Factors relevant to planning an Economic Forest Policy

By W H JACK, Ph D

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INTRODUCTION

Mr Gray dealt very largely with the finances of growing a crop of trees but there are a number of other factors which have considerable influence on forest policy and economic planning and I propose to highlight a few of these The details are relevant to Northern Ireland and were originally prepared in somewhat greater detail for a symposium of forest officers Opinions and forecasts are not official policy but are the author's responsibility

Wood Usage

A major consideration in overall economic planning must be the extent to which a resource which can be provided locally is being brought into the country In Ireland there is a virtual absence of mineral resources but the country is well situated for tree growth from which timber harvesting removes no more mineral nutrients than fall in rainwater during the life of the trees I propose first to investigate the import and usage of forest products

Although it is not possible to obtain precise figures of trade some valuable information can be gleaned from the Summary of Trade in Northern Ireland prepared by the Ministry of Commerce [4] A comparison of changes in the value of total imports, wood and timber net imports and paper, paperboard, newspaper and stationery net imports into Northern Ireland for 1945–1961 is given in *Diagram* 1 where the wholesale price index is also shown This diagram has been prepared from the Summary of Trade [4]

It will be noted that wood and timber imports, 1945–1961, have generally kept pace with overall trade growth although following easement of wartime import restrictions industries using wood either built up their stocks or increased their sales very much more quickly than general trade expanded but there has been a levelling off in 1955–1961 With paper,

paperboard, newspaper and stationery the net import pattern changed rapidly from a small export surplus in 1945 up to a considerable import surplus in 1951 From this date the net import of these items has grown fairly steadily at a slightly faster rate than total imports

TABLE 1

VALUE AND ROUNDWOOD EQUIVALENT OF NET IMPORTS OF FOREST PRODUCE TO NORTHERN IRELAND
(1957–61 averages)

Product	Average Amount of Net Imports 1957–61	Average Value of Net Imports 1957–61	Conversion factor (a)	Roundwood equivalent in cu ft
		£'000		
Wood and other Veg Charcoal	8,300 cwt	13	4 5 (b)	37,300
Wood in the round or roughly squared, conifer and hardwood	255,000 cu ft	218	1 0 (c)	255,000
Wood sawn sleepers	100,000 cu ft	54	1 67	168,700
Wood sawn conifer Wood sawn hardwood	5,520,000 cu ft	2,640	1 67	9,200,000
Wood not elsewhere specified	175,000 cu ft	76	1 67	251,000
		3,001		9,912,000
Wood pulp	15,428 tons	804	170 (d)	2,620,000
Paper and paperboard	1,169,000 cwts	5,583	3 2 (e)	3,730,000
Stationery	68,000 cwts	986	6 5 (f)	490,000
Newspapers, periodicals, etc	262,000 cwts	2,646	5 3 (g)	1,390,000
Matches	2 200 cwts	9	2 0 (h)	4,000
Total derived wood produce used	1,809,760 cwts	10,028		8,234,000
Wood and Cork Manufactures		1,298		
Furniture, personal and household effects		3,879		
		5,177		

Notes
(a) See F A O Year Book of Forest Products Statistics 1961 [8]
(b) Based on charcoal yield of one-third of weight of wood and 30 cu ft per ton roundwood equivalent
(c) No allowance made for bark
(d) Approximately 8% mechanical pulp at 90 cu ft per metric ton and 92% chemical pulp at 178 cu ft per metric ton giving an average of 171 cu ft per metric ton, say 170 per long ton
(e) Taken as 63 cu ft per metric ton or 3 2 cu ft per cwt
(f) Taken as 129 cu ft per metric ton or 6 5 cu ft per cwt
(g) Taken as 106 cu ft per metric ton or 5 3 cu ft per cwt
(h) 30 cu ft per ton and conversion factor of 1 67 per cu ft

The value of net imports of paper, etc at £10,000,000 in 1961 greatly exceeded the value of wood and timber at £3,500,000 Wood and timber now accounts for just under 1% of total import value compared with 4% in the United Kingdom as a whole, according to Streyffert [12]

Table 1 gives the net imports of forest produce into Northern Ireland and the roundwood equivalent of these imports as an average of the 1957–61 period Average values are also indicated This indicates that in the past five years the annual value of imports of wood and products derived from wood but excluding furniture and personal and household effects is £14½ million or just over 4½% of the total import trade against a corresponding figure for the United Kingdom as a whole in 1955 of 9%[12]

In addition to the imports of forest produce there is a net home production of some 2 million cu ft roundwood equivalent which is used as constructional wood It can, therefore, be assumed that the consumption of wood in Northern Ireland during the 5-year period from 1957–1961 averaged 12 million cu ft of roundwood, while consumption of products derived from wood averaged over 8 million cu ft giving a *per capita* consumption as in Table 2

TABLE 2

ANNUAL *PER CAPITA* CONSUMPTION OF WOOD IN NORTHERN IRELAND
(Roundwood equivalent) average for 1957–61

Constructional wood	0 24 cubic metres
Derived wood products	0 17* cubic metres^3
Total	0 41 cubic metres^3

*This can be expressed as 66 kg *per capita* including imported wood pulp which reduces to 59 kg *per capita* excluding wood pulp

The average consumption in selected countries and regions in the 1957–1959 period is shown in Table 3 with the Northern Ireland figures from Table 2 also quoted Table 3 has been derived from the F A O Year Books of Forest Products Statistics [8]

TABLE 3

PER CAPITA CONSUMPTION

Country	Total* Roundwood m^3	Industrial‡ Wood m^3	Paper† etc kg
Northern Ireland	0 41	0 41	59
World	0 77	0 44	33
Europe	0 76	0 52	50
United Kingdom	0 64	0 63	97
Republic of Ireland	0 30	0 26	40
West Germany	0 74	0 67	74
Norway	1 65	1 18	98
Sweden	2 30	1 62	133
France	0 96	0 55	57
U S A	1 93	1 67	192

*Wood and derived wood products expressed as roundwood equivalent
‡Total roundwood excluding fuelwood
†Included in previous columns

It would appear to be a not unreasonable assumption that the *per capita* consumption of paper and paperboard in Northern Ireland will rise to 100 kg if prices, etc remain stationery and that very long term policy should count on it increasing to three times its present level, i e, 180 kg which is under the present U S A level and just 30% above the present Swedish level Assuming a population increase to 1½ million this would require 24 million cu ft roundwood equivalent It can also be argued that Northern Ireland consumption of constructional wood will be raised to at least the present United Kingdom level or approximately 0 36 cu metres per head, i e, 18,000,000 cu ft round-wood equivalent To this total of 42,000,000 cu ft roundwood equivalent must be added a factor for imported wood pulp for textile manufacture which is currently running at over 1,000,000 cu ft roundwood equivalent

It should not be assumed that even if Northern Ireland could produce these quantities they could be used locally Some of the overall paper import is in the form of newspapers and books printed in Great Britain for the United Kingdom as a whole, some imports are products of factories which to be economic would have to be able to produce more than Northern Ireland requirements, and certain classes of wood cannot be grown in Northern Ireland

In view of the importance of processed wood generally it is relevant to note that a conference of the Society of Foresters of Great Britain in November 1959 suggested that an efficient modern sawmill requires 500,000 cu ft per annum, a boardmill 3,000,000 cu ft per annum and a pulpmill 15,000,000 cu ft It was also emphasised that a pulpmill could only exist on a very large scale and, therefore, if one is to be built it should be able to absorb all available supplies for some time, produce must be reserved for it and not permitted to be sold in the intervening period enabling other industries to start and have a prior claim on supplies Some of the minimum requirements of various types of pulp-mill according to the findings of the Sandwell Report[5] are given in Table 4

TABLE 4

COMPARISON OF MINIMUM REQUIREMENTS OF VARIOUS TYPES OF PULPMILL

Component	Unit	Bleached Sulphate	Ground-wood	Integrated Ground-wood
Production of air dried pulp per annum	Long tons	27,000	68,000	12,000
Pulpwood required per annum	H Ft Equivalent	5,000,000	5,600,000	1,000,000
Water required	Gals per day	5,100,000	2,000,000	350,000*
Effluent disposal, minimum flow	Million gals per day	240	210	37*
Labour operating force	Men	152	272	38*
Total capital	Thousand £	2,240	3,000	490
Capital per employed labour	£	15,000	11,000	13,000

*Pulping only

It should be noted that if reduced timber prices attract investments which might not otherwise occur, the decrease in profitability of forestry might be more than balanced by some useful gains to the economy, Thomas [14]

Land Use

Out of a total land area of 3,350,000 acres in Northern Ireland, permanent grass covers approximately 1,000,000 acres and rough grazing a further 750,000 acres These figures have been taken from the General Reports of the Ministry of Agriculture [3] Changes in area under rough grazing together with a note on the number of farm holdings are shown in *Diagram* 2 which has been prepared from the above Reports and that of the Agricultural Enquiry Committee, Cmd 249 [1] The considerable increase in area of rough grazing from 1939 to 1945 is probably explained by the Compulsory Tillage Orders during this period when 40 per cent of the crops and grass area had to be ploughed and the introduction of this scheme resulted in a reassessment of rough grazing by local agricultural staff There is a possibility that the introduction of the Small Farmer Scheme has recently produced a trend in the opposite direction with land classified as rough grazing being reclassified by the farmer as permanent grass These variations indicate the difficulty of using such census figures

The number of holdings is not very indicative of the number of farm units as quite a considerable area is taken in conacre and it has been suggested, Shemilt,[10] that the future of upland farming will go to those men who can, *inter alia*, bring together a number of small upland farms into larger units

The estimated agricultural output from hill land in Northern Ireland averaged for 1956–60 is given in Table 5 which has been obtained by the writer from the Ministry of Agriculture Reports[3] using certain assumptions which are more fully given in Jack [9]

TABLE 5

ESTIMATED AGRICULTURAL OUTPUT FROM HILL LAND IN NORTHERN IRELAND
(Annual Averages for 1956–61)

	£	£
Gross output		
Hill sheep, including wool	2,227,000	
Hill cattle	2,150,000	
	———	4,377,000 (b)
Subsidies		
General subsidies	547,000	
Fatstock guarantee—sheep	412,000	
Fatstock guarantee—cattle	280,000	
	———	1,239,000 (a)
Net Output		3,138,000 (c)

Notes
(a) Equivalent to 33/- per acre per annum or 28% of gross output
(b) Equivalent to £5 8 per acre per annum comparable with £7 55 gross (including 1 84 for pigs and poultry) quoted by Shemilt [10]
(c) Equivalent to £4 2 per acre per annum (using 750,000 acres as the area of hill land)

Pigs and poultry are dependent more on buildings and capital available than on the land itself and are excluded from Table 5 It should be noted that many general subsidies are complementary but the general subsidy total is nevertheless the subsidy paid for the improvement of marginal land Deficiency payments such as the fatstock guarantee prices are, however, a means of keeping the prices of farm produce to the consumer at a low figure thereby keeping down the cost of living If they were removed, the farmer could probably command approximately the same price he obtains at present and the consumer would have to pay more The capitalised value of the general subsidies (say £16 per acre at a 20-year purchase) is, therefore, the extent of the overall Government grant to hill farming and the deficiency guarantee subsidies can be taken as consumer and not producer subsidies

It should be noted that a price for forest produce of 2s per H ft loaded on customer's transport at the forest is lower than is generally obtained at present but at this figure land capable of yielding a mean annual increment of 58 H ft per acre, which is less than 45 per cent of the Forestry Commission figure for Sitka spruce Quality Class V, would yield an equivalent gross output to present day agriculture on the basis of the gross return of £5 8 per acre per annum given in Table 5

It would only be of value to the community as a whole to save on imports of forest products if this could be done without reducing by an equivalent amount the value of mutton and beef exports unless the production of these forest products generated further home-based industry and carried social and economic benefits such as creation of more employment It appears that the sheep population is increasing even faster than the acreage of rough grazing and that an increasingly greater acreage is becoming rough grazing in spite of increasing competition for land for forestry

Employment

The level of unemployment in Northern Ireland has remained at the high level of 6 to 7 per cent of the employed population for some time and in March 1962 there were 36,000 unemployed persons of whom 4,000 were craftsmen with time served and over 10,000 were classified as general labourers, Hall Report [2] The Hall Committee suggested that the male population of Northern Ireland at the end of the century would be 20 per cent higher than the 1961 level with a natural population increase of 15,000 per annum and an average net migration of 9,000 Payment of unemployment benefit reached £6,000,000 in 1961 which represented a considerable drain on the country's resources

The greatest decrease in employment is in agriculture and changes in the total number of persons employed in agriculture taken from the Year Books for Northern Ireland[6] are given in Table 6

TABLE 6

TOTAL NUMBER OF PERSONS EMPLOYED IN AGRICULTURE

Category	1945	1952	1958	1961
Owners of farms	62,645	56,961	59,870	47,700
Other members of family	87,544	65,930	58,320	50,400
Workers permanently employed	20,837	12,868	10,050	8,900
Workers temporarily employed	13,378	9,235	7,960	7,700
Total	184,404	144,994	136,200	114,700

Using the standard labour requirements of the Small Farmer Scheme as given in Land Use in Northern Ireland[11] it would appear that one man is expected to look after approximately 400 ewes to give him full employment This would mean a hill farm of 600 to 800 acres which is a very low level of employment density The level of forest employment is largely determined by the rate of growth of the tree crop and it would appear that areas acquired to date in Northern Ireland which are largely hill land are likely to average 100 H ft per acre per annum Using this assumption, reasonably efficient use of men in forestry would be one man per 100 acres planting and tending the plantation and estate generally with a further man per 100 acres on production operations, i e felling and extracting the timber to roadside In addition, one trained forester would be required for every 1,000 to 1,500 acres approximately

Unfortunately, forestry operations cannot employ labour at the above intensity immediately on acquisition of land and although careful management, e g, timing of road construction, can ensure continuity of labour work, a full labour force cannot be efficiently maintained until production operations commence, i e, at least twenty years after acquisition It may, therefore, be essential to employ labour in an uneconomic manner to retain it in certain areas such as Co Fermanagh *Diagrams* 3 and 4 taken from Ulster Lakeland[7] show the overall population decline and the present shortage of young working people in this county Changes in the employment of agricultural workers and overall unemployment statistics for the Enniskillen Office area (virtually Co Fermanagh) 1948–1961 are given in *Diagram* 5 This diagram illustrates how agricultural workers have left the land to go to other occupations

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DISCUSSION

Professor T Clear, in proposing the vote of thanks, said Timber growing is an investment type of enterprise Cash outlays made today for land, roads, afforestation, equipment and improvements are largely for wood yields and income that will be realised in the more or less distant future Such expenditure, or capital outlay, are investments for future earnings

The annual cash outlays for land, establishment of new plantations and construction of roads are treated as capital items These are, however, only part of the capital that is the concern of the forest manager A large portion of the capital subject to the decisions of the forest manager are the existing land holdings, growing stock, roads, equipment and improvements These assets are the consequence of past investments Decisions to hold and maintain them, to liquidate them or to replace them are largely a reflection of the manager's analysis and judgment of their future earning capacity

The task of planning the allocation of new capital outlays, or proposals therefore, and the management of existing capital assets is the key issue in Forestry The forest manager is essentially an investment manager This is his primary function whether his role is to make the final decisions or to participate in them with top management by presenting budget requests and proposals His key problem is to attract capital into the forest interprise, to budget its allocation or release to those management functions which will contribute most to the objectives of the owners of the forest It is not surprising, therefore, that increased attention is being focused on forestry investment analysis

The forest manager in theory, plans capital outlay in such a way that the expected stream of net earnings over the years will be a maximum Expressed in terms of the immediate present, planning to maximise future profits is equivalent to maximising the net present worth of the firm's future earnings and thereby the present net worth of the firm The net present worth of the firm will be a maximum when the difference between discounted expected gross revenues and the discounted costs, including investments for roads, plant, equipment, etc , is a maximum

The Faustmann Formula, with which foresters are so familiar, does just that It discounts all future income and outlay to now, and the rotation age or management system that gives the maximum net worth, or land expectation value, is the optimum

The forestry investor is envisaged as ranking the investment opportunities available to him on the basis of their prospective profitability and allocating his investment funds accordingly Non-forest investment opportunities are included in making those comparisons

The practical and technical difficulties in applying the concept of maximum discounted net worth have been brought out in Mr Gray's paper These difficulties have been generally recognised by foresters and forest economists In particular, the time element in timber production necessitates the use of price and demand projections many years in the future Estimates based on these projections are very uncertain In addition, the heterogeneity of forest land productivity, the range of species and mixtures complicate the task of predicting the physical yields of crops under various management systems The lack of biological information on what makes trees grow is also a factor (perhaps the greatest)

It is, therefore, apparent that some rather difficult information problems must be solved before calculations of present net worth can be made or the formulae used successfully. If conjectural data are used to implement a theory for comparing investment alternatives, it is difficult to see how the results would be other than conjectural Filtering conjectural data, through a theoretical framework will not increase the plauseability of the conclusions drawn therefrom

The Rate of Interest use in calculations involving discount is of vital importance Low rates of interest tend to favour alternatives that involve postponement of revenue High rates favour those that promise quicker returns Thus in comparing, say butter fat and timber production, you can paint any picture you like by ringing the changes with the interest rate

It is easily possible for the unwary user to run wild with the Faustmann Formula, with ridiculous consequences By using a high rate of interest it is easy to show that any investment of resources will eat up deferred returns before they ever materialise By assuming a very low rate of interest, recurring future values can be shown to be so great that no cost to win them is too great a sacrifice

In practice top management determines the guiding rate of return, or the rejection rate as it is sometimes called, for capital rationing purposes Historically forests have appreciated relative to the value of other commodities The properly managed, sustained yield forest enterprise is an appreciating asset Unlike manufacturing plants and equipment, it does not depreciate Unlike an oil well or a mine, it is not depletable Unlike many new products and equipment developments it does not suffer sudden obsolesence If necessary, it can always be liquidated to recover the original capital outlays The main task in forest management is maintenance of the capital assets created (sustained yield)

The productivity, capacity and efficiency of labour at all levels in forestry is obviously important Mr Gray has shown what is being done to improve labour productivity here Forest management has to deal with many questions affecting productivity such as what is the best

combination of the agents of production? Have we the right ratios of foresters, to gangers to workers? Have we the right ratios of machines to man and so on?

Mr Gray, in his paper, says "the quality of the land devoted to forestry is the most critical controllable factor in determining the ultimate profitability of the undertaking but policy has, with unquestionably good reason, tended to exclude highly productive land on which a forester could show excellent profits and to favour the inclusion of sites of marginal productivity" Further he states "that what can be done to use this country's natural climatic and other advantages for forestry purposes to the greatest community profit attainable is in fact being done"

Foresters everywhere are increasingly aware that only good planting sites can justify present planting costs In 1919, as we have heard, the Acland Committee selected a production of 40 hoppus feet as the lower limit of production In 1962, Hummel and Grayson of the British Forestry Commission calculated that, for Britain, production is profitable down to sites capable of yielding 80 hoppus feet Productivity in State forests here ranges from 30 to 300 hoppus feet

On the question of quality of land for forestry Entrican, Director General of Forests in New Zealand, writes "A good, well distributed rainfall, together with moderate and relatively uniform temperatures will enable all soils to grow grass or trees equally well or poorly according to their quality Fertile river flats will just as readily yield 500 hoppus feet of radiata pine as they now yield 400 lb of butter fat per acre The poorer lands will yield either 100 lb of butter fat or 160 hoppus feet of pine"

Here in Ireland, surveys have shown for areas under pasture and hay yield of 45 lb of butter fat on land that could give an annual yield of 200 hoppus feet of Sitka spruce

I suggest it is our role to present facts to the people, to establish truth and help to disseminate it Let the people or their representatives interpret the truth and debate the policy of land use and come out with decisions about what to do