g., pay the first 5-10 years of the rental, in exchange for a proportionate share in the clearfelling revenue. This would shorten the period during which money had to be "out" to something closer to an acceptable planning horizon for financial institutions.

B. Government undertakes the entire programme, paying the annuity and therefore owning the wood.

15.40 There are advantages to both of these approaches; the first would minimise the cash drain on the Exchequer, while also making fullest use of the entrepreneurial energies now emerging in this area, and providing choice to landowners; the second would provide the government with first hand knowledge of the rental system in operation — this would be useful for monitoring the private effort — while it would also facilitate the most complete integration with the Forest and Wildlife Service's existing management and utilisation programmes.

Finance from EEC Institutions

15.41 There are a number of existing programmes and current developments related to the EEC which are of interest *vis-à-vis* the encouragement of tree-farming in Ireland.

15.42 EEC directive 160 provides for the payment of an annuity subject to certain conditions, to farmers who are at least 55 years old,

who release at least 85% of their farm to development farmers or whose land is "withdrawn from agricultural use permanently, in particular by being reallocated for afforestation, recreational activities, public health or other public purposes" (Article 5). The annuities payable at present are £960 (married) and £660 (single). As implemented in Ireland, to qualify, a landowner must sell or lease for a minimum period of 12 years his/her holding to a farmer/farmers whose approved development plans provide for the acquisition of additional land, subject in all cases to the approval of the Land Commission, *or* sell his/her holding to the Land Commission.

15.43 It seems, therefore, that there is a real possibility that payment of a rental for tree growing, either by the Government (Land Commission under current regulations) or by private investors, could be combined with the annuity payment to provide a reasonable income for the landowner, if a serious effort were made to facilitate this type of development. If such a scheme were in operation, then a landowner transforming his 30 acre farm from livestock to tree farming might be paid £40/Ac/Annum rental in real terms, which would yield an inflation-proof income annually of £1,200, which combined with the retirement annuity of £960 (married) would leave him with a total annual income of £2,150. Alternatively, if the life expectancy system were applied (rental payments terminate on the death of the owner), and if an average life expectancy of 20 years prevailed, then, assuming a 4% rate of interest, the annual rental payments could be increased from £40 to £55/Ac/An. This would presumably be of most appeal to a single landowner; taking the 30 acre example again, rental income would be £1,650/An, which, with the £660 annuity, results in an annual land-based income of £2,310.

15.44 The reader will recall that the rental payments are not in any sense subsidies or transfer payments to the owner. They are the economic worth of the land for tree-growing. If the payment comes from the Exchequer, then it is an investment in tree-growing by the public which will return to them the assumed rate of real interest when the wood is harvested. If the private sector does it, then of course there is no drain on the Exchequer.

15.45 What of the adjacant farmers who are looking to the transfer

of this land to provide them with sufficient area to form viable holdings? Of course, every effort should be made to ensure that land is not tree farmed which will provide higher net returns in other uses. However, for those lands where tree farming yields a higher net return to the owner than other alternative land uses, and where the owner voluntarily decides to engage in it, on a rental basis or otherwise, tree farming should be encouraged. For development farmers themselves, tree farming on such areas will in any event be the most financially efficient form of land-use.

15.46 There is at present a "package" being prepared by the Commission of the European Communities, to support agricultural development in the West of Ireland. The set of proposals — referred to hereafter as the "Gundelach plan", named after the present EEC Agricultural Commissioner who initiated it — follows on the approval of a special development plan for the Mediterranean region. It should be clear form the analysis presented in this section that tree farming has a valuable role to play in western agricultural development; any plan that does not encourage the harvesting of this potential will be seriously deficient.

15.47 Although there is as yet no EEC Common Forestry Policy, the Council has approved regulations and a programme of support for forestry in the Mediterranean region, as part of the overall Mediterranean plan. Clearly this sets an excellent precedent for the encouragement of tree farming in the West of Ireland under the Gundelach plan. The Economic and Social Committee of the European Communities also approved a set of wide-ranging proposals for the support of forestry prepared by T. J. Maher, president of the Irish Agricultural Organisation Society.

15.48 The European Investment Bank (EIB), created by the Treaty of Rome which established the EEC, gives loans to finance investments "contributing to the solution of regional problems, the promotion of industrial conversion and the creation of new ventures". The Bank is a non-profit making institution which raises its capital in markets, and lends it according to sound economic, financial and technical criteria. The loan must be repaid in the currencies borrowed. The Bank rarely lends more than 50% of the cost of fixed assets involved, and loans

normally fall in the range of £0.6-50.0 million per project. The money rate of interest charged on a sample 15-year loan in August 1977 was 8.75%. The maximum loan period allowed by the EIB used to be 20 years, so that the financing of rental payments for tree farming over a 35-year period was not feasible. Recently, however, a long-term loan was made to Italy for forestry development, and it is very likely that Ireland could now also get a long-term (40-year) loan for this purpose. Except for the exchange risk problem (which can, however, be a significant factor in this period of fluctuating exchange rates), the EIB appears to be an ideal source of funds for financing the first years of the annual payments under the tree farming rental scheme, on behalf of the government, with "conventional" capital financing the rest, the total capital commitment to be paid out of harvest proceeds.

The Role of the Cooperatives

15.49 It is significant that much of the recent initiative for the promotion of tree farming in Ireland has come from a cooperative — the North Connacht Farmers — and that the president of the national organisation, Mr. T. J. Maher, has taken a lead in preparing for and getting a forestry programme approved by the Economic and Social Committee of the EEC. The co-ops. can play a crucial role in helping to establish the credibility of tree farming as an acceptable commercial agricultural enterprise for farmers. They can also act as useful intermediaries, ensuring that the farmer is getting value for money, providing plants, fencing material, crop establishment services, and, later on, marketing services. The services would be provided for a small commission deducted from the planting grant (in the case of the tree farmer as owner) and/or the rental (in the case of the tree farmer as renter).

Suggestions

15.50 The first general recommendation is that tree farming be treated like other farming activities for purposes of input subsidies and taxation. The analysis of tree farming presented earlier illustrates that there is an as yet unrealised potential for this activity on the drumlin soils. On extensive areas, the practice of commercial tree growing would substantially increase the net income of the landowner, while simultaneously creating a wood raw material supply for industrial

development. How is this potential to be realised? There is need now for the application of resources and dynamic leadership in this area which will provide:

—Up-to-date information to landowners regarding all of the tree farming options available, and the costs and revenues involved.

—Educational programmes designed to break down the antipathy of landowners to tree farming, e.g., tours for farmers of existing tree farms and the development of additional "model" farms. The development of co-operative information services by Macra na Feirme, the Co-ops., the IFA, ICA, etc.

—Training courses and certification in tree planting, management and harvesting techniques for landowners, agricultural instructors, etc.

—A research programme oriented to the needs of the tree-farmer.

—An array of options for the landowner, ranging form the owner doing the planting and owning the timber outright himself, to the owner simply renting the land and playing no other part.

—A means for fulfilling whichever of the options is chosen. This means that the potential for availing of the various EEC provisions must be explored in detail. Where the programmes as implemented at present do not meet the needs of tree farmers, then alternative methods of implementation must be explored. The various choices available for financing the rental and other alternatives must be carefully examined, and then action taken to ensure that these sources are available to the landowner.

15.51 In a word, a unit should be developed which leaves no stone unturned in both informing landowners of the costs and rewards of tree farming and in developing the means whereby this potential can be realised by as wide a spectrum of landowners as possible. This unit would also ensure that the needs of existing forest owners, as described earlier, were also facilitated.

15.52 A modest annual planting goal — say 5,000 acres per annum

initially — should be established. Although this is large in terms of existing private planting in Ireland, it is low when compared with achievements elsewhere; in Scotland private planting has been close to 30,000 acres annually throughout the 1970s. Criteria relating to minimum acreage, minimum acceptable yield class, etc., need to be established.

15.53 As with other land uses, the adoption of tree farming should, of course, be entirely at the discretion of the landowner. The changes in the Forest and Wildlife Service acquisition procedures recommended earlier can be used to complement the private efforts. For example, the State might wish to buy some key areas by paying a lifetime annuity to the landowner based on the productivity of the holding for tree growing.

15.54 In what institutional framework would a Tree Farming Development Board (TFDB) be most likely to succeed? The Forest and Wildlife Service is providing many of the services listed on a small scale already, it has a high level of professional competence and a reputation for achieving what it sets out to accomplish. On the negative side, *vis-à-vis* private forestry development, the development and management of the State forests have been and remain the predominant concerns of the Service, and there may be a disinclination to move aggressively into this new field, along the lines indicated. The reorganisation proposals outlined earlier, if implemented, would facilitate the undertaking of initiatives in this area. If the service were not prepared to mount a substantial tree farming development programme, then a unit in the Department of Agriculture, working with an expanded advisory service and supported by a research effort from An Foras Taluntais, could be effective. This approach would have the great advantage of being fully integrated with the Service structure already available to the farmer. On the negative side, some duplication with the Forest and Wildlife Service would be likely to occur and the effort might be dwarfed by the more predominant and pressing agricultural interests and concerns. It does not matter who takes the lead in this area as long as it gets done, and done well.

SECTION IV

SUMMARY AND RECOMMENDATIONS

The commissioning of this report was timely, because Irish forestry is now at a threshold, and major policy initiatives are required. The quadrupling of the domestically produced supply of wood which is going to take place within the next 10-15 years will require changing from the present cottage industry type of forest products processing structure to a fully horizontally and vertically integrated, export-oriented complex. In addition, it is now clear that the growing of wood on the drumlin soils could be a financially attractive proposition for many landowners. Recommendations relating to both the management of the existing forests and the extension of the forest estate have been stated throughout the report. These are summarised in this section.

CHAPTER 16

SUMMARY AND RECOMMENDATIONS

A THE EXISTING FOREST ESTATE

State Forestry

...stment in State Forestry

16.1. State woodlands now comprise 687,000 acres. Just over 94% of the State plantations are coniferous, and 40% of these fall in the 1-10 year age bracket. As a result of the age structure, a rapid expansion in wood harvest is anticipated; roundwood production is expected to increase from about 500,000 M^3 at present to 2,108,000 M^3 in 1994. It was concluded that, using current costs and prices, the State investment could be expected to show a real rate of return in the range of 3-6%. The Forest and Wildlife Service will begin to show a positive annual cash flow within 10-15 years. The analytic team which evaluates the State forestry investments is now comprised of 2-4 individuals, depending on how one allocates personnel. Since the total State forest investment at present amounts to about £200 million, I recommend that the analytic effort be doubled.

Land Acquisition Procedures

16.2 The present land acquisition policies leave too little flexibility in the hands of the Service. I recommend that an acquisition plan be prepared, that the Land Commission (or whichever land-restructuring agency takes its place) be depended upon to ensure that acquisition by the Forest and Wildlife Service is not inconsistent with agricultural policy, and that a small overview committee, chaired by an individual nominated by the Department of Finance, be set up to establish and monitor land acquisition procedures. Within this context an annual land

acquisition budget should be established, and the Forest and Wildlife Service should be free to spend this money as it sees fit. A total annual budget of £1.5 million (1978£) is recommended.

Wood Marketing

16.3 About 85% of the Forest and Wildlife Service's wood is sold standing; most of the sales are by sealed tender. This system maximises competition, but, since it does not permit reaction bids, planning an orderly and least cost wood intake by mills is difficult. I suggest that up to one-third of the pulpwood using industries' intake be on the basis of a negotiated price for wood delivered to mill. For the non-negotiated sales, those that are deemed likely to be competitive should be sold by oral auction, with the balance disposed of through wholesale log markets. The present piece-work system of harvesting, loading and transporting wood should be maintained, but it should be supplemented by a good user oriented back-up research and development service.

Employment Policy

16.4 The Forest and Wildlife Service should continue its policy of using financial efficiency criteria in its personnel hiring, unless there is a government-wide decision to adopt an alternative policy.

Private Forestry

The Existing Estate

16.5 There are 203,000 acres of privately-owned forest. However, 82,000 acres are classified as scrub. Of the remaining high forest area, 69% is hardwood, with the balance comprised of coniferous woodland; 45% of the total high forest area is more than 70-years old, while only 8% falls in the 1-10 year age class. The age structure accounts for the fact that the annual wood volume growth (increment) is very low, amounting to less than 2% of standing volume.

Existing Incentives

16.6 Government involvement is effected primarily through incentives and regulation. The incentives consist of free advice to owners and a planting grant; the latter now amounts to £50 per acre payable on satisfactory crop establishment, with two additional £20

payments being made five and ten years later. With a few minor exceptions, a felling permit must be secured before tree cutting on private land can take place legally. Silvicultural criteria are used to evaluate applications. Permission to fell may be granted, refused, or granted with conditions, such as a replanting requirement.

Measures to Increase Output

16.7 The underlying theme is that forestry should qualify with agriculture on an equal footing for all non-price support subsidies, and that they should be treated equally for tax purposes. It is recommended that policies should be directed towards increasing the annual harvest rate from 1.6% to 3.0% of standing volume, i.e., from 70,000 M^3 to 132,000 M^3; this higher output level can be sustained, and would increase net owner incomes by about £1.25 million. To achieve this, information on standing timber volume and value, implications for taxation, and evaluations of timber merchants should be available. In addition, information on various selection felling and management methods which are not destructive of wildlife or other amenity values, and which enhance the long-term productivity of the stand, should also be readily available to owners. All of this effort should be closely co-ordinated with and proceed in tandem with the Forest and Wildlife Service's programmes for establishing nature reserves and wildlife refuges, protecting wildlife etc. It is also recommended that a 5-year grant be given to the Irish Timber Growers' Association to get such a programme under way, this to be complemented by an expansion of the research and dissemination efforts of the Forest and Wildlife Service in this area.

Taxation

16.8 No adjustment specific to forestry is required for rates. Income from forestry should be taxed in the same manner as farming income, but with some provision for averaging the income over a number of years when the receipts are periodic. For liability under the Capital Acquisitions Tax, the present net worth of the land under the most financially efficient silvicultural system should be used for capital valuation purposes, regardless as to whether it is a newly established or a mature plantation. This will assure neutrality *vis-à-vis* forestry and annually harvested crops.

Scrub Clearance and Replanting

16.9 In line with the principle of parity among forestry and agricultural incentives, it is suggested that the scrub clearance grant for forestry be £50 per acre (the present grant ceiling) *or* 40%-50% of total costs (the agricultural scrub clearance grant rate).

The Tree Felling Permit System

16.10 It is suggested that a working party be set up, which includes some agricultural representation, to develop a set of *publicly available* criteria for deciding on tree felling requests, and the conditions to be appended in given circumstances.

Forest Industry

Present State of the Industry

16.11 The services provided to forest industry comprise the weakest element in present State forest policies, although a belated *ad hoc* State involvement in downstream industries is now being undertaken in response to the severe difficulties currently being experienced by the Irish pulpwood using firms.

The Changes Required

16.12 The present cottage industry type of wood processing structure will need to be transformed to a fully integrated, horizontally and vertically export oriented complex. This change is required because substantial economies in both production and marketing can be achieved by doing so, and will be facilitated by the large volume of wood now becoming available. Since the infant Irish forest products industry will of necessity have to export 50% or more of its output into the highly competitive world market, advantage of every net cost-saving and/or value enhancing opportunity must be taken, if the industry is to prosper.

Forest Products Development Board

16.13 To effect this transition, I recommend that a Forest Products Development Board (FPDB) be established, with responsibility to (a) conduct wood product research and development work, (b) identify and

service product markets, (c) develop a long-range plan for wood utilisation, and (d) implement the plan, including, if necessary, investing, either alone or in partnership, in processing capacity. While the Forest Products Development Board will probably have a stake in some of the processing capacity, it is envisaged that there will also be a substantial private sector processing effort, supported by the product and market development work of the FPDB. The processing units without State equity should not be discriminated against when wood allocations etc. are being made.

Amenity Policy

The Existing System

16.14 Beginning in 1970, the Forest and Wildlife Service began to substantially expand its provision of amenity services. Six major forest parks have been developed which are designed to accommodate primarily the general recreationist. The number of park visits increased from 350,000 in 1972 to 550,000 in 1976. A comprehensive set of well patronised trails and picnic facilities has also been developed. In 1977 the Wildlife Act was enacted. This gives the Minister, acting through the Service, substantial powers to protect individual species, to establish nature reserves and wildlife refuges, and to regulate hunting.

Recommendations

16.15 The following steps are recommended: (a) The development of a programme of action outlining needs, opportunities and procedures in the conservation area. A separate budget, with a clearly identified land acquisition component, should be prepared and published annually. An interdepartmental committee embracing personnel from the Forest and Wildlife Service, the Parks and Monuments Branch of the Office of Public Works, and perhaps An Foras Forbartha and An Taisce should be formed to co-ordinate and plan the national effort in this area. (b) A similar nation-wide planning-co-ordinating unit concerned with outdoor recreation should be established. (c) Where it is feasible and financially worthwhile to do so, a charge sufficient to cover at least variable (mainly operating and some maintenance) costs should be imposed for amenity services.

Wood for Electricity Generation

16.16 It was estimated that 1 M^3 of wood could be used to generate 713 kilowatt hours of electricity, and that 0.5 million M^3 of wood could meet 5.2% of total current consumption. Due to the absence of processing capacity, a substantial pulpwood surplus is expected to exist for the next decade. It is therefore recommended that the small-scale biomass conversion pilot projects already underway with the ESB, the National Board of Science and Technology and the Agricultural Institute, be expanded, and that the work be accelerated.

B EXTENDING THE FOREST ESTATE

State Forestry

Cutaway Bogs for Forestry Use

16.17 The primary issue involved in extending the State forest area is land acquisition which has already been discussed. The second main issue relates to cutaway bogs. Bord na Móna is developing, or planning to develop, 71,000 hectares (175,000 acres) of bogland for fuel production. Once fuel harvesting on this area is complete, the cut-over area will be available for agricultural or forest crop production. At Trench 14 at Clonsast bog, County Offaly, experimental tree planting was initiated in 1955; replicated trials indicate that this cutaway site can support Sitka spruce of Yield Class 26 (produces an average of 26 M^3/Ha/Yr.). Using present costs and prices, and reducing production to Yield Class 22 to adjust for production and area losses, afforestation shows a real net rate of return of 10.7%. If the entire 175,000 acres of State owned cutaway bog were afforested, and the Clonsast production, costs and revenues are typical, it was estimated that these woodlands would show a real rate of return in excess of 10%, and employ 438 persons in the forest and 3,319 persons in wood harvesting, transport and processing for a total long-term sustained employment of 3,757. It is recommended that the NESC commission

an independent study to clarify the policy options *vis-á-vis* financial efficiency, employment, community stability, etc. involved in the utilisation of the State cutaway bogs.

Private Forestry

Scheme for Afforesting Drumlin Soils

16.18 The most promising investment opportunities for tree growing are found on the one million hectares of drumlin and related soils in Leitrim, Monaghan, Cavan, Longford, Roscommon, West Limerick, North Kerry and Clare. A careful analysis of six sites in Leitrim indicated that, using present costs and wood prices, real internal rates of return in the range of 9 to 10.5% can be expected from tree farming on the drumlin soils. A land-owner who plants 21 adjusted acres of Yield Class 24 land in three-acre annual increments over a period of seven years can, if he tree farms on a 30-year rotation, expect the annual return to his labour to increase from £180 in year 12 (first thinning) to £7,000-£9,000 in years 30-36 (clear-felling), assuming that he harvests the wood himself. Since the labour requirement of such a programme is quite modest, this land-use option should be of particular interest to young land-owners who have off-farm employment, and to farmers who have land which is not essential to the success of their farming enterprise, e.g., pig farmers.

16.19 The annual equivalent is defined as the amount which an investor could afford to pay annually in real terms for the use of the land for tree-growing over the rotation, and still cover all costs, including interest charges. Two types of annual equivalent can be identified: gross annual equivalent, wherein all of the crop establishment and management costs are undertaken by the landowner, and net annual equivalent, wherein all of the costs are incurred by the investor. Gross annual equivalent is of interest because the planting grant (£50 payable on crop establishment) almost covers all non-labour costs involved in crop establishment, while the two £20 follow-up payments more than cover subsequent non-labour management costs. It has been estimated that 71% of County Leitrim's land falls in the productivity range of Yield Class 26-30 for tree

growing; this county is probably representative of the drumlin area as a whole. The spread of gross and net annual equivalent returns per adjusted acre at real (net of inflation) interest rates of 4% and 7% are presented below:

Yield Class	Interest Rate	Annual Equivalent (£)	
		Gross	Net
26	4	66	54
	7	40	25
20	4	45	31
	7	24	7

16.20 On Yield Class 26 sites, land-owners could be paid £40-£66 per acre in real terms for allowing the investor to use their land for tree growing if the owners incurred the establishment and management costs. If the investor pays for all of these costs, then the payments to the land-owner could fall in the £25-£54 range. In each case the payments could be price indexed to keep pace with inflation. From the Agricultural Institute's Farm Management Surveys, we find that the average returns per adjusted care to agriculture on drumlin and related soils in 1976 and 1977 were as follows:

Per Acre	1976	1977
Average Family Farm Income(£)	58.3	37.5
Average Management and Investment Income (£)	-19.7	-24.4

16.21 Family farm income is roughly comparable to gross annual equivalent, while net annual equivalent corresponds to management and investment income. Even allowing for the fact that net agricultural incomes could be substantially increased on many farms by better

management, it appears that many land-owners could increase net returns substantially by turning to tree farming.

Information, Advice and Research

16.22 Up-to-date information needs to be available to land-owners regarding all of the tree farming options available, and the costs and revenues involved. Education programmes designed to help break down the antipathy of landowners to tree farming need to be developed, while training programmes and certification in tree planting, management, and harvesting techniques for landowners, agricultural instructors etc. should also be provided. A research programme oriented to the needs of the tree-farmer should be mounted.

Financing

16.23 Financing the rental payments to landowners for the right to grow trees on their land gives rise to problems; almost regardless of the overall attractiveness of the rate of return, financial institutions are not at present geared to handle the payout period of 15-20 years during which the rental would have to be paid without any significant revenue accruing. However, this problem could be handled by financing the early payments with a European Investment Bank loan, repayable out of the timber harvest proceeds. There are a number of existing EEC programmes which are of interest *vis-à-vis* the encouragement of tree-farming in Ireland. For example, Directive 160 provides for the payment of an annuity, subject to certain conditions, to farmers who are at least 55 years old, who release at least 85% of their farm to development farmers or whose land is "withdrawn from agricultural use permanently, in particular by being allocated for afforestation, recreational activities, public health or other public purposes". Therefore a farmer renting his land for tree growing could also qualify for the annuity, which now amounts to £960 (married) and £660 (single). It is recommended that a continuous effort be made to identify financial resources and to facilitate their utilisation by tree farmers, and that every opportunity be taken to draw on EEC and other programmes which are advantageous to tree farming.

Subsidies and Taxation

16.24 As with the existing private forest estate, it is recommended that tree farming be treated like other farming activities for purposes of input subsidies and taxation.

Tree Farming Development Board

16.25 To implement all of the above, it is recommended that a Tree Farming Development Board be established. This Board would also be responsible for co-ordinating the efforts of the Irish Timber Growers' Association and the co-operatives. An annual tree farming planting goal of 5,000-10,000 acres, with an overall total planting goal of 500,000 acres (about 20% of the total drumlin area) would be appropriate and realisable objectives.

C GENERAL INSTITUTIONAL CONSIDERATIONS

16.26 It has been recommended that both a Forest Products Development Board and a Tree Farming Development Board be established. How should these units be structured, and how should they relate to the Forest and Wildlife Service? To fulfil the rather demanding and pioneering tasks outlined, it is important that these units operate with a maximum of efficiency and flexibility, and be able to react quickly to new opportunities and changing circumstances. At the same time, it is desirable that policies and actions be co-ordinated with those of the Forest and Wildlife Service, and that personnel be able to move from one unit to another with relative ease. This will not be possible if the existing organisational structure is maintained.

16.27 The Forest and Wildlife Service has, like all Civil Service units, a dual management structure, with parallel administrative and technical arms. This two tier system exacerbates the natural "territorial imperative" instincts which are features of all organisations. Whenever new personnel are to be hired, or new initiatives taken, the questions of who will do what, and on which side of the fence the authority will rest, will be recurrent issues. Policy relevant information flows between technical and administrative personnel become unnecessarily

complicated, while routine decision-making is slowed down, since documents, etc., must be checked, signed and counter-signed at both sides of the divide.

16.28 I recommend that the Service adopt a merit oriented, unified management structure, with a single director. The Northern Ireland Forest Service, the Swedish Forest Service and vertically integrated forest industry firms such as Weyerhaeuser (US) and Svenska Cellulosa AB (Sweden) provide useful models in this regard. If successful, this re-orienting would improve the flow of information, speed-up and improve the calibre of decision-making and enhance the flexibility of the Service to adapt to new circumstances. It would also facilitate transfer of personnel between the Service and Boards of Forest Products Development and Tree Farming Development. Thus we might envisage a broad policy-making entity called the Forest Authority, under which serves, at the core, the Forest and Wildlife Service, with its two main thrusts being commercial tree growing and the protection and provision of wildland related wildlife and amenity. Parallel with the Service, under the Authority, would be the Forest Products Development Board and the Tree Farming Development Board. The whole point of this system would be to provide a merit oriented, efficient management system and a well co-ordinated approach to forest use and development.

16.29 After reviewing an earlier draft of this report, a number of knowledgeable commentators observed that the institutional framework proposed — the Forest and Wildlife Service and the two boards, all serving under a Forest Authority — was perhaps over-elaborate and administratively too cumbersome. My view on this matter is that as long as the tasks outlined are accomplished in a cost effective and efficient manner, the precise administrative mechanisms and titles adopted are of little significance. However, whichever structure is chosen should have the following characteristics:

a. It should provide *continuous* attention to the successful development of a forest products industry, and to the carrying out of a substantially expanded tree-farming programme, along the lines indicated in the report.

b. Goals, budgets and responsibilities should be separately identified, so that progress and performance can be evaluated.

c. Personnel mobility among the various units should be facilitated; for management purposes, the distinction between the technical and administrative chains of command in the Forest and Wildlife Service should be eliminated.

16.30 It is always a challenge to identify and implement an organisational system and set of incentives which will provide sufficient autonomy to individual units so that intelligent initiative and innovation are rewarded, while still recognising the crucial interdependencies that exist among units. I believe that the framework which I have suggested provides a promising approach to this issue for the future, while also incorporating the characteristics outlined earlier. However, I recognise that there are alternative structures which also have merit. I hope that my proposals will stimulate debate and study of this important, but usually neglected, issue. A number of alternative models [Northern Ireland Forest Service, Swedish Forest Service, forest owning forest products corporations such as Weyerhaeuser Corporation (US) and Svenska Cellulosa AB (Sweden)] provide interesting bases for comparison.

D PRIORITIES AND COSTS

16.31 The most important short-term priority is to come to grips seriously with the issue of developing a sustainable forest products industry, with all of the ramifications this has for the organisation of the Forest and Wildlife Service itself and the methods by which it sells wood. Next in importance is the setting in train of the mechanisms to facilitate tree farming, where financially and socially appropriate, on the drumlin soils. With regard to State forestry, early attention also needs to be devoted to modifying the land acquisition procedures, while the acceptance of parity with agriculture *vis-à-vis* subsidies and taxation should be an important policy objective for private forestry.

16.32 It is difficult to estimate the costs of these initiatives. Looking at the annual budgets of technical research and development institutes

such as An Foras Forbartha and the Institute for Industrial Research and Standards, it seems that about £1.25 million annually would be sufficient to mount a comprehensive forest products development effort. This does not of course include any investment in downstream processing *per se*. An expanded timber harvesting research, development and service programme would cost a further £0.15 million annually. A tree farming development programme could be financed for about £0.5 million annually; this would pay for service staff and the research programme. Assuming that planting under this scheme reaches 10,000 acres per annum, this would result in average back-up development and service costs per acre of new planting of £25. However, the initial per acre planting grant (£50) must also be paid, together with subsequent follow-up payments. Therefore the total drain on the Exchequer of the tree-farming development programme will probably be about £1.1 million. It is assumed that the financing of rental payments themselves will be done on a commercial basis without any net cost to the Exchequer. However, consideration should be given to having the government perhaps guarantee the exchange risk in the use of EIB loans.

16.33 A further £0.5 million will be required annually for improvements in the land acquisitions programme, while the expanded efforts in recreation and eco-system preservation planning will require an additional £0.15 million annually. The total *additional* estimated gross budgeting requirement then will be as follows:

	Millions of £ (1978)
Forest Products Development Board	1.25
Timber harvesting-research, development and service programme	0.15
Tree Farming Development Board	0.50
Planting Grants	0.60
Land Acquisition by the Forest and Wildlife Service	0.50
Recreation and Eco-system preservation Planning	0.15
Total	3.15

16.34 If all of these costs were added to the Forest and Wildlife Service's budget, the break-even point would be postponed by a few years if there were no compensating financial benefits accruing.

However, the whole point of establishing the Forest Products Development Board and the timber harvesting research programme is to add value to the wood; the cost of these programmes should more than be recovered through increased stumpage prices. Indeed we can turn the question around and ask what will happen if we do not take steps similar to those indicated. Given the world export markets in which most of our forest products — including lumber — will have to compete, unless every feasible step is taken to give the Irish product a competitive edge, the viability of the whole commercial forestry venture will be in jeopardy.

16.35 The rationalisation of the Forest and Wildlife Service's land acquisition and management programme, which should be facilitated by the budgeting increase in this area, should also realise some cost saving, while variable cost pricing in the recreation-amenity area will also reduce the net cost of these programmes. The benefits to the nation of the drumlin tree farming programme are comprised of the net additional income accruing to participating land-owners, together with the net increase in downstream benefits — income, employment etc. The extent to which the exchequer can reclaim some of these benefits will depend on taxation policy. All-in-all, it appears that the net annual cost to the government of the initiatives outlined should not exceed £1.5 million.

E—EMPLOYMENT

16.36 Because of the great uncertainty regarding productivity trends *vis-à-vis* wood use, the range estimate of employment expected to be provided in the forest, in harvesting, transportation and processing in the year 2000 as a result of outputs from the existing forest is rather broad, falling between 7,000-12,000. Tree farmed land with an average Yield Class 24 would produce a net output per hectare per annum of 18 M^3 (7.3 M^3/Ac) after making a 15% reduction for losses due to insects and disease and a further 10% reduction for the conversion from total to adjusted forest acres. Therefore, the sustained yield level of output which 500,000 acres would provide amounts to 3.65 million M^3. Applying the crude average coefficient derived earlier

of 2.5 man years of employment in harvesting, transportation and processing per 1,000 M^3 of wood output, this would provide 9,125 downstream jobs (say in the range of 7,000-11,000 jobs) in addition to the 1,250 (500,000/400) man years of work provided on the land. The rate at which these would come on-stream will depend on the rate of planting; even if a 5,000-10,000 acre programme were initiated beginning in 1980, it would be 40-45 years hence, i.e., 2020-2025, before the full downstream potential would be realised. To the extent that agricultural output was reduced, there would be a corresponding reduction in agriculture-based downstream employment.

16.37 Taking the existing forest based and the tree farm based employment together, we find that by about the year 2025 we would have 15,000-25,000 employed in forest, harvesting, transportation and processing. Applying the one-to-one basic/service job ratio used by the IDA, total forest-based employment then would be in the range of 30,000-50,000, and almost all of this would be in rural areas, much of it in the West. Given the magnitude of the potential social benefits, the relatively modest initiatives required to encourage their realisation appear to be worthwhile.

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APPENDIX TABLES

APPENDIX TABLE 1

Forest Area, Annual Increment and Harvest, EEC, 1974 and Nordic Countries, 1970

Country	Forest Area	Forest as % of total land area	Forest Area per Capita	Annual Total	Net Increment per ha.	Harvest
Unit	1,000 ha.	%	ha.	Million M^3O.B.	M^3O.B.[a]	Million M^3U.B.
Belgium	617	20	0.6	2.6	4.3	2.9[b]
Germany	7,180	29	0.11	34	4.82	27.8
Denmark	473	11	0.09	2.3	5.9	2.2
France	14,000	25	0.26	41.4	3.14	29.8
Great Britain	1,920	8	0.03	5.7	3.49	3.5
Italy	6,210	21	0.11	14	2.12	10.9
Ireland	300	4	0.10	1.8	6.91	0.35
Luxembourg	83	32	0.24	0.4	4.87	—
Netherlands	290	7	0.02	1.2	4.35	0.9
N. Ireland	75	5	0.05	—[c]	—[c]	—[c]
EEC	31,151	20	0.12	103.4	3.5	78.35
Nordic Countries:						
Finland	18,700	74	4.03	55.8	2.98	44.1
Norway	8,300	29	2.23	15.6	1.88	8.7
Sweden	23,500	64	3.04	63.3	2.69	59.1
Nordic Countries	50,500	52	3.14	134.7	2.67	111.9

[a]O.B. is over bark, U.B. is under bark. Bark comprises 10-15% of over bark volume, depending on species etc.

[b]Includes Luxembourg. [c]Included in the total for Great Britain.

Sources: EEC data are from Commission of the European Communities (1976) pp. 12, 14, 25. Scandinavian data are from Economic Commission for Europe (1976) pp. 65, 91.

APPENDIX TABLE 2

Age Class Distribution, State and Private Forests, Coniferous and Broadleaf, 1973, Ireland

Coniferous High Forest

Age Class	State		Private		Total	
	Area Ha.	% of Total	Area Ha.	% of Total	Area Ha.	% of Total
1-10	85,582	40	3,012	20	88,594	38
11-20	77,479	36	2,871	19	80,350	35
21-30	26,665	12	1,629	11	28,294	12
31-40	17,440	8	1,113	7	18,553	8
41-50	7,398	3	771	5	8,169	4
51-60	1,093	1	810	5	1,903	1
61-70	—	—	854	6	854	—
71 +	—	—	4,000	27	4,000	2
Total	215,657	100	15,060	100	230,717	100

Broadleaf High Forest

Age Class	State		Private		Total	
	Area Ha.	% of Total	Area Ha.	% of Total	Area Ha.	% of Total
1-10	3,566	27	156	—	3,722	8
11-20	2,993	23	802	2	3,795	8
21-30	1,258	10	2,398	7	3,656	8
31-40	1,734	13	3,320	10	5,054	11
41-50	435	4	2,538	8	2,973	6
51-60	2,995	23	1,520	5	4,515	10
61-70	—	—	1,524	5	1,524	4
71 +	—	—	20,595	63	20,595	45
Total	12,981	100	32,853	100	45,834	100

APPENDIX TABLE 2—*continued*

Coniferous and Broadleaf High Forest

Age Class	State		Private		Total	
	Area Ha.	% of Total	Area Ha.	% of Total	Area Ha.	% of Total
1-10	89,148	39	3,167	7	92,315	33
11-20	80,472	35	3,672	8	84,144	30
21-30	27,923	12	4,028	8	31,951	12
31-40	19,174	9	4,432	9	23,606	9
41-50	7,833	3	3,309	7	11,142	4
51-60	4,088	2	2,328	5	6,416	2
61-70	—	—	2,377	5	2,377	1
71 +	—	—	24,594	51	24,594	9
Total	228,638	100	47,907	100	276,545	100

Source: Derived from Gallagher and Purcell (1976) p. 11.

APPENDIX TABLE 3

Imports, Exports and Net Imports, Forest Products, Ireland 1977 by Quantity and Value

All Quantities in 000's Metric Tons, all Values in 000's £

	Imports		Exports		Net Imports	
	Quantity	Value	Quantity	Value	Quantity	Value
Div. 24—Wood and Lumber						
Sawlogs and Veneer Logs						
Coniferous	7.3	875	0.8	119	6.5	756
Non-Coniferous	2.6	491	1.1	88	1.5	403
Poles, posts etc.	11.3	1,132	38.5	492	27.2	640
Lumber						
Softwood	195.4	28,804	4.9	866	109.5	27,938
Non-Coniferous	35.3	7,187	4.4	929	30.9	6,258
Railway Sleepers	4.2	380	0.1	4	4.1	376
Fuel Wood and Wood Waste	0.1	8	18.3	122	18.1	−114
Pulpwood	—	—	17.3	92	−17.3	−92
Other	0.2	47	—	4	0.2	43
Total	256.4	38,924	85.4	2,716	171.0	36,208
Div. 25—Pulp and Paper Waste						
Paper Waste and Old Paper	8.6	713	12.0	465	−3.4	248
Mechanical Wood Pulp	0.2	46	27.6	1,930	−27.4	−1,884
Sulphate Wood Pulp	21.0	4,603	0.2	47	20.8	4,556
Sulphite Wood Pulp	3.2	767	—	—	3.2	767
Other	—	—	—	1	—	—
Total	33.0	6,129	39.8	2,443	−6.8	3,687
Div. 63—Wood Manufactures						
Veneer Sheets etc.	1.4	1,284	0.4	404	1.0	880
Plywood, Blockboard etc.	16.0	5,501	0.5	162	15.5	5,339

APPENDIX TABLE 3—*continued*

	Imports		Exports		Net Imports	
	Quantity	Value	Quantity	Value	Quantity	Value
Particle Board (Re-constituted wood) etc.	29.1	4,788	29.9	3,569	0.8	1,219
Builders Woodwork and Prefab.	3.4	2,246	6.2	3,222	2.8	−976
Other	10.9	5,390	2.9	1,034	8.0	4,356
Total	60.8	19,209	39.9	8,391	20.9	10,818
Div. 64—Paper, Paper-board & Manufs.						
Newsprint	45.3	11,046	0.4	84	44.9	10,962
Other Printing & Writing Paper	16.3	8,219	4.6	1,727	11.7	6,492
Kraft Paper	48.6	10,901	3.6	1,065	45.0	9,836
Machine-made Paper and Board	21.5	6,641	7.9	1,414	13.6	5,227
Fibreboard etc.	2.9	600	12.4	1,820	9.5	−1,220
Paper in Rolls and Sheets	54.4	23,008	10.4	7,280	44.0	15,728
Bags, Boxes etc.	18.7	11,313	13.7	5,486	5.0	5,827
Other	15.0	12,885	4.6	4,064	10.4	8,821
Total	222.7	84,613	57.6	22,940	165.1	61,673
Total (Divs. 24, 25, 63, 64)	572.9	148,875	222.7	36,490	350.2	112,386

Source: CSO (1978) pp. 13, 14, 24, 25, 44, 50.

APPENDIX TABLE 4

Annual Net Expenditure, 1923-50, Compounded at 5% to 1975, Forest and Wildlife Service

	Net Expenditure 000s£	Compounding Factor $(1.05)^n$ N = 1975 – A	Compound Amount £
1923	31	12.6	391
1924	31	12.0	372
1925	30	11.5	345
1926	44	10.9	480
1927	52	10.4	541
1928	58	9.9	574
1929	57	9.4	536
1930	60	9.0	540
1931	65	8.6	559
1932	62	8.1	502
1933	71	7.8	554
1934	105	7.4	777
1935	128	7.0	896
1936	149	6.7	998
1937	192	6.4	1,229
1938	181	6.1	1,104
1939	198	5.8	1,148
1940	159	5.5	874
1941	168	5.3	890
1942	206	5.0	1,030
1943	162	4.8	778
1944	137	4.5	616
1945	183	4.3	787
1946	225	4.1	922
1947	334	3.9	1,303
1948	393	3.7	1,454
1949	436	3.6	1,570
1950	674	3.4	2,292
1951	1,066	3.2	3,411
1952	985	3.1	3,054
1953	1,171	2.9	3,396
1954	1,248	2.8	3,497
1955	1,470	2.7	3,969

APPENDIX TABLE 4—*continued*

	Net Expenditure 000s£	Compounding Factor $(1.05)^n$ N = 1975 – A	Compound Amount £
1956	1,648	2.5	4,120
1957	1,775	2.4	4,260
1958	1,764	2.3	4,057
1959	2,083	2.2	4,583
Total	17,801		58,409

Source: Successive Annual Reports of the Minister for Lands *(Forestry and Wildlife Service).*

APPENDIX TABLE 5

Net Expenditure, Area Planted and Employment, Forest and Wildlife Service, 1923-1977

Year	Gross Expenditure £	Net Revenue £	Net Expenditure £	Area Planted		Employment (Direct) Nos. State Forest
				Hectares	Acres	
	(1)	(2)	(3)	(4)	(5)	(6)
1923				475	1,176	
1924				894	2,210	
1925				1,235	3,053	
1926-7				1,176	2,908	
1927-8				1,390	3,436	292
1928				1,395	3,447	331
1929-30				1,242	3,069	411
1930-1				1,442	3,565	462
1931				1,475	3,646	455
1932-3				1,442	3,564	488
1933-4	74,982	4,450	70,532	1,691	4,179	575
1934-5	112,310	6,900	105,410	2,230	5,511	732
1935-6	136,352	8,200	128,152	2,800	6,919	1,057
1936-7	156,785	8,220	148,565	2,962	7,321	1,136
1937-8	200,748	9,150	191,593	2,990	7,389	1,443
1938-9	191,639	10,222	181,417	3,076	7,603	1,499
1939-40	215,382	17,556	197,826	2,758	6,815	1,455
1940-1	204,374	45,102	159,272	2,412	5,961	1,340
1941-2	213,642	45,801	167,841	1,813	4,482	1,823
1942-3	271,874	65,611	206,263	1,747	4,318	1,667
1943-4	231,978	70,200	161,778	1,627	4,022	1,359
1944-5	230,932	94,096	136,886	1,711	4,230	1,412
1945-6	263,926	81,328	182,598	1,456	3,598	1,565
1946-7	320,621	95,780	224,841	1,558	3,850	1,793
1947-8	433,753	99,710	334,043	2,430	6,005	1,936
1948-9	496,761	103,725	393,036	3,130	7,736	1,961
1949-50	540,243	103,761	436,482	2,991	7,393	2,273
1950-1	800,741	126,434	674,307	3,792	9,372	2,734
1951-2	1,258,909	192,929	1,065,980	6,067	14,992	3,420

APPENDIX TABLE 5—*continued*

Year	Gross Expenditure £	Revenue £	Net Expenditure £	Area Planted		Employment (Direct) Nos. State Forest
				Hectares	Acres	
	(1)	(2)	(3)	(4)	(5)	(6)
1952-3	1,163,763	179,151	984,612	5,053	12,488	3,539
1953-4	1,337,326	166,091	1,171,235	5,038	12,449	4,085
1954-5	1,426,060	176,711	1,248,349	5,603	13,845	4,305
1955-6	1,691,230	220,912	1,470,318	6,068	14,996	4,843
1956-7	1,928,261	280,277	1,647,984	7,044	17,407	5,048
1957-8	2,107,011	331,967	1,775,044	8,116	20,056	4,835
1958-9	2,079,991	316,134	1,763,857	9,263	22,891	4,673
1959-60	2,463,700	380,295	2,083,414	10,157	25,100	4,779
1960-1	2,722,538	457,230	2,265,308	10,550	24,069	4,653
1961-2	3,055,161	573,629	2,481,532	10,057	24,851	4,803
1962-3	3,133,196	563,678	2,569,518	9,822	24,271	4,663
1963-4	3,443,984	704,709	2,739,275	10,162	25,109	4,773
1964-5	3,997,623	627,202	3,370,421	9,699	23,967	4,812
1965-6	3,966,976	712,419	3,284,557	9,004	22,249	4,668
1966-7	4,014,645	604,102	3,410,543	7,624	18,838	4,134
1967-8	4,243,394	707,221	3,536,171	8,666	21,414	3,851
1968-9	4,638,835	818,355	3,820,430	8,488	20,974	3,677
1969-70	5,435,602	811,453	4,624,149	8,547	21,120	3,468
1970-1	6,609,570	1,061,170	5,548,400	8,498	20,999	3,382
1971-2	7,243,411	1,218,392	6,025,019	9,522	23,529	3,091
1972-3	7,733,859	1,384,160	6,349,699	9,451	23,354	2,910
1973-4	8,704,702	1,923,283	6,781,419	9,150	22,610	2,811
April-Dec '74	7,608,188	1,905,827	5,702,361	—	—	2,750
1975	12,441,034	2,575,836	9,865,198	8,961	22,143	2,659
1976	14,820,632	3,295,433	11,525,199	8,360	20,658	2,592
1977	16,250,249	4,541,581	11,703,668	8,178	22,208	2,546

Source: Forest and Wildlife Service.

APPENDIX TABLE 6.

Grant-Aided Private Planting and Payments, 1930-1977.

Private Forestry (Planting Grants)						
	Area Planted with Granting Aid					
Year	Hectares	Acres	1st Instalment £	Area Ha.	Acres	Subsequent Instalments £
	(1)	(2)	(3)	(4)	*(5)	**(6)
1930-31	48	120	240	—	—	—
1931	69	171	342	—	—	—
1932-33	50	125	250	—	—	—
1933-34	51	127¾	255	—	—	—
1934-35	51	128¼	256	—	—	—
1935-36	64	158¼	471	—	—	—
1936-37	60	150½	451	43	106¾	107
1937-38	69	172¾	518	73	180¼	180
1938-39	66	165¼	496	35	86¼	86
1939-40	63	157	471	28	68¼	68
1940-41	42	106¼	289	79	196¼	196
1941-42	35	87½	263	95	234¼	234
1942-43	43	106¾	482	81	199½	200
1943-44	158	390½	1,172	90	222½	222
1944-45	48	119	357	93	229¾	230
1945-46	33	83½	418	—	—	—
1946-47	53	132¼	659	31	77	77
1947-48	61	152½	732	26	64¾	65
1948-49	83	205¼	1,012	60	148	148
1949-50	94	233¼	1,064	19	47¼	47
1950-51	42	105¼	508	26	64½	203
1951-52	101	251¾	1,259	40	97¾	470
1952-53	162	401¼	2,006	60	141¼	714
1953-54	152	377½	1,887	84	206½	998
1954-55	185	459¼	2,296	41	100¼	501
1955-56	183	451¼	2,256	122	300¾	1,378
1956-57	256	632	3,160	81	199	995
1957-58	171	424	2,116	161	399	1,811
1958-59	241	597¾	3,012	117	288	1,440
1959-60	523	1,294	11,389	201	496	2,482

APPENDIX TABLE 6—*continued*

Private Forestry (Planting Grants)						
	Area Planted with Granting Aid					
Year	Hectares	Acres	1st Instalment £	Area ha.	Acres	Subsequent Instalments £
1960-61	399	986½	9,419	173	425	2,110
1961-62	432	1,069	10,429	182	449¼	2,239
1962-63	528	1,307	12,864	184	454	2,261
1963-64	368	910	8,816	176	434	2,308
1964-65	418	1,035	10,159	418	1,034	8,249
1965-66	426	1,054	10,338	325	803	7,257
1966-67	248	615	6,125	423	1,045	9,452
1967-68	867	2,142	8,609	506	1,250	12,124
1968-69	709	1,751	7,078	347	858	6,273
1969-70	731	1,806	7,176	333	824	8,023
1970-71	342	847	8,440	411	1,015	9,724
1971-72	383	946	9,441	224	553	5,491
1972-73	301	743	7,588	276	682	6,553
1973-74	246	607	10,603	306	756	7,558
April-Dec 1974	178	439	8,153	332	820	8,165
1975	217	536	10,460	321	793	7,924
1976	199	491	9,630	288	712	7,113
1977	156	385	7,540	311	768	7670

*Areas listed in columns 4 and 5 are areas to which second and third instalment payments apply.

**Payments in Column 6 are second and third instalments paid in respect of earlier plantings.

Source: Forest and Wildlife Service.

APPENDIX TABLE 8

Forest Based Employment, 1977[1]

	Wood Volume[4] 000's M³	Total per 1 000M³ Man-years	M³ per Employee
In Forest			
State	—	3 646[2]	—
Private	—	395[3]	—
Total	—	4 041	—
Harvesting[5]			
Pulpwood	275	500	550
Sawlog	278	327	850
Total	553	827	669
Transportation			
Pulpwood	246	38	6 500
Sawlog	225	35	6 500
Total	471	73	6 500
Processing			
Pulpwood	295	812	363
Sawlog	225	718	313
Total	520	1 530	340
Total (Harvesting Transportation Processing)			
Pulpwood	275	1 350	203
Sawlog	278	1 080	257
In forest	553	2 436	228
Grand Total		6 477	

National Forecast: in 000's M³ of Wood Output from the Forests of the Forest and Wildlife Service

000sM³

	THINNING VOLUME				FELLING VOLUME				TOTAL VOLUMES				
		Sawlog Boxwood				Sawlog Boxwood			Sawlog + Boxwood				Pulp and Residues
Year	Total	Sawlog	Boxwood	Pulp	Total	Sawlog	Boxwood	Pulp	Total	Sawlog	Boxwood	Pulp	
1980	464 21	132 98	288 38	42 85	193 16	46 89	127 73	18 54	657 37	179 87	416 11	61 39	432 03
1981	536 13	167 44	145 69	223 00	226 06	49 83	154 96	21 27	762 19	217 27	300 65	244 27	463 42
1982	598 26	72 23	159 68	366 34	266 03	64 00	173 90	28 04	864 28	136 23	333 58	394 31	549 45
1983	668 86	76 80	176 65	404 41	296 45	64 00	173 90	58 55	965 31	140 80	350 55	473 76	670 96
1984	723 18	81 66	193 21	448 31	302 28	66 56	173 90	61 82	1 025 46	148 22	367 11	535 94	679 58
1985	792 93	85 73	212 12	493 08	293 55	64 00	173 90	55 65	1 086 48	149 73	386 01	591 59	708 79
1986	858 15	88 40	232 09	537 66	303 30	64 00	173 90	65 40	1 161 45	152 40	405 99	653 24	761 02
1987	918 73	91 34	252 64	574 75	367 10	64 00	173 90	129 20	1 285 83	155 34	426 54	703 44	827 92
1988	970 26	95 12	272 47	602 67	374 24	64 00	173 90	136 34	1 344 62	159 12	446 37	739 01	893 48
1989	1 028 88	102 19	295 31	631 37	415 91	64 00	173 90	178 01	1 443 79	166 19	469 21	809 38	938 54
1990	1 082 46	108 37	317 40	656 67	540 73	64 00	173 90	302 83	1 623 19	172 37	491 30	959 21	1 000 50
1991	1 135 74	115 85	338 65	681 23	407 64	64 00	173 90	169 74	1 543 38	179 85	512 55	830 88	982 67
1992	1 200 38	133 10	379 46	727 81	575 96	64 00	173 90	338 06	1 816 33	197 10	553 36	1 065 94	1 126 09
1993	1 261 05	142 81	399 56	748 59	816 72	64 00	173 90	578 82	2 107 77	206 81	573 46	1 327 76	1 261 52
1994	1 290 10	142 81	399 56	748 59	540 01	64 00	173 90	302 11	1 830 11	206 81	573 46	1 050 70	1 248 72
1995	1 343 87	153 71	419 38	770 78	747 14	64 00	173 90	509 24	2 082 60	217 71	593 28	1 279 94	1 212 00
1996	1 396 86	164 29	439 86	792 71	539 80	64 00	173 90	301 90	1 936 66	228 29	613 76	1 094 65	1 282 42
1997	1 442 97	172 36	454 19	816 42	823 42	64 00	173 90	585 52	2 266 39	236 36	628 09	1 401 17	1 337 81
1998	1 413 31	178 39	466 02	829 90	703 97	64 00	173 90	466 07	2 117 28	242 39	639 92	1 296 07	1 464 68
1999	1 498 83	186 57	476 58	836 68	789 47	64 00	173 90	551 57	2 288 30	250 57	650 48	1 388 25	1 573 30
2000	1 525 72	193 17	488 63	844 52	1 500 06	64 00	173 90	1 262 16	3 025 78	257 17	662 53	2 106 68	2 051 43
2001	1 543 07	198 91	495 67	848 50	1 440 75	64 00	173 90	1 202 85	2 983 82	262 91	669 57	2 051 35	2 014 31
2002	1 564 78	202 41	500 59	851 78	1 494 80	64 00	173 90	1 256 90	3 059 58	266 41	674 49	2 108 68	2 067 99
2003	1 563 46	207 32	503 79	852 35	1 505 95	64 00	173 90	1 268 05	3 069 41	271 32	677 69	2 120 40	2 077 32
2004	1 585 46	212 89	516 92	861 65	2 112 25	64 00	173 90	1 874 35	3 697 71	276 89	690 82	2 736 00	2 341 87
2005	1 563 46	207 32	503 79	852 35	1 505 95	64 00	173 90	1 268 05	3 069 41	271 32	677 69	2 120 40	2 077 32
2006	1 616 33	229 93	526 71	887 69	1 984 47	64 00	173 90	1 746 57	3 601 80	293 93	700 61	2 634 26	2 542 02
2007	1 676 19	244 37	542 59	887 43	2 313 39	64 00	173 90	2 075 49	3 989 62	308 37	716 49	2 962 92	2 942 59
2008	1 676 19	244 37	542 59	887 43	2 313 39	64 00	173 90	2 075 49	3 989 62	308 37	716 49	2 962 92	2 942 59
2009	1 656 21	241 50	535 61	889 03	2 285 85	64 00	173 90	2 047 95	3 942 07	305 50	709 51	2 936 98	2 915 86
2010	1 656 21	241 50	535 61	889 03	2 285 85	64 00	173 90	2 047 95	3 942 07	305 50	709 51	2 936 98	2 915 86
2011	1 661 99	237 79	533 21	891 08	2 276 20	64 00	173 90	2 038 30	3 938 19	301 79	707 11	2 929 38	2 915 86
2012	1 644 47	235 25	531 51	887 56	2 332 03	64 00	173 90	2 094 13	3 976 50	299 25	705 41	2 983 69	2 915 86
2013	1 615 33	229 93	526 71	887 69	1 984 47	64 00	173 90	1 746 57	3 601 80	293 93	700 61	2 634 26	2 542 02
2014	1 616 43	229 99	522 09	870 35	1 964 40	64 00	173 90	1 726 50	3 580 83	293 99	696 00	2 597 85	2 523 45
2015	1 602 81	219 43	518 06	866 33	2 173 33	64 00	173 90	1 935 43	3 776 14	283 43	691 96	2 801 76	2 684 28
2016	1 584 46	212 89	516 92	861 65	2 112 25	64 00	173 90	1 874 35	3 697 09	276 89	690 82	2 736 00	2 608 56
2017	1 563 46	207 32	503 79	852 35	1 505 95	64 00	173 90	1 268 05	3 069 41	271 32	677 69	2 120 40	2 077 32
2018	1 564 78	202 41	500 59	851 78	1 494 80	64 00	173 90	1 256 90	3 059 58	266 41	674 49	2 108 68	2 067 99
2019	1 543 07	198 91	495 67	848 50	1 430 75	64 00	173 90	1 192 85	2 973 82	262 91	669 57	2 041 35	2 014 31
2020	1 525 72	193 17	488 63	844 52	1 500 06	64 00	173 90	1 262 16	3 025 78	257 17	662 53	2 106 68	2 051 43
2021	1 498 83	186 57	476 58	836 68	789 47	64 00	173 90	551 57	2 288 30	250 57	650 48	1 388 25	1 573 30
2022	1 413 31	178 39	466 02	829 90	703 97	64 00	173 90	466 07	2 117 28	242 39	639 92	1 296 07	1 464 68
2023	1 442 97	172 36	454 19	816 42	823 42	64 00	173 90	585 52	2 266 39	236 36	628 09	1 401 17	1 337 81
2024	1 396 86	164 29	439 86	792 71	539 80	64 00	173 90	301 90	1 936 66	228 29	613 76	1 094 65	1 282 42
2025	1 343 87	153 71	419 38	770 78	747 14	64 00	173 90	509 24	2 082 60	217 71	593 28	1 279 94	1 212 00
2026	1 290 10	142 81	399 56	748 59	540 01	64 00	173 90	301 11	1 830 11	206 81	573 46	1 050 70	1 248 72
2027	1 240 38	133 10	379 46	727 81	575 96	64 00	173 90	338 06	1 816 33	197 10	553 36	1 066 87	1 126 09
2028	1 165 78	123 59	359 27	702 92	553 82	64 00	173 90	315 92	1 719 60	187 59	533 17	1 018 84	1 009 28
2029	1 156 74	115 85	338 65	681 23	407 64	64 00	173 90	169 74	1 564 38	179 85	512 55	850 97	982 67
2030	1 082 46	108 37	317 40	656 67	540 73	64 00	173 90	302 83	1 623 19	172 37	491 30	959 50	1 000 50
2031	1 078 88	102 19	295 31	631 37	415 91	64 00	173 90	178 01	1 494 79	166 19	469 21	809 38	938 54
1998	970 26	95 12	272 47	602 67	374 24	64 00	173 90	136 34	1 344 62	159 12	446 37	739 01	893 48
1997	918 73	91 34	252 64	574 75	367 10	64 00	173 90	129 20	1 285 83	155 34	426 54	703 44	827 92
1996	858 15	88 40	232 09	537 66	303 30	64 00	173 90	65 40	1 161 45	152 40	405 99	653 24	761 02
1995	792 93	85 73	212 12	493 08	293 55	64 00	173 90	55 65	1 086 48	149 73	386 01	591 59	708 79
1994	723 18	81 66	193 21	448 31	302 28	66 56	173 90	61 82	1 025 46	148 22	367 11	535 94	679 58
1993	668 86	76 80	176 65	404 41	296 45	64 00	173 90	58 55	965 31	140 80	350 55	473 76	670 96
1992	598 26	72 23	159 68	366 34	266 03	64 00	173 90	28 04	864 28	136 23	333 58	394 38	549 45
1991	536 13	67 44	145 69	323 01	226 06	49 83	154 96	21 27	762 19	117 27	300 65	244 27	463 42
1990	464 21	62 85	132 98	288 38	193 16	46 89	127 73	18 54	657 37	109 74	260 71	206 92	432 03
1989	429 06	56 95	122 17	257 92	132 76	46 89	127 73	18 54	561 82	103 84	249 90	276 46	381 74

Source: Forest and Wildlife Service — See assumptions listed in Table 5

[1]Total roundwood — [2]Residue volume is estimated as 33% of Sawlog + Boxwood Volume

[1] Some data are for 1976.

[2] Comprised of 2,546 workers in-forest and 1,100 administrative staff.

[3] Assuming that there is one person employed full-time per 300 acres of high forest. The employment rate on State forests is one person per 269 acres of forest.

[4] The volume harvested represents the actual cut. The volume transported represents the roundwood transported to mills in the Republic. The difference is accounted for by exports and roundwood uses. The volume processed includes (in the pulpwood case) the wood residues.

[5] The harvest data is comprised of State sales of sawlog (228,000 M^3) and pulpwood (255,000 M^3) together with 50,000M^2 and 20,000M^3 of sawlog and pulpwood respectively cut from private lands.

Sources: The State production and employment data come from Forest and Wildlife Service (1977). The productivity in harvesting and transport is estimated from timber merchants. The data on wood-use and employment in pulpwood processing was provided by the firms themselves. The estimate of wood use and employment in sawmilling is taken from IIRS (1978).

APPENDIX TABLE 9.

Revenues and Costs, Total and per Acre, Site No. 4. Yield Class 24, 1978 Prices (£), Area 24 acres.

	Total (£)			Per Acre (£)		
Year	Revenues	Costs	Cash Flow	Revenues	Costs	Cash Flow
0		3,000	−3,000		125	−125
1		64	−64		3	−3
2		131	−131		5	−5
3-7		64	−64		3	−3
8		171	−171		7	−7
9		64	−64		3	−3
10		144	−144		6	−6
11-12		64	−64		3	−3
13		265	−265		11	−11
14		502	−502		21	−21
15	1,791	514	1,277	75	21	54
16		136	−136		6	−6
17-18		64	−64		3	−3
19		96	−96		4	−4
20	4,071	637	3,434	170	27	143
21		136	−136		6	−6
22-23		64	−64		3	−3
24		154	−154		6	−6
25	5,597	491	5,106	233	20	213
26		136	−136		6	−6
27-28		64	−64		3	−3
29		96	−96		4	−4
30	8,228	406	7,822	343	17	326
31-33		64	−64		3	−3
34		96	−96		4	−4
35	72,351	364	71,987	3,015	15	3,000
Total	92,038	8,633	83,405		360	3,475

Note: Numbers may not sum to totals shown because of variance due to rounding.

Source: Forest and Wildlife Service.

APPENDIX TABLE 10.

Family Farm and Management and Investment Income, Connacht and Ulster, 1976, 1977, per Adjusted Acre.

	Connacht				Ulster			
	Avg Fam. Farm Income (£)		Avg. Mgt. and Invest. Income (£)		Avg. Fam. Farm Income (£)		Avg. Mgt. and Invest Income (£)	
	per adjusted Ac.				per adjusted Ac.			
	1976	1977	1976	1977	1976	1977	1976	1977
All Farms								
Soil Group 2 (includes gleys)	63 8	55.6	5 0	- 10.8	54.3	65.4	–18.4	-9.8
System of Farming								
Mainly Creamery Milk	96.7	75 5	25 5	11.2	53.5	79.5	-33.8	- 1.5
Creamery Milk & Tillage	132 2	90.1	38 5	14 5	101.3	53.1	47.2	-0.4
Creamery Milk & Pigs	45 5	73.7	8.1	18.7	88.8	111.3	20.2	34.4
Liquid Milk	—	—	—	—	—	—	—	—
Mainly Drystock	51 0	55 1	0 2	7.0	40.3	33.3	- 19.8	34.9
Drystock & Tillage	95.5	74 8	50 3	20.1	91.7	47.3	35.3	8.3
Hill Sheep & Cattle	26.9	23 3	27 8	-29.0	20.1	16.3	–13.4	27 0
By Size (Acs.)								
5- 15	74 0	53 8	7.5	36.3	52.3	45.3	51.1	62 7
15–30	52.2	57.5	5 8	- 7.9	50.1	56.0	- 21.8	- 20 9
30–50	53 8	53 7	6.7	2.0	59.7	65.8	7.6	8.1
50–100	41.1	46.9	10.1	12.3	43.5	45.4	14.4	12.6
100–200	32 1	36.9	9.8	13.7	43.7	24.7	22 4	- 1.7
200 +	30.1	21 6	- 4.2	–14.7	12.4	13.2	4.5	3.8
All sizes	54 5	53.3	0	– 7.2	50.9	51.6	- 14.6	- 18.6

APPENDIX TABLE 10—*continued*

	Connacht				Ulster			
	Avg. Fam. Farm Income (£)		Avg Mgt. and Invest Income (£)		Avg. Fam. Farm Income (£)		Avg. Mgt. and Invest Income (£)	
	per adjusted Ac				per adjusted Ac.			
	1976	1977	1976	1977	1976	1977	1976	1977
Full Time Farms								
Soil Group 2	58.3	37 5	14 2	- 24.4	67 8	76.8	2.9	3.0
System of Farming								
Mainly Creamery Milk	74 6	77.3	- 12 2	7.8	60 6	79.2	- 4.6	9.5
Creamery Milk & Tillage	132.2	90.1	38.5	14.5	101.3	53.1	47.2	0 4
Creamery Milk & Pigs	45.5	73.7	- 8 1	18 7	81.3	102.8	22.8	37.9
Liquid Milk	—	—	—	—	—	—	—	—
Mainly Drystock	50 2	52 5	5 8	21 8	52 7	46.9	13.7	40.7
Drystock & Tillage	97 7	74 4	49 3	17 2	95 1	47.0	38.8	2.1
Hill Sheep & Cattle	34.7	31 8	53 6	71 5	19 6	15 5	- 19.3	28.1
By Size								
5–15	—	—	—	—	—	—	—	—
15–30	61.1	64 3	19 7	25 3	70 8	61.1	- 27.1	- 40.0
30–50	64 0	59 2	3 8	6 7	67 8	71 3	10 4	6 1
50–100	47 9	53 1	12 7	12 9	44 8	49 5	13 0	13 4
100–200	35 0	36 7	11 1	12 2	52 7	25 0	28 0	3 7
200 +	34 0	17 9	1 6	20 8	13 4	14 8	5 3	4 5
All sizes	57 7	57 0	8 8	18 1	59 3	48 9	2 5	18 4

Source: Farm Management Survey, 1976 and 1977, An Foras Taluntais, Dublin.

APPENDIX TABLE 11.

Revenue Generated by Planting 21 Acres of Y.C., 24 Sitka Spruce in 3 acre Annual Increments. 29 Year Rotation

		Thinning		Clear Felling		Revenue		
Year	Planting	Area	Volume[1] (M^3)	Area	Volume (M^3)	Stumpage	Return to Labour in Harvesting[2]	Total
0	1a, 1b, 1c							
1	2a, 2b, 2c							
2	3a, 3b, 3c							
3	4a, 4b, 4c							
4	5a, 5b, 5c							
5	6a, 6b, 6c							
6	7a, 7b, 7c							
7								
8								
9								
10								
11		1a, 1b, 1c	3 × 6.7[3]=20			3 × 20=60	6 × 20=120	180
12		2a, 2b, 2c	3 × 6.7=20			"	"	180
13		1a, 1b, 1c 3a, 3b, 3c	20+20=40			3.5 × 40=140	6 × 40=240	380
14		2a, 2b, 2c, 4a, 4b, 4c	20+20=40			"	"	380
15		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c	3 × 10.8[4]=32+20+20=72			4 × 72=288	5 × 72=360	648
16		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c	32+20+20=72			"	"	648
17		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c	32+32+20+20=104			5 × 104=524	5 × 104=524	1,048
18		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c	32+32+20=84			5 × 84=420	5 × 84=420	840
19		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c	32+32+32+20=116			5 × 116=580	5 × 116=580	1,160
20		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c	32+32+32=96			5.5 × 96=528	5 × 96=480	1,008
21		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c	32+32+32+32=128			5.5 × 128=704	5 × 128=640	1,344
22		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c	96			528	480	1,008
23		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c	128			6 × 128=768	4 × 128=512	1,280
24		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c	96			8 × 96=768	4 × 96=384	1,152
25		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c	128			10 × 128=1280	4 × 128=512	1,792

APPENDIX TABLE 11—*continued*

		Thinning		Clear Felling		Revenue		
Year	Planting	Area	Volume[1] (M^3)	Area	Volume (M^3)	Stumpage	Return to Labour in Harvesting	Total
26		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c 96				12 × 96=1152	4 × 96=384	1,536
27		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c 128				12 × 128=1792	3 × 96=288	2,080
28		2a, 2b, 2c, 4a, 4b, 4c, 6a, 6b, 6c 96				14 × 96=1344	3 × 96=288	1,632
29		1a, 1b, 1c, 3a, 3b, 3c, 5a, 5b, 5c, 7a, 7b, 7c 128		1a, 1b, 1c	3 × 115=345	17 × 473=8041	2 × 473=946	8,987
30	1a, 1b, 1c			2a, 2b, 2c	345	17 × 345=5865	2 × 345=690	6,555
31	2a, 2b, 2c			3a, 3b, 3c	345	5865	690	6,555
32	3a, 3b, 3c			4a, 4b, 4c	345	5865	690	6,555
33	4a, 4b, 4c			5a, 5b, 5c	345	5865	690	6,555
34	5a, 5b, 5c			6a, 6b, 6c	345	5865	690	6,555
35	6a, 6b, 6c			7a, 7b, 7c	345	5865	690	6,555
36	7a, 7b, 7c							
37								
38								
39								
40		1a, 1b, 1c 20						180
41		2a, 2b, 2c 20						180
42		1a, 1b, 1c, 3a, 3b, 3c 40						380

[1]Full stocking reduced by 15% for losses due to fire, insects, disease, windblow, etc.

[2]Total harvesting cost less cost of equipment depreciation, maintenance and materials.

[3]From yield tables, 39M³/Ha taken out in 2 instalments (years 12 and 14) = 19.5/Ha/thinning = 7.89/Ac/thinning = 6.7/Ac thinning after 15% reduction for losses.

[4]From yield tables, 252M³ Ha taken out in 8 instalments (years 16 to 30) = 31.5/Ha/thinning = 12.75 /Ac/thinning = 10.8/Ac thinning after 15% reduction for losses.

Sources: Volumes are from Table 1; prices are interpolations of Forest and Wildlife Service prices for 1977. Returns to labour in harvesting are estimated from Appendix Table 14.

APPENDIX TABLE 12

Felling and Extraction Costs per M³, Co. Leitrim, 1977.

Thinning (Yr)	Harvest Costs/M³									
	Felling			Extraction[1]						
	Costs M³ (£)			Cost per M³ per 100 Metres	Costs M³ (£)			Total M³ (£)		
	hrs M³	Chainsaw[2]	Labour	Total	Tractor[3]	Labour	Total	Equipment	Labour	Total
1st	2	0.62	4.88	5.50	2	0.75	2.25	3	1.37	7.13	8.50
2nd	2	0.62	3.78	4.40	2	0.75	2.25	3	1.37	6.03	7.40
3rd	1.75	0.54	2.76	3.30	1.75	0.75	1.87	2.62	1.29	4.63	5.92
4th	1.25	0.39	2.21	2.60	1.50	0.75	1.5	2.25	1.14	3.71	4.84
Clearfell	1.00	0.31	0.99	1.30	1.00	0.75	0.75	1.50	1.06	1.74	2.80

[1] Assumed that the average haulage distance is 150 metres

[2] Includes non labour costs of ¥. Total tractor costs including fuel maintenance operating labour £4.00/hr

Operator cost £2.50/hr Depreciation fuel maintenance etc £1.50/hr

Tractor takes out 2M³/hr Tractor costs M³ 1.75/hr operator and £0.75 for depreciation etc. for a total of £2

[3] Hourly cost of chainsaw £0.31

Source Work Study Section, Forest and Wildlife Service

APPENDIX TABLE 13.

Employment Generated per Acre In-Forest as a result of Planning 27 Acres in Co. Leitrim, 1978, NCF Case Study No. 2 (Yield Class 22).

Year		Employment/Acre	
		Man Hours	Man Years[1]
0	Clear some furze plough drain fence plant and manure	20	0.013
1		8	0.005
2	Beating up (replacing failed trees) trample grass	2	0.0013
3-7		1	0.0006
8	Fence repairs	1	0.0006
9		–	–
10	Brush paths	2	0.0013
11		–	–
12	Road formation, gravelling	4	0.0026
13-14		–	–
15	Measure thinnings, treat stumps	4	0.0026
16	Repair drains	2	0.0013
17-18		–	–
19	Grade road surface, repair drains	1	–
20	Measure thinnings, treat stumps	7	0.0047
21	Repair drains	2	0.0013
22-23		–	–
24	Grade road, repair drains	1	–
25	Measure thinnings, treat sumps	6	0.004
26	Repair drains	2	0.0013
27-28		–	–
29	Grade road, repair drains	1	–
30	Measure thinnings, treat stumps	4	0.0026
31	Repair drains	2	0.0013
32-33		–	–
34	Grade road, repair drains	1	–
35	Measure thinnings, treat stumps	3	0.002
36	Repair drains	2	0.0013
37-38		–	–
39	Grade road, repair drains	1	–
40	Measure clearfell, treat stumps	5	0.003

[1] Based on an effective working year of 1500 hours

Source Work Study Section, Forest and Wildlife Service

APPENDIX TABLE 14.

In-Forest and Harvesting Employment Generated by Afforesting 21 Acres of Gley Soil (Co. Leitrim, Site No. 2) in 3 Acre Annual Increments, Man Years.

Area Year	1a, b, c	2a, b, c	3a, b, c	4a, b, c	5a, b, c	6a, b, c	7a, b, c	Total	Harvesting	Total
0	0.039							0.039	—	0.039
1	0.015	0.039						0.054	—	0.054
2	0.0039	0.015	0.039					0.0579	—	0.058
3	—	0.039	0.015	0.039				0.0579	—	0.058
4	—	—	0.0039	0.015	0.039			0.0579	—	0.058
5	—	—	—	0.0039	0.015	0.039		0.0579	—	0.058
6	—	—	—	—	0.0039	0.015	0.039	0.0579	—	0.058
7	—	—	—	—	—	0.0039	0.015	0.0189	—	0.019
8	0.018	—	—	—	—	—	0.0039	0.0219	—	0.022
9	—	0.018	—	—	—	—	—	0.018	—	0.018
10	0.0039	—	0.018	—	—	—	—	0.0219	—	0.022
11	0.0078	0.0039	—	0.018	—	—	—	0.0297	0.015	0.045
12	0.0078	0.0078	0.0039	—	0.018	—	—	0.0375	0.015	0.052
13	0.0039	0.0078	0.0078	0.0039	—	0.018	—	0.0414	0.03	0.071
14	0.0078	0.0039	0.0078	0.0078	0.0039	—	0.018	0.0492	0.03	0.08
15	0.0039	0.0078	0.0039	0.0078	0.0078	0.0039	—	0.0351	0.054	0.09
16	0.0078	0.0039	0.0078	0.0039	0.0078	0.0078	0.0039	0.0429	0.054	0.097
17	0.0039	0.0078	0.0039	0.0078	0.0039	0.0078	0.0078	0.0429	0.078	0.12
18	0.0078	0.0039	0.0078	0.0039	0.0078	0.0039	0.0078	0.0429	0.063	0.106
19	0.012	0.0078	0.0039	0.0078	0.0039	0.0078	0.0039	0.0471	0.087	0.134
20	0.0039	0.012	0.0078	0.0039	0.0078	0.0039	0.0078	0.0471	0.066	0.133
21	0.012	0.0039	0.012	0.0078	0.0039	0.0078	0.0039	0.0513	0.08	0.131
22	0.0039	0.012	0.0039	0.012	0.0078	0.0039	0.0078	0.0513	0.066	0.177
23	0.0078	0.0039	0.012	0.0039	0.012	0.0078	0.0039	0.0513	0.08	0.131

APPENDIX TABLE 14—*continued*

Area Year	1a, b, c	2a, b, c	3a, b, c	4a, b, c	5a, b, c	6a, b, c	7a, b, c	Total	Harvesting	Total
24	0.0039	0.0078	0.0039	0.012	0.0039	0.012	0.0078	0.0513	0.066	0.177
25	0.0078	0.0039	0.0078	0.0039	0.012	0.0039	0.012	0.0513	0.08	0.131
26	0.0039	0.0078	0.0039	0.0078	0.0039	0.012	0.0039	0.0432	0.07	0.133
27	0.044	0.0039	0.0078	0.0039	0.0078	0.0039	0.012	0.0433	0.08	0.123
28	0.0078	0.004	0.0039	0.0078	0.0039	0.0078	0.0039	0.0391	0.07	0.109
29	0.006	0.0078	0.004	0.0039	0.0078	0.0039	0.0078	0.0412	0.27	0.331
30	0.039	0.006	0.0078	0.004	0.0039	0.0078	0.0039	0.0724	0.19	0.262
31	0.015	0.039	0.006	0.0078	0.004	0.0039	0.0078	0.0835	0.19	0.273
32	0.0039	0.015	0.039	0.006	0.0078	0.004	0.0039	0.0796	0.19	0.270
33	—	0.0039	0.015	0.039	0.006	0.0078	0.004	0.0757	0.19	0.266
34	—	—	0.0039	0.015	0.039	0.006	0.0078	0.0717	0.19	0.262
35	—	—	—	0.0039	0.015	0.039	0.006	0.0639	0.19	0.254
36	—	—	—	—	0.0039	0.015	0.039	0.0579	—	0.058
37	—	—	—	—	—	0.0039	0.015	0.0189	—	0.019
38	0.018	—	—	—	—	—	0.0039	0.0219	—	0.022
39	—	0.018	—	—	—	—	—	0.018	—	0.018
40	0.0039	—	0.018	—	—	—	—	0.0219	0.015	0.037
41	0.0078	0.0039	—	0.018	—	—	—	0.0297	0.015	0.045
42	0.0078	0.0078	0.0039	—	0.018	—	—	0.0375	0.03	0.067

Source: Appendix Tables 11 and 12, and Work Study Section, Forest and Wildlife Service.

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