

Economic Aspects of Forestry in Northern Ireland

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It was stated in 1960 that forestry policy in Northern Ireland is governed by three major factors "Firstly, there is the compelling need, which two world wars have so painfully demonstrated, to reverse the centuries-old process of deforestation and create home-grown timber resources equal at least to emergency requirements. Secondly, there is the need, no less compelling, to provide productive work in areas of serious unemployment, the existence of which not only impoverishes the areas themselves but, by causing a drift to the towns and overseas, accentuates the social problems of the whole country. Afforestation projects in these areas (which are predominantly marginal land) offer an ideal solution by providing a source not only of immediate employment but of future national wealth. Thirdly, though private planting can contribute usefully to the solution of both these problems, under present economic conditions any such contribution can inevitably do no more than touch their fringe and the principal share of direct action must therefore be taken by the state"¹ These considerations have resulted in a programme of expansion which is designed to create "by the earliest possible date" a productive state forestry area of 150,000 acres

A significant aspect of these reasons for investing in forestry is the limited importance placed on the economic motive. No mention is made of the expected rate of return on capital, and the overwhelming emphasis is on strategic and social considerations² It appears from official publications that even less emphasis has been placed on economic criteria in Northern Ireland than in Great Britain. The Forestry Commissioners concluded in 1943 that, in addition to providing strategic and social benefits, afforestation would probably yield a direct return ranging from 3 to 4 per cent.³ This was thought to be "satisfactory" for "a very long term investment". The Natural Resources (Technical) Committee noted the import saving contribution of a larger home forestry industry⁴ In Northern Ireland, on the

¹Ministry of Agriculture, Northern Ireland: *Forestry in Northern Ireland* (1960).

²Since this paper was written there has been a change of emphasis in forestry policy. The latest policy statement concludes that "the initial emphasis on building up a strategic reserve of timber for use in case of emergency has changed to an emphasis on economic timber production based on the gradual build up of a sustained supply of raw materials which will attract new wood industries to the country with a promise of expansion" (British Commonwealth Forestry Conference, 1962, Progress Report 1955-60 by the Ministry of Agriculture for Northern Ireland, (Belfast H.M.S.O., 1962)

³Cmd. 6447. Report by H.M. Forestry Commissioners: *Post-War Forest Policy*, para 230. (London H.M.S.O., 1943).

⁴A Report by the Natural Resources (Technical) Committee: *Forestry, Agriculture and Marginal Land*, para. 18. (London H.M.S.O., 1957).

other hand, the Government's policy statement makes only an incidental reference to forestry's ability to create economic wealth, and the only specific mention of economic criteria was made by the Agricultural Enquiry Committee who claimed that forestry represented the best economic use of certain hill land areas.⁵

Two comments are relevant here. This claim was probably true, but no evidence was given to indicate that forestry might also have been more economic than farming on some of the better agricultural land which the Committee designated as unsuitable for forestry. Moreover, by suggesting that forestry should be confined to the more inferior soils, including unplanted agricultural areas, the Committee was ensuring that the rate of return would be reduced. However, it did not consider whether investment in these areas represented the best use of the resources⁶ available in the country; investment in manufacturing industry, for instance, might provide a better return to the nation.

Since the section devoted to forestry in the Report of the Agricultural Enquiry Committee summarises the results of the only major government investigation into this question in Ulster since the war, its attitude towards the type of land on which forestry should be developed is of considerable interest. The Committee emphasised⁷ that forestry should interfere as little as possible with agriculture, which was to have priority over it in the economy. It stressed the absence of competition between the two industries as if this was desirable in itself. Competition would be eliminated because, in general, nothing but the most unproductive land could be devoted to forestry. It was stated that "It is clearly right that the existing area of cultivated land should be reserved to agriculture," and the use of land for forestry was considered to be a "residual use which should only be adopted when the land is not capable of being economically used for agricultural purposes." The only exception was some "second rate hill grazing land or arable land" when it was necessary to provide a unit of economic size for forestry. No consideration was given in the Report to specific economic criteria in allocating land between agriculture and forestry. The most productive soils were automatically assumed to be more economic under agriculture. This would ensure that forestry would be confined to peat lands and areas of hill grazing and barren mountain land where its competition would be least felt.

The lack of emphasis on economic criteria as a guide to investment in forestry is most clearly seen in practice in the method by which the industry acquires land, and by the policy of giving financial assistance for the rehabilitation of hill and marginal land agriculture. The Forestry Division of the Ministry of Agriculture, which is the authority responsible for developing forestry in Ulster, has no compulsory powers for acquiring land, and all negotiations between the land-owners and the Ministry are free and voluntary. In recent years all acquisitions have had to be ratified by the County Agricultural Executive Officers, and there have been occasions when they have

⁵Cmd. 249. Government of Northern Ireland: *Reports of the Agricultural Enquiry Committee*, p. 82. (Belfast, 1947).

⁶For a list of the criteria which should guide the allocation of resources in the economy, see pp 10-11

⁷Cmd. 249, p. 80.

refused to grant permission to transfer the land to forestry, even when the farmer has agreed to sell it to the Forestry Division

In negotiating for land the Forestry Division is restricted by the knowledge that the County Agricultural Executive Officers have to ratify every acquisition, and past experience has indicated that the latter will permit only the most infertile land to be transferred to forestry. There is no indication, however, that the Executive Officers are specifically guided by economic criteria in deciding on the proper allocation of land between the two industries. They attach very little importance to the relative return to capital invested in forestry and agriculture, and their decision is based on few definite principles. In general, they believe that it is not in the national interest to transfer land out of agriculture if it supports a certain number of livestock per acre, and if the transfer is likely to "unbalance" the existing agricultural pattern. In other words, it appears that the attitude of the Agricultural Enquiry Committee which stressed the fundamental importance of agriculture in the economy, and expressed the opinion that forestry should compete as little as possible with it, is uppermost in the Officers' minds. Moreover, they also justify this policy on social grounds. The type of land which they are prepared to transfer to forestry is frequently situated in the areas where unemployment, underemployment in agriculture and rural depopulation are most severe, and which the Government is anxious to rehabilitate.

To implement the policy of rehabilitating hill and marginal land agriculture subsidies and improvement grants have been made available to farmers. The most important of these are listed in Table I, which also gives the total amount of financial assistance provided by them in the period 1946 to 1958. No figures are available for the number of acres affected by these schemes, and the amount of subsidy per acre cannot, therefore, be calculated. A very approximate

TABLE I.—STATE SUBSIDIES AND GRANTS TO MARGINAL AND HILL FARMING, 1946-1958 (£ THOUSAND)

Year	SCHEME					Total
	Marginal Production	Marginal Land Farm Buildings	Hill Sheep Subsidy	Hill Cattle and Hill Cow Subsidies	Hill Farm Improvement	
1946	34	—	61	169	—	264
1947	31	—	60	138	—	229
1948	31	—	150	155	—	336
1949	38	—	91	151	1	281
1950	47	—	44	155	7	253
1951	30	—	51	145	11	237
1952	49	—	21	134	13	217
1953	40	113	—	216	47	416
1954	45	78	—	238	67	428
1955	46	78	39	253	83	499
1956	44	69	39	223	26	401
1957	232	50	1	303	30	616
1958	238	—	—	344.5	30	612.5
TOTAL	905	388	557	2,624.5	315	4,789.5

Source : Calculated from Ministry of Agriculture Reports

indication of this however, can be obtained by dividing the total amount of subsidy paid each year by the number of acres of rough grazing which roughly corresponds to the category of land eligible for financial assistance. This calculation is made in Appendix, Table A, and it is seen that, on an average, each acre of rough grazing has obtained an annual subsidy of at least twelve shillings per acre since 1953. This is a tenth of the average price which the Forestry Division currently pays for an acre of forestry land. Moreover, the total payments (£4,789,500) made under the five schemes listed, was nearly equal to the entire expenditure on state forestry in the same period.

It is very questionable whether the public money invested in these areas yields a satisfactory rate of return. Although the subsidies and grants are mainly given to increase domestic food supplies and to make farm holdings economically viable no specific provisions can be satisfactorily made to ensure that what is achieved on each holding represents a reasonable contribution to the national economy. This will depend on numerous factors including the standard of management of the farmer. Since these are so difficult to evaluate it frequently means that grants to hill farming have to be given indiscriminately. "The effect is an almost random scatter of improvement, and a proportion of the grants made probably serve only to prolong the separate existence of basically uneconomic holdings"⁸ No reliable figures have been published of the rate of return on this public investment in marginal areas, but a recent writer,⁹ after examining the available information, stated that "it is very doubtful whether the return to capital invested under the Hill Farming Acts are in any sense satisfactory". He further concluded that the government's agricultural policy in Great Britain "may have failed both to secure an economic hill farm production and to ensure the success of the Forestry Commission".

The apparent inconsistency of land use policy in the Six Counties is most clearly seen in the post-war efforts of the Ministry of Agriculture to locate an increasing number of forests in the marginal areas of Fermanagh and West Tyrone while at the same time encouraging farmers to hold on to their land by providing large scale financial assistance. Since 1943 these areas have received £1.4 million in Marginal Land and Marginal Production grants alone. Additional payments have also been made under numerous other schemes, and the recently introduced Small Farmer Schemes¹⁰ will inject considerably more capital into these potential forestry areas.

II

A brief analysis of the limited role played by economic factors in forestry investment serves as a background against which the progress of expansion in the post-war period, and some aspects of the organisation and structure of the industry may be judged.

The total area acquired for forestry has increased from 40,000 acres

⁸ *Forestry, Agriculture and Marginal Land*, para 142

⁹ K. R. Walker. "The Forestry Commission and the Use of Hill Land," *Scottish Journal of Political Economy*, 1960, Vol VII, pp 31-32

¹⁰ 7 and 8 Eliz 2, ch 12

in 1946 to over 83,000 acres at the beginning of 1958, with the annual rate of acquisition varying between 2,600 acres and 3,800 acres, except in 1954-55 and 1955-56 when it exceeded 7,000 acres. Nearly a fifth of the total area, however, is unplatable, and the acreage suitable for forestry at the end of March 1958 was 66,115. The area planted by 1946, 26,500 acres, had risen to 46,000 acres in 1958, and the annual planting rate at the latter date (over 3,000 acres) was over three times the immediate post-war figure. It is apparent that if this rate of planting continues the target of 150,000 acres will be reached before 2000 A.D.

Two main factors explain this expansion. Firstly, the Forestry Division has been willing to accept increasingly poorer quality land, and over 80 per cent. of the annual area acquired at present is on peat soils. The post-war increase in the prosperity of the marginal agricultural areas, and the method of allocating land for forestry mean that foresters have now to consider these more infertile and difficult areas. The peatlands of Northern Ireland contain a high proportion of marginal and sub-marginal agricultural land, and considerable areas are either completely unproductive or carry only a small flock of sheep. They can, therefore, be acquired at a relatively low price, and the government is able to extend the size of the industry with the minimum of competition for agricultural land.

Secondly, the Forestry Division has increased the maximum price which it is prepared to pay for land from £4 per acre, which it was offering in the pre-war years, to over £12 per acre by 1958. The average price paid in the last three years has been around £6 per acre. There is no evidence that the forestry programme since the war has been hindered by inadequate finance. Indeed the Forestry Division was granted all the money it asked for in the period between 1946 and 1958. But the extent to which it is able to utilize the sum voted by Parliament depends mainly on its ability to acquire land. Although the forestry area has considerably increased during the post-war period, the Forestry Division was able to spend only 69.7 per cent. of the total sum granted for the purchase of new areas. The present policy of restricting to forestry only those areas which are sub-marginal from the point of view of agriculture has retarded the expansion of the industry, and its ability to provide employment. It seems likely also that it greatly reduces the average rate of return on investment in forestry below what it would otherwise be.

Not only has the total forestry area expanded, but the average size of forest unit has also increased. A comparison of the size distribution of forest units in 1947 and 1958 on the basis of both the total area acquired and the total area planted at these dates reveals that the average area acquired per forest increased from 1,033 acres to 1,361 acres, and the average planted per forest increased from 507 acres to 754 acres. Nevertheless, there is still a predominance of small forest blocks in the Province: over 75 per cent. of the state forests, classified according to their total area planted, were less than a thousand acres in 1958, and the proportion was nearly 56 per cent. if they are classified according to their total acquired area. This feature of the forest organisation is even more strikingly stressed when the size distribution of units is compared with the pattern existing in England, Scotland and Wales. In each of these three countries the average area planted per forest unit in 1958 exceeded two thousand acres (Table II).

TABLE II.—SIZE DISTRIBUTION OF FORESTS IN THE UNITED KINGDOM (1958)

Size (acres)	England		Scotland		Wales		Northern Ireland	
	Number of Forests	% of Total	Number of Forests	% of Total	Number of Forests	% of Total	Number of Forests	% of Total
500 and under	75	33 78	33	15 35	10	12 90	28	45 90
501—1,000	46	20 72	36	16 74	20	25 97	18	29 51
1,001—1,500	31	13 96	31	14 42	11	14 29	5	8 19
1,501—2,000	20	9 01	27	12 56	8	10 39	6	9 84
2,001—2,500	13	5 86	19	8 84	5	6 49	3	4 92
2,501—3,000	7	3 15	11	5 12	3	3 90	1	1 64
3 001—4,000	10	4 51	20	9 30	6	7 79	0	0 00
Over 4,000	20	9 01	38	17 87	14	18 18	0	0 00
Total	222	100 00	215	100 00	77	100 00	61	100 00

Average Size

England	2045 55 Acres
Scotland	2357 46 Acres
Wales	2742 39 Acres
Northern Ireland	754 16 Acres

Source : 1) 39th Annual Report of the Forestry Commission

2) Government of Northern Ireland 17th Report of the Ministry of Agriculture

The relatively small size of forest unit has a number of economic implications. Although no figures are available indicating the variation in production costs as the scale of operations expands, officials of the Forestry Division believe that the present average size is below the optimum. Two main arguments are advanced in support of this conclusion. Firstly, financial economies would be reaped if some operations, particularly fencing, draining and ploughing were carried out on larger areas of land than are at present available. Secondly, small units restrict the numbers of acres over which the overhead expenses of the supervisory staff are spread. Small units also increase the difficulties of establishing forests on a sustained yield basis,¹¹ which diminishes the possibility of creating labour redundancy or under-employment during the period between the establishment of the forest and brashing and increases the over-all efficiency of the organisation. Moreover, they reduce the quantity of timber available for the

¹¹ "That is, one where the annual volume of timber available for felling is kept constant through the creation of a forest containing all age-classes of trees. The annual acreage felled would equal the annual acreage planted. For example—it could take the form of a 500 acre forest, to be worked on a cycle of 50 years, containing 50 ten-acre block of trees of each age from 1 year to 50 years. Ten acres would be felled each year after the fiftieth, while 10 acres would be replanted, so that timber production was continuously sustained throughout the years." (K. R. Walker, p. 29.)

setting up of industries based on wood in a certain locality, and increase the expense of marketing felled timber scattered in small lots over a wide area.

In view of the high proportion of the forestry area which is situated on peat soils, a brief discussion should be given of the economic aspects of this type of investment. To begin with, the government is investing in an enterprise for which it has no reliable estimates of its future physical productivity. This is because very little planting has been done on the more acid peaty soils of the United Kingdom and, although the growth of some species up to the present has been reasonably satisfactory, the future of plantations on peat is still uncertain. This fact greatly increases the difficulties of estimating the future revenue and therefore, the rate of return expected from the investment.

The deficiency of knowledge on the suitability of soils for forestry means that the planting programme mainly depends upon trial and error, and this affects the magnitude of production costs. The Forestry Commission commenting on the results of its experiments in tree planting on peat concludes that "the costing of operations has been a subsidiary task to the trial of methods for afforestation,"¹² and describes the practice they adopt as follows:

"In many cases costs will be the test of a point of technique which has given some slight benefit, and similarly costs are the deciding factor between alternative methods which have given the same result. On the other hand costs have not been allowed to deter the Research Branch, since if an operation is costly but effective some less costly means of achieving the same end may often be devised, even though at a later date."

A similar type of approach has also to be adopted in Northern Ireland, and it undoubtedly involves an expenditure of resources which do not necessarily contribute to the success of the final product in the present production period. Among the examples which can be quoted are the planting of species which fail to grow satisfactorily, and the use of fertilisers which do not yield useful results.

Although two factors—the larger size of forestry units, and the less vigorous vegetation growth—reduce the costs of fencing, draining and ploughing operations and weeding respectively in forests established on peat relative to those on other types of soil, the poor quality of the land and the limitations imposed on the choice of species reduce the expected net rate of return.

III

What criteria should guide the government in making decisions relating to the alternative possibilities for investing capital? These are summarised in the concept of "the net productivity of a project to the whole economy," which is calculated "by adding together all the known and expected benefits" of an investment project, and "subtracting from this total its known and expected economic costs"¹³

¹²Forestry Commission Bulletin No 22 Experiments in Tree Planting on Peat, Chapter 4, p 12 (London, H.M.S.O., 1954)

¹³W. J. L. Ryan "Investment criteria in Ireland," *Journal of the Statistical and Social Inquiry Society of Ireland*, 1961-62, p. 18.

In addition to the rate of return on capital, net social productivity would include an estimate of the net advantages which would accrue to the nation from the use made by the project of unemployed or under-employed domestic resources, the generation of increased income, the linkage with other industries, the contribution to the balance of payments and the improvement of skill and technological knowledge.

It is apparent that a number of these criteria can not be measured quantitatively, and an assessment of them requires the exercise of judgment. An estimate of the rate of return, however, can be made more precisely, and since considerable emphasis should be placed on the direct financial productivity of any investment the following analysis is mainly concerned with estimating the rate of return on the capital invested in forestry in Northern Ireland and comparing it with the rate of return which the funds might expect to earn in alternative investments. In the comparison with hill and marginal land farming, however, some consideration is also given to the other criteria which constitute the net social productivity of investing in these two industries in the Province.

An attempt is made in this section to calculate the rate of return on the capital invested in 100 acres of forestry in Northern Ireland. It is assumed that the production period is 50 years, and the total expenditure incurred in establishing and maintaining this area is estimated, and compared with the receipts realised from selling the timber produce. Details of the capital expenditure of the Forestry Division in creating 100 acres of forestry are summarised in Appendix, Table B, which also gives the number of years for which the expenditure has to be discounted. (All expenditures incurred after the first year will be discounted back to the beginning of the production period)

The revenue earned from investing in forestry depends on two factors: the physical productivity of land under timber, and the price at which the timber is sold.

The long production period in forestry means that considerable risks are involved in estimating the physical productivity of an acre of forest land in Ulster. Very few forests have been fully planted, and the relative distribution of species in the final crop in most of the rest is unknown. There are no records of production from mature forests, and the future rate of growth of the young forests, particularly those established on peat soils, is very uncertain. Head Foresters and District Forestry Officers who provided the estimates of physical productivity used in this calculation constantly stressed these difficulties, and stated that for some forests the margin of error could be very considerable. In the absence of more accurate information, however, they are the best that can be made.

Estimates of the physical productivity of 20 forests, which represent nearly a third of the total number under the Ministry's control, were obtained, and the average per 100 acres over a production period of 50 years, which includes 6 thinnings, is given in Appendix, Table C.

Future forestry prices depend on numerous factors including the world demand and supply situation for timber products, the attitude of the Government towards imports and the existence or otherwise of local markets, etc. Owing to the long time period between the formation of a forest and the final felling of the mature timber the effects of these factors on prices cannot be reliably estimated at the beginning of the production period, and this presents the potential investor in

forestry from making meaningful price estimates. This difficulty is met by calculating the rate of return on the basis of present costs and prices, and examining the effects of various assumptions about future changes in the ratio of current costs and prices. The chief merit of this method is that it suggests the most important variables influencing the profitability of investing in forestry.

There are no published data of the prices of forestry products in the Province, and it was not possible to obtain the actual prices received for the different types of timber sold by the Forestry Division. Nevertheless, with the use of information obtained from local foresters, timber merchants and officials of the Forestry Division it has been possible to construct a schedule of prices which probably conforms reasonably closely with the average net return¹⁴ received for timber currently sold by forest owners in Ulster. It should be stated, however, that two major difficulties were encountered in constructing such a schedule. In the first place, it was necessary to obtain the average net return per hoppus¹⁵ foot of timber extracted at various years over the whole production period, but since only a negligible proportion of the timber extracted from state forests is over 40 years old, the Forestry Division has no records of prices for the later thinnings and the main crop. Secondly, prices per hoppus foot vary greatly between the various categories sold, and from one year to another. In view of these difficulties a single price estimate for timber extracted in various years would be very arbitrary, and the price schedule (Appendix, Table D) gives in addition to a "most likely" estimate, an upper and a lower limit of the average price per hoppus foot of timber extracted at given years after the second thinning. Although these limits represent actual price quotations it is not possible, in the absence of more adequate data, to assess how representative they are. The "most likely" estimate is approximately the mean of the two limits, and the main justification for using the latter is that they provide a range within which the actual rate of return probably lies.

The revenue from 100 acres of forest is obtained by applying the estimates of prices to the average volume of timber extracted at given years (Appendix, Table E).

To obtain an estimate of the rate of return it is necessary to calculate that rate which equates the value of future revenue with total outlay at the beginning of the production period (All expenditures incurred after the first year are discounted back to the beginning of the production period at rates of interest from 0 to 6 in Appendix, Table F). The results of this calculation, which are summarised in Table III, show that the rate of return in forestry varies with the market rate of interest. Thus with the "most likely" price estimate, and the market rate of interest rising from 0 to 6 per cent, the rate of return increases from 2.1 per cent to 3.6 per cent. In other words, under the assumption that current costs and prices remain unchanged throughout a production period of 50 years, the Forestry Division earns 3.6 per cent on the total capital invested in forestry when the long term market rate of interest is at its current level of 6 per cent. Using the upper and

¹⁴Net return is equal to the gross selling price minus the costs of felling, extraction and conversion operations, and (where relevant) transportation.

¹⁵The hoppus foot, equal to 1.273 cubic feet, is the traditional unit of measurement of timber in the round.

lower price estimates, and a market rate of interest of 6 per cent. the rate of return is 4.4 and 3.0 per cent respectively ¹⁶

TABLE III—RATE OF RETURN IN FORESTRY

Market rate of interest %	Most likely estimate %	Upper Limit %	Lower Limit %
0	2.1	3.0	1.6
1	2.5	3.3	2.0
2	2.8	3.6	2.2
3	3.0	3.8	2.5
4	3.2	4.0	2.7
5	3.4	4.2	2.9
6	3.6	4.4	3.0

Before comparing this estimate of the rate of return in forestry in Northern Ireland with the rate of return the funds might expect to earn in alternative investments, it may be noted that the calculation indicates the variables which influence the profitability of investing in forestry. One of the most important is the rate of interest charged on the invested capital. The cumulative effect of the interest rate is such that the later the expenditures are incurred or the earlier the revenues are realised, the higher is the rate of return on capital. Cost economies in the early part of the production period, particularly during the establishment phase, can result in a substantial increase in profitability. These economies can be derived from four main sources. Firstly, larger sized forest units would give rise to cost reductions in fencing, ploughing and draining operations, diminish the degree of under-employment of labour and reduce supervision charges per unit of output. Secondly, the introduction of an incentive payment system would increase output per man and reduce the cost of producing a unit of product. Thirdly, it may be possible to decrease the present relatively high ratio of management to land without diminishing the efficiency of the management function. Finally, the road policy should be carefully scrutinised with a view to lower construction costs. In particular, the type of road built, the resources used and the time of construction should be related solely to the economic requirements of the forest.

The relatively small proportion of total expenditure accounted for by the cost of purchasing land suggests that a substantial percentage increase in the cost per acre even if other costs and revenue remain unchanged would not markedly reduce the net rate of return. In the past the government has set a limit on the price per acre payable by the Forestry Division for land, with the result that the quality of a

¹⁶In accepting these figures the high degree of uncertainty surrounding the future of peat plantations must again be stressed. Although some allowance for this has been made in arriving at the estimate of the physical productivity of forest land, this would be very inadequate if the trees failed to mature to large saw-log size. In addition, the cost of peatland afforestation may be increased as fertilizers and various techniques are applied in an effort to sustain growth, and experiments are made with extraction and conversion operations. Nevertheless, since there is already evidence that growth can be sustained for two or three decades a volume of timber can be expected from peat soils which will ensure a rate of return of about 2 per cent.

large proportion of it is poor. If higher prices were offered better quality land could be acquired in larger sized blocks. This would not only increase the volume of timber and total revenue, but also introduce economies in creating and establishing a forest. The rate of return, instead of being reduced, might actually increase.

Another variable affecting the magnitude of the rate of return is housing costs. Forestry houses are a legitimate cost of forest operations only if they represent a net claim on national resources. Since most of the houses built by the Forestry Division would probably have been built and subsidised by various other bodies (local authorities, etc.), there is a strong case for excluding at least part of the housing costs from total forestry expenditure.

Owing to the difficulty of obtaining land, investment in forestry tends to be based less on the return from any particular bit of land than on the return from the total area which is physically capable of producing timber and which is available to the Forestry Division. Many forests are planted on areas in which much of the soil is peaty and of low physical productivity, on areas which are too small for economic working or in relatively inaccessible regions from the point of view of transport. If these relatively inefficient forests yielding a low return on capital were brought out of production, and future investment confined to the more efficient units, the overall return to the industry would be greater.

Finally, the rate of return is affected by variations in net receipts for timber received by the Forestry Division. Given the selling price of the product the net return is increased by a reduction in transport costs and in the other expenses—felling, extraction and conversion—which are deducted from the gross price. Since forests which are being currently planted will not be extracted for another twenty to thirty years it is expected that these costs will decrease as efficiency is increased through the introduction of new techniques, more mechanisation and a better organisation of productive resources.

IV

How does the rate of return in forestry compare with what the funds might have earned in alternative investments? Many productive units in the industrial and commercial sector of the economy yield a return considerably in excess of 3·6 per cent. These, however, are characterised by a very much shorter production period and there are, in fact, very few enterprises engaged in a productive activity with a length of production period similar to that of forestry. The best indicator of the return obtained on capital invested for a long period of time is the rate of interest yielded on long-dated British Government securities and $2\frac{1}{2}$ per cent. Consols, and these indicate that the current rate is over 6 per cent. It appears, therefore, that funds invested in forestry, under present cost and revenue conditions, yield about 2·4 per cent less than they would earn if they were allocated to some other uses. But since forestry also yields imponderable benefits to which no monetary value can be attached, the receipts from this industry may be discounted at a lower rate than the relevant market rate. Or, to look at it from the other side, the government may value these imponderable benefits at more than their cost as measured by the discrepancy between the financial return in forestry and in other uses.

On comparing the rate of return in forestry with other productive activities that which is most often quoted is agriculture, particularly hill and upland agriculture¹⁷ It was mentioned above that the Agricultural Enquiry Committee claimed in 1946 that expansion of forestry was justified because it represented the best use of certain hill land areas This claim was advanced without statistical evidence of the relative productivity of the two industries, and it is the aim of this section to try and examine to what extent it was justified.

The lack of satisfactory statistical data on the financial returns of hill farming in the Province is a serious handicap in attempting to compare the relative productivity of this industry with forestry. The main data available are confined to a sample of less than 10 hill farms which furnish information on their financial operations to the Economics Division of the Ministry of Agriculture The results of this sample are analysed in the following paragraphs, but it must be stressed at the outset that the sample is extremely small and non-random and is probably biased in favour of the better equipped and more efficient hill farms, the occupiers of which are able and willing to supply information. Consequently any conclusions can only be tentative.

Table IV summarises the essential data for this sample of hill farms which were included in the Survey of Farm Accounts for three consecutive years, 1957/58, 1958/59 and 1959/60. The average and range are tabulated, and a figure of £500 representing the estimated value of the manual and managerial work of the farmer and his wife has been deducted from the net profit to give the investment income, or the income derived from the use of the total capital invested in the farm.

The capital invested in a farm enterprise in conventionally divided into two broad categories landlord's capital which includes the land, buildings, fences and drains, and tenant's capital which includes machinery and equipment, livestock, crops, etc No details of landlord's capital are included in the sample, and it has not been possible to obtain actual figures for hill and upland farms in the Province. It was hoped that a valuation of landlord's capital on the basis of current market value, as suggested by G. F. Hendry¹⁸ could be made, but the only available source of information on the current value of hill and marginal land in the Province is the price paid by the Forestry Division for the land it acquires for forestry. The average quality of land for forestry, however, is probably much poorer than that of the farms included in the sample, and it is sold with very few buildings. The average price paid per acre, therefore, is probably less than the current value of the land and buildings belonging to the sample farms. In discussions with officials of the Ministry of Agriculture it was suggested that the most reasonable estimate that could be made of the latter is £10 per acre. The value of the main classes of tenant's capital is included in the sample, and this is added to the estimate of landlord's capital to give the estimated total value of the capital assets of these hill farms.

¹⁷There is very little commercial exploitation of the peat deposits on which the majority of the forests are situated, and a survey in 1956 suggested that they were inadequate for electricity generation. Peatland continues to provide much of the fuel used in rural households.

¹⁸G. F. Hendry: "The Value of Capital Assets of Agriculture in Scotland," *Scottish Agricultural Economics*, 1955, (Vol. VI).

TABLE IV—FINANCIAL RESULTS OF A SAMPLE OF HILL FARMS, 1957-1959

(i) Year	(ii) Number of Acres			(iii) Gross Output (£)			(iv) Net Output (£)			(v) Net Profit (£)			(vi) Manual and Managerial Income (£) Average		
	Av	H	L	Av	H	L	Av	H	L	Av	H	L			
1957-58	380	1,105	142	2,285 2	3,654 9	697 2	1,312 8	2,187 6	515 8	618 8	1,108 2	18 0		500	
1958-59	371	1,055	142	2,211 4	3,887 1	554 4	1,307 7	2,392 2	466 1	654 1	1,391 0	-78 8		500	
1959-60	371	1,055	142	2,093 2	3,452 2	684 4	1,280 8	1,910 6	513 8	560 4	1,038 2	-11 2		500	
	(vii) Investment Income (£)			(viii) Estimated Value of Landlord's Capital (£)			(ix) Value of Tenant's Capital (£)			(x) Total Capital (£)			(xi) Investment Income as A% of Total Capital		
	Av	H	L	Av	H	L	Av	H	L	Av	H	L	Av	H	L
1957-58	118 8	608 2	-422 0	3,800	11,050	1,420	2,281 8	4,941 7	737 0	6,081 8	15,991 7	2,157 0	1 95	3 80	—
1958-59	154 1	891 0	-573 8	3,710	10,550	1,420	2,309 2	5,080 2	786 5	6,019 2	15,630 2	2,206 5	2 56	5 71	—
1959-60	60 4	538 2	-511 2	3,710	10,550	1,420	2,314 1	4,883 5	683 0	6,024 1	15,433 5	2,103 0	1 00	3 49	—

Note—Av represents the average figures for the farms included in the sample, and H and L the highest and lowest values respectively

Source—Calculated from data obtained from the Economics Division of the Ministry of Agriculture

To obtain an estimate of the rate of return the investment income is expressed as a percentage of the total capital invested in the holding (Table IV, column XI). The answer indicates that this estimate ranges from 5.71 per cent. to below zero. In interpreting this result it must again be emphasised that the limited size and non-representative character of the sample prevents any definite conclusions regarding the overall state of hill farming in the Province to be drawn. Nevertheless, since it is probable that the sample is biased in favour of the more efficient farms, it seems safe to conclude that the current return on total capital invested in many hill farms is less than what it could earn if it were invested in the same land under forestry. Moreover, in view of the financial assistance given to agriculture by the government this estimate of the rate of return is not equal to that which the community receives from the investment in the industry. To obtain the latter farmers' revenue should be calculated not on the basis of subsidised prices, but on the basis of the prices which would have to be paid to obtain the same products from abroad. Adjustments should also be made for the extent of subsidies on home-grown feeding stuffs, the tariff on the imported cereal feeds and the value of direct subsidies in reducing farm costs. In the absence of adequate data it is impossible to make an accurate allowance for these factors and no attempt is made, therefore, to estimate the rate of return to the whole economy from investing in hill and marginal land farming.

The degree of marginality of Ulster hill farming can also be approached by a different method. It is estimated¹⁹ that the net profit per mountain ewe in Northern Ireland is 25 shillings, and the average rate of stocking of hill and mountain land, 1 ewe to 2 acres.²⁰ In order that the farmer and his wife should receive an income of £500 for their manual and managerial labour this requires a flock of 400 sheep on 800 acres of land. A flock of this size would yield no return on capital, which, even if it amounted to only the current market value of the land (say, £10 per acre) and of the ewes (say, £2 10s 0d. per acre) would be £1,250 per 100 acres. The total capital required to carry a flock of this size on 800 acres is, therefore, £10,000, and to achieve an investment income of £360, representing a rate of return of 3.6 per cent on this capital, would require an additional sum equivalent to the net profit on 288 sheep.

There is no classification of hill farms by acreage in Ulster, but the small average size of hill sheep flocks may be indicated by the figures for the hill sheep subsidy payment. In 1960 there were 2,408 applications for subsidy in respect of a "national hill flock" of 158,000 ewes. This gives an average of 66 ewes per applicant. A more detailed study for 1952²¹ indicates that flocks of over 200 ewes accounted for 5 per cent of the total, whereas 63 per cent. of the total number of applicants had less than 50 ewes. These figures strongly suggest that the average size of the hill sheep flock in Ulster is too small to yield a rate of return on capital comparable to what could be achieved from forestry.

This is true despite the main deficiency of this approach, namely, its assumption that a hill farm relies on only a single enterprise. The

¹⁹Private communication from the Economics Division, Ministry of Agriculture (N I)

²⁰L. Symons. "Hill Land Utilisation in Ulster," *Journal of the Statistical and Social Inquiry Society of Ireland*, 1955-56, (Vol. XLX), p. 70

²¹L. Symons "Hill Land Utilisation in Ulster, p. 70

majority of small hill farms in Ulster combine sheep rearing with cattle rearing and other subsidiary enterprises including dairying, pigs and poultry. Some of these, particularly the three last named, yield a higher net profit per acre and, therefore, increase the income yielding capacity of the smaller farm. A higher net profit, however, is usually associated with a greater amount of capital so that the rate of return is not increased proportionately.

The suggestion of the high degree of marginality presented by these figures should not obscure the fact, however, that some hill farms, if properly managed and organised, are capable of yielding a return on total capital exceeding 3.6 per cent. The most important condition is that either the farms should have a large acreage of hill land or a smaller total acreage with a relatively high proportion of good quality lowland.

Finally, the rate of return in forestry also compares favourably with the rate of return on capital on many other types of farms in the Province. An analysis²² of the financial results of a sample of 330 farms, representing all types of farming practised in Northern Ireland, for 1956-57, for instance, indicated that the average investment income for all types of farms under 30 acres was £-153, and for all types between 30 and 50 acres £+58.²³

In comparing the rate of return in forestry and in agriculture it should be noted that the estimates for both industries are based on the average rather than on the marginal return to capital. Unfortunately, the latter can not be estimated with any degree of accuracy, and no definite conclusions can be drawn. Two generalisations, however, may be made. Firstly, it is probable that the rate of return on the capital involved in accommodating an additional enterprise or in expanding an existing enterprise on farms with adequate labour and management facilities, surplus building capacity and land which is under-utilised, would be relatively high. This is because expansion of this nature involves a consideration of only direct costs (mainly feeding stuffs, seed, fuel and repairs), and the sample of farm accounts shows that the gross profits (total receipts—direct costs) for most agricultural commodities are high. On the other hand, the burden of compound interest in forestry means that the return to the marginal unit of capital, even in the second production period when it is not necessary to incur the capital expenditure of creating a new forest, is unlikely to be much greater than the estimates calculated above.²⁴

Secondly, the rate of return in agriculture is fundamentally related to the present system of farming. A reorganisation of the uneconomic holdings into larger, more efficient units, and the adoption of new husbandry techniques could probably raise the rate of return to the level which some efficiently managed units are already achieving.

The preceding comparison of the return to capital under forestry and

²²D. E. L. Thomas. 'Farm Types and Farm Incomes,' *Land Use in Northern Ireland*, Chapter 10. University of London Press, 1962.

²³Since no precise information on the total amount of capital invested in these farms was available, it has not been possible to estimate the rate of return. It is apparent, however, that there was no rate of return on average on the capital invested in farms less than 30 acres and the rate of return was probably very low on the capital invested in the farms between 30 and 50 acres.

²⁴Assuming, of course, that the present ratio of other costs to revenue remains constant.

agriculture is based on current costs and prices. The relative productivity of current investment in these industries, however, depends on the relation between the prices ruling in the future, that is on the terms of trade between these industries.

Various indices are available which suggest that there has been a definite upward trend in the prices of agricultural and forestry products since before the war, and that timber prices have increased at a faster rate than prices in general. These, however, are of limited value in indicating what prices are expected to rule when currently planted forests reach maturity. In fact, the long time interval prevents meaningful price estimates from being made, and the most that can be done is to consider the main factors which are likely to influence the future world supply and demand situation.

With given tastes and preferences, the price of timber products and of all other products, the demand for timber will increase as the level of the real gross national product rises. There is at present a wide disparity in consumption per head of population, throughout the world, with the highly industrialised countries showing the highest, and the under-developed regions the lowest figures. As economic development progresses in the latter areas consumption of timber products is expected to rise steeply. But tastes and preferences and the prices of substitute materials are unlikely to remain constant, and demand will also be affected by changes in these. In particular, the consumption of timber for construction, mining and wood working industries is expected to rise at a slower rate than for packaging, printing, textiles and other pulp products. The market will be extended as new uses for the product are discovered, but some traditional uses will decline or disappear as new substitutes for timber are developed. It is impossible to say on balance which of these two alternatives will be more important.

The discovery of new techniques for exploiting and converting into pulp products the remaining areas of accessible forest which have not yet been cut, and currently inaccessible forests, a high proportion of which consist of hardwoods, could increase the supply of timber products. But timber is a replaceable asset and the afforestation programmes now being implemented in various parts of the world will increase the supplies available for the future, while more systematic management of existing woodlands should increase the yield per acre. Many regions including Africa, Asia, Latin America and the Pacific area, with large home supplies of timber are at present net importers. Provided these meet their future requirements from their own resources a greater supply would be released to satisfy demand in Europe and North America.

A number of studies of the demand and supply situation for timber products have been made recently.²⁵ Bearing in mind that the reliability of their conclusions depend on the validity of the assumptions relating to the variables influencing timber consumption and supply, it is interesting to note that there is no suggestion that the future relationship between demand and supply is likely to cause a fall in timber prices relative to the prices of other industrial commodities.

There also appears no reason to believe that the prices of agricultural products will rise faster than the prices of forestry products. The fear

²⁵These are analysed in *World Timber, Trends and Prospects*, by T. Streyffert, Almqvist and Wiksell/Gebens Förlag AB, (Stockholm, 1958)

of a shortage of agricultural products which was prevalent in the years immediately after the last war has not been justified for the Western economies. They discovered that production could expand rapidly, and their current problem is rather how to minimise the effect on producers' income of the fall in market prices from surpluses of various commodities. The problem of over production in these countries is very much accentuated by the obstacles to the transfer of food supplies to the under nourished and less economically advanced areas, but even if these were removed in the near future two other factors would tend to have a depressing influence on farm prices. Firstly, the low income elasticity of demand will mean that food consumption will increase relatively slowly as national income rises. Secondly, since an increase in agricultural efficiency tends to be associated with an increase in output, supply is also likely to increase.²⁶

Thus while no definite conclusions can be drawn, it does not appear at present that agricultural prices are likely to rise faster than forestry prices. The implication of this is that there is no justification for currently investing in agriculture rather than forestry because of an impending shift in the terms of trade in favour of farming.

VI

Of the other investment criteria listed in section III the most important for the economy of Northern Ireland is undoubtedly the provision of employment, both directly in forestry and farming, and indirectly through the establishment of new industries and the increased incomes generated. Before analysing this criterion, however, it should be noted that in discussions relating to the utilisation of hill and marginal land in the United Kingdom as a whole considerable importance has been placed on two others, namely, the contribution of the investment to the balance of payments, and the role of the hill areas as a breeding and rearing reservoir for cattle and sheep for lowland farms. The balance of payments criterion is of no direct importance in judging the merits of a particular investment in Ulster, and it is obvious that an increase or a decrease in investment in either forestry or hill farming in the Province would have only a marginal effect on the United Kingdom balance of payments. In connection with this criteria, however, it is important to remember that although an increased supply of both agricultural and forestry products would help the balance of payments by diminishing expenditure on imports, this contribution has to be weighed against the possible alternative use of the resources involved in other industries producing import substitutes or exports. Since nearly 70 per cent. of the total number

²⁶The absence of conclusive evidence indicating that agricultural prices in general will increase relatively to forestry prices does not preclude however, the possibility of the prices of individual products exhibiting important changes. In particular, it is possible that if the United Kingdom joins the Common Market, economic conditions will favour beef and sheep farming relative to dairying and pig and poultry rearing. This would increase the competition for forestry land, but it could also mean that many of the smaller marginal farms which rely heavily on milk, pigs and poultry would have their profits reduced. In that case a greater supply of land would eventually come on the market which could be distributed between forestry and agriculture according to the principles described below.

of sheep and 12 per cent of the total number of cattle in the Province are carried on the hills, the effect of forestry expansion on the efficiency of the livestock industry is of greater significance to the economy. Nevertheless, since possibilities exist for raising the stock carrying capacity of hill areas and for expanding breeding and store rearing in the lowlands, this effect must not be exaggerated.

The number of permanent workers directly employed in state forestry has increased from 160 in 1939 to 1,460 in 1958. Employment has increased at a much faster rate than the acreage under trees, and this is reflected in the decline in acreage per worker from 95.6 in 1939 to 39.6 in 1958. Employment in agriculture on the diversified land acquired for forestry is difficult to assess accurately, but as a rough estimate it may be inferred that it is unlikely to exceed 1 man per 100 acres. This estimate is a broad average ranging from 3 to 4 persons in regions of small farms to none on the totally unproductive peat moorland country. If this estimate is accepted, employment per 100 acres in forestry in 1958 was two and a half times the average number employed in agriculture on the type of land acquired for forestry.²⁷ Since a high proportion of forestry employees, however, is recruited from agriculture, the net increase in employment in rural areas as a result of forestry expansion is relatively small. Its main contribution is to reduce the degree of under-employment in agriculture and retard the process of rural depopulation.²⁸

In future, employment per unit of land in forestry will depend on the extent to which the extra labour required as more forests reach the thinning stage will be balanced by reductions caused by the progress of mechanisation and other measures designed to increase efficiency and output per head. Future employment in hill and marginal land farming will depend on the progress of the amalgamation of holdings, introduction of labour saving devices and migration of labour into other industries. The relative contribution of the two industries will also depend on the density of population in agriculture prior to transferring the land to forestry.

The relative ability of both industries to provide employment should also be related to the standard of living which each employee can achieve. Forestry currently supports 2.5 men on 100 acres at a weekly wage of at least 168 shillings, but a farmer with 100 acres of the average type of land acquired for forestry would in most instances obtain a net income considerably lower than this. It would probably take a farm of at least 500 acres to earn a comparable net income.

²⁷A sample of 16 forests indicated that on an average 80.5 per cent of the forest employees were either previously engaged in agriculture or the sons of farmers.

²⁸The extent of its contribution to the problem of rural depopulation, however, can easily be exaggerated. Between 1950 and 1958 the number of persons in civil employment in agriculture and fishing declined by 22,050, whereas employment in forestry increased by only 880, which is equivalent to an increase of less than 20 men per county, per year. If we assume that 80 per cent of the employees enrolled for forestry were absorbed from agriculture, the total contribution of forestry in the period was just over 700 men. In fact, the decrease between 1957 and 1958 of 4,112 in agricultural employment was over 4 times as great as the total increase in forestry employment between 1950 and 1958, or, nearly 3 times as much as the total number permanently employed in state forestry operations in 1958 (1460). It is apparent that forestry can make only a marginal contribution towards stemming the "drift" from the land if it continues at its present rate.

(£400 approximately). Thus forestry with its present employment ratio could employ remuneratively on the average type of land it acquires about twelve times as many as farming.

To obtain the net overall employment effect of investing in forestry relative to hill farming it would be necessary to know : (i) the number of men recruited in new industries which might be established using wood as a raw material, (ii) the employment in ancillary occupations connected with the timber trade, including transport and local servicing trades, (iii) the extra employment generated by the spending of the income of forestry workers and employees in wood using and in ancillary industries and (iv) the effect of forestry expansion on employment in the hill farming industry. No precise calculation can be made of the importance of these factors, but the most important effect on net indirect employment probably depends on the possibility of establishing local wood using industries

The prospects for investment in wood processing industries are not discussed here, but it may be noted that they raise an interesting point concerning the net productivity of forestry development to the whole economy. Variations in the price at which timber is delivered to pulp and board mills exert a considerable influence on their profitability, and one method, therefore, of encouraging investment would be to offer timber at reduced prices. If this attracted investment which might not otherwise have occurred, the decrease in the profitability of forestry might be more than balanced by some useful gains to the economy.

VII

Conclusions and recommendations

Since no attempt has been made in this article to evaluate those investment criteria which cannot be measured quantitatively, and the analysis of the rate of return and employment is based on inadequate data, no definite conclusions can be drawn of the relative net social productivity of investment in forestry and other industries. Nevertheless if the comparison is confined to forestry and hill farming it may be suggested that forestry should acquire a greater supply of land, and of a better quality, than it has acquired in the past.

Firstly, despite the post-war policy of investing large sums of money in hill and marginal land agriculture in an attempt to reconstruct it on an economic basis there are still many farms which currently yield no return or a very low return on capital. An analysis of a sample of 20 forests suggests, on the other hand, that the average return calculated on the basis of current costs and prices is probably between 3·0 and 4·4 per cent. Moreover, there is no evidence to indicate that future movements in prices will favour agriculture rather than forestry.

Secondly, it is very probable that an efficiently organised forestry industry would contribute more towards stability in rural areas and the prevention of migration to the towns and overseas than the present system of keeping small uneconomic farms in production at a very low standard of living. Forestry will maintain if not increase, the present density of population in these areas.

To obtain a better allocation of land the government should conduct a detailed survey into its potential productivity, and compare the

relative costs and returns of various regions under timber and agriculture. Such a survey could only be undertaken if data were available of the financial productivity of the two industries, and the first step, therefore, is to arrange for their collection. The survey would indicate those areas in which each industry has a comparative cost advantage and this could then be modified in the light of other investment criteria. The final result would indicate the ideal allocation of land between forestry and agriculture when all policy objectives are considered.

What policy changes are necessary to achieve the allocation of land as suggested by the results of the survey? The present indiscriminate subsidisation of farms which have virtually no chance of achieving a reasonable return on the capital employed should be discontinued, and the grants and subsidies confined to holdings which are most likely to become viable economic units. This would, by gradually forcing the inefficient farm units out of production, result in their consolidation into holdings of an economic size or increase the supply of land available to the forestry industry.

To accelerate the acquisition of uneconomic farms for forestry the present methods of acquiring land should be changed. The present role of the County Agricultural Executive Officers who decide on the type of land which is suitable for forestry, would be dispensed with by the Survey but, in addition, the Forestry Division should adopt a more positive approach. It should become an active agent in the land market offering to pay higher prices for land than it has done in the past. This would increase the willingness of farmers to sell and enable the Forestry Division to establish larger and more efficient forest units.

APPENDIX

TABLE A—STATE SUBSIDIES AND GRANTS PER ACRE OF ROUGH GRAZING

Year	Total Subsidies and Grants	Area of Rough Grazing	Subsidies and Grants per Acre of Rough Grazing
	£	Acres	Shillings
1946	264,000	716,756	7
1947	229,000	695,260	7
1948	336,000	711,520	9
1949	281,000	717,631	8
1950	253,000	708,164	7
1951	237,000	709,988	7
1952	217,000	696,857	6
1953	416,000	690,518	12
1954	428,000	675,580	13
1955	499,000	674,880	15
1956	401,000	674,830	12
1957	616,000	723,520	17

Source : Calculated from Ministry of Agriculture Reports

TABLE B—CAPITAL EXPENDITURE OF FORESTRY DIVISION PER 100 ACRES OF FOREST

Item	Expenditure per 100 Acres	Number of Years Expenditure Discounted
	£	
Land acquisition .. .	650	0
Forest creation and establishment .	5,000	3
Brashing	900	20
Road construction :		
Half expenditure incurred in first year	750	0
Half expenditure incurred in twentieth year .	750	20
House construction	820	3
Maintenance of forest	150 p a ¹	0-50
Maintenance of roads :		
Half expenditure incurred for 50 years	25 p a	0-50
Half expenditure incurred for 30 years	25 p.a	20-50

¹per annum

Source : Ministry of Agriculture (Forestry Division).

TABLE C.—ESTIMATED AVERAGE PHYSICAL PRODUCTIVITY OF 100 ACRES OF FOREST (HOPPUS FEET)

Year of extraction	Thinnings					Main Crop	
	20	25	30	35	40	45	50
Volume	19,774	32,972	33,872	32,249	34,215	31,463	335,475

TABLE D—ESTIMATES OF CURRENT NET AVERAGE RETURN PER HOPPUS FOOT OF TIMBER EXTRACTED AT GIVEN YEARS (PENNY PER HOPPUS FOOT)

Year of extraction	20	25	30	35	40	45	50
Most likely estimate	—	—	10	13	18	24	30
Upper limit	—	—	13	16	24	33	45
Lower limit	—	—	7	10	12	18	24

TABLE E—REVENUE FROM 100 ACRES OF FORESTRY OVER A 50 YEAR PRODUCTION PERIOD (£)

Year	30	35	40	45	50
Most likely estimate	1,411	1,747	2,566	3,146	41,934
Upper limit	1,835	2,150	3,422	4,326	62,902
Lower limit	988	1,344	1,711	2,360	33,547

TABLE F—CAPITAL EXPENDITURE OF FORESTRY DIVISION PER 100 ACRES OF FOREST DISCOUNTED TO BEGINNING OF PRODUCTION PERIOD (£)
PRODUCTION PERIOD=50 YEARS

Item	Expenditure Per 100 Acres	Number of Years Expenditure Discounted	Rate of Interest						
			0	1	2	3	4	5	6
Land Acquisition	650	0	650	650	650	650	650	650	650
Forest Creation and Establishment	5,000	3	5,000	4,854	4,712	4,579	4,444	4,318	4,198
Brushing	900	20	900	738	606	499	411	339	281
Road Construction									
Half Expenditure incurred in First year	750	0	750	750	750	750	750	750	750
Half expenditure incurred in Twentieth year	750	20	750	615	505	416	343	282	234
House Construction	820	3	820	796	773	751	729	708	688
Maintenance of Forest	150 p a	0-50	7,500	5,860	4,714	3,855	3,220	2,739	2,364
Maintenance of Roads									
Half expenditure incurred for 50 years	25 p a	0-50	1,250	977	786	642	537	456	394
Half expenditure incurred for 30 years	25 p a	20-50	750	528	377	271	198	144	107
Total			18,370	15,768	13,873	12,413	11,282	10,386	9,666

DISCUSSION

Mr. Simpson of the Forestry Division, Ministry of Agriculture, said he had much pleasure in proposing a vote of thanks to Mr. Thomas because (a) a personal reason—Mr. Thomas came to the Forestry Division on several occasions to obtain details for his paper and they were interested in it, he was sorry they could not give Mr. Thomas all the information he wanted; (b) because of the importance of the paper—it should be stressed how little is known of the subject. It is highly necessary that this paper should be brought before the Society and the emphasis not being on the economic aspects of forestry. Both in Northern Ireland and Great Britain the Forestry Divisions have bought a lot of land which is not likely to be productive. There is a question of policy. Compared with Great Britain the Forestry Division in Northern Ireland has bought a larger proportion of this poor land. Question of size—this has been forced on his Department owing to the land tenure system. They would prefer larger units. Having accepted poor land, small size of block in the past, his department has employed men on relatively small schemes, giving employment when it is needed. This has given problems, but the work is not now available. Doing work on unproductive land which might prove productive might not be economically justifiable but it gives work and is socially desirable. Does Forestry pay?

His Department had received two accounts from forests which do show a profit. Mr. Thomas has visited forests and farms and gone to a tremendous lot of trouble in preparing this excellent paper.

Dr. Symons said he joined with Mr. Simpson in moving the vote of thanks. Mr. Thomas had performed a valuable service in comparing the return on capital between forests and farms but he has been handicapped by lack of data. There is a clash of Government policy. Forests were hampered by units being too small for economical operation and the Forestry Division were trying to make these small units pay. In New Zealand a forest of 10,000 acres was considered quite small, but there are some of 250,000 acres. He felt that no one should be content to have many units less than 1,000 acres. If the Forestry Division was allowed to pay more for land it would be a considerable help. Farmers received more help in the way of subsidies for their lambs than New Zealand farmers. Size of forest units is part of the explanation why forests are not more successful, but they could employ more men than hill farms and prove more profitable.

Mr. Larmor said that bare mountain land used for sheep was no use for forestry. He thought some confusion had arisen by comparing large scale forestry with small scale farming. He felt it would be better to compare like with like.

Mr. Thomas Brown asked what proportion there was of private planting and what was the position with regard to taxation. Mr. Thomas replied that it was small but tended to increase, but still very small in proportion to Government planting.

Mr. Shemilt, Ministry of Agriculture, said Mr. Thomas' paper was an excellent study of the situation. Subsidies were not a matter for the County Agricultural Executive Officers but were decided by the Ministry. It was a pity that accounts could not be given from hill farms, in fact more detailed accounts to give a true picture. It was present policy to encourage larger farm units and these could be made more profitable. This policy could bring long term results. The number of larger farms was growing even if slowly. Encouragement was also provided for top class management and this with large farm units might show a more prosperous picture for farming.

Dr. Jack, *Mr. Harbinson* and *Mr. McIlreavy* also contributed to the discussion.

Dr. R. D. C. Black congratulated Mr. Thomas on his excellent paper which had produced a lively discussion. This was the last meeting of the session and he hoped that in the Autumn the Society would have an interesting programme arranged for the next session.