IRISH FORESTRY

Volume XVIII. AUTUMN, 1961. Number 2

The Planning of Forest Engineering Activities *

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FOREST engineers are usually associated with forest roads. Can you think of anything less likely to fire one's soul with inspiration? A newly-constructed road, which is little more than a track hacked from the hillside, serves a purely functional purpose—that of timber extraction and general administration. Perhaps in thirty or forty years time the poet may see it mellowed into the forest scene, set in a silhouette of leafy shade. To-day—it is just a forest road. Therefore, at first sight, the activities of the engineer in the forest would appear to be not only unexciting, but, also, more or less detached from the other main branches of forestry. In fact, such is not the case.

Forest engineering (including timber extraction) is an important part of the whole managerial plan. It is not a 'thing apart', but influences, and is influenced by, the policies of silviculture, management and utilisation. In the numerous situations where one man is in charge of all branches within his area, e.g. the average District Officer or Estate Agent, he should be conscious of the inter-relationship of policies to achieve efficient overall management. He must let his left hand know what his right hand is doing. If there are engineers, as distinct from foresters, working within and for the organisation then it is doubly important that liason should be complete and harmonious. An awareness of this inter-dependency must be developed among all the staff, and this may best be achieved by an understanding of each other's needs and difficulties.

Ever since its inception in 1919 the Forestry Commission in the United Kingdom has employed an increasing number of District Officers and foresters to form an efficient organisation. The quality and extent of its plantations (in spite of war and a scarcity of available land) testify to the efficiency of the Commissioners and their employees. However, soon after the war, there was introduced into the Commission a band of civil engineers who were employed primarily for the con-

^{*} Paper read at the Annual General Meeting of the Society of Irish Foresters, Dublin, 11th March, 1961.

struction of forest roads. It was not clear whether they formed a separate Engineering Branch or whether they were an integral part of the whole organisation. Whatever the relationship, there was little doubt that the Commission suffered from quite severe teething trouble. All sorts of medicines were used to ease the agony. Such was the pain that the patient was not at all sure whether he wanted to have teeth, especially if getting them was so distressing. Neither the sharp tongue of the Commission nor the back-biting of the teeth helped matters. Even 'extraction' was resorted to, in cases where the teeth were assumed to be bad. My qualification for indulging in this metaphoric tale is that I was one of the teeth. Not, I might add, the wisdom tooth. Nor was I extracted—I fell out naturally.

This somewhat unpleasant chapter is now ancient history, but important enough to deserve recording. It is my opinion that the unquestioned harmony which exists between the Commission and its 'Engineering Branch' to-day could have been achieved much sooner and much less painfully. I venture to suggest that when the planning of engineering activities was mooted the first item should have been concerned with the psychological and educational aspects of integration. It is an unfortunate facet of human nature that we feel like 'taking it out' of the 'new boy'—just in case he might become bumptious—with the result that the innocent are punished with the guilty. If too much wind is taken out of one's sails one can very easily drift into the doldrums.

It is my intention, to-night, to survey briefy the influence which the engineer has on the other branches of forestry. It will possibly form a basis on which advice and guidance might be given to an engineer on entering the forestry profession. It is quite likely that the Irish Forest Service may wish to extend the use of engineers before very long. It could be equally useful to a District Officer responsible for all the branches of forestry.

The chart (Fig. I) briefly outlines the various aspects of forestry which are influenced by engineering and extraction. They are set out in no particular order and are by no means complete; they may be referred to under the following headings :----

Silvicultural Systems.

There is no scarcity of silvicultural systems. India and Europe abound in them. Professors propose them; students invent them; nature even tolerates them! They flow like flood water from the mouths of every member at a Society Outing. The choice of system affects the cost and method of extraction quite appreciably. If we are to plan future economic extraction effectively it is almost essential to know the probable thinning plan. Most woodland owners and, I dare say, the majority of State Forest Organisations to-day are in forestry for the money, although it is fully realised that there are supplementary reasons for growing trees, such as the relief of unemployment in some districts,



Figure I.

amenity, the preservation of game, as shelter or to form a national reserve. In commercial forestry the uneconomical silvicultural system, however ideal in theory, will be sacrificed for the sake of sound economy. It is very common now, especially amongst private owners, to thin heavily in order to cheapen extraction and obtain a quicker return.

Generally speaking, the Extraction Engineer dislikes logging from mixed plantations or from systems which necessitate light and scattered fellings. The clear felling of a heavy-yielding single-species stand is the logger's delight. Of course, many different silvicultural systems and mixtures are correctly advocated for various reasons such as the conservation of soil, the obtaining of maximum or sustained yields, or the encouragement of natural regeneration, etc., but the implementation of any treatment in a good plan will have been costed and due account taken of the considerable differences in extraction cost which results from using a different silvicultural system. It just would not be good enough to make calculations of profit based on an "average" extraction cost. The true value of timber to the grower is when it is at the mill not at the stump. To boost that he can sell 'standing' is a 'red herring' —the price offered will take into account the difficulty or otherwise of extraction.

Establishment.

Surveying and map making is a much jollier subject—it is precise and there is little room for argument. There is something oddly humorous about the other fellow ending up in the wrong county—like one's friend falling on a banana skin. Prior to, and during, establishment, the engineer may be asked to carry out surveys and prepare plans. He is well trained for it and such employment would help to broaden his views on forestry. The checking and setting out of boundaries, the location of rides and fire lines, etc., need not be the prerogative of the silviculturist, certainly not in an organisation in which the aim of all employees is to produce trees and timber.

Liaison will be necessary for the possible provision of access roads, the cost of which will be debited against general administration and fire protection. It is very doubtful if it would be sound economics to lay out much money on access roads as the interest in the capital involved is generally greater than the gain in lower establishment costs. If some roading is to be built in the early life of a plantation (perhaps for fire protection) then it should be constructed prior to planting. To plant and then realise the need for roads because of the danger of fire is bad planning. It happens!

Labour.

There are few factors of forest management more likely to lead to wastefulness than a lack of co-operation between forester and engineer regarding the employment of labour in sparsely populated areas. This

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is particularly noticeable when the two separate camps are vying against each other not only for the labourer's particular skill, but also for the purpose of maintaining an adequate labour force on his books. There is, at the moment, in labour-scarce Britain, a distinct tendency for firms, during slack periods, to reduce the working days of all employees rather than to operate a redundancy scheme. The system has its advantages, as well as disadvantages, both for worker and employer but, on the whole, it is nationally wasteful. In the forest there is the opportunity of operating a scheme of full-time employment. Integration of forest and engineering activities supplies an answer, provided the year's work is planned co-operatively in advance.

Mechanisation.

Much of the machinery used in forestry, from establishment to delivery of the timber in the mill, has been developed or borrowed from other professions, chiefly agriculture and civil engineering. Now forest machinery development is going ahead, but we are still just beginning to travel the path of development leading to complete mechanisation. Scientific progress is so rapid in all other branches of industry that every effort in forestry will be required in order to keep pace. More help is required from higher authority for promoting forest machinery research. The problem is a general one and not particularly influenced by engineers and there is little chance of the engineer influencing higher authority, so we will leave the matter there.

Utilisation.

The various branches of forestry are so intermingled that it is difficult to single out all the aspects of engineering influence. Utilisation is the 'bread and butter' of forestry (there is little or no jam) and on it depends the whole work and success of forestry.

Of direct importance to the Extraction Engineer are the policies concerning conversion centres and the position of mills. Regarding the former, the trend now appears to be to haul the tree in full length to break-down depots prior to loading on a lorry. Several recent Russian publications advocate the hauling of the whole tree, including foliage, to strategic centres. It is maintained that the conversion is more easily mechanised, there is less waste, the hauling effort is, if anything, reduced and the floor of the forest is kept clean of brush. The last advantage is debatable.

The siting of saw mills, pulp mills and chipboard factories affects the engineer to a much lesser degree. In the most general terms the location of large utilisation mills will depend on many factors including the following :—

The quality, quantity and distribution of the raw material (wood); the minimum requirements of the mill for economic working; the mill size/cost of unit output ratio; and the transport system.

Whether or not there should be intermediate break-down centres between forest and mill will partly depend on the saving to be made on the transport of semi-processed material compared with the cost of that breakdown. With reference to Fig. II the complete timber movement plan is economically correct when the sum of A,B,C,D,E,F, and G is at a minimum.

Other considerations influencing the engineer would be the size, shape and moisture content of the logs most acceptable to the mill. The plan is quite fluid. Suggestions are actually being made that chips, suspended in water, might be transported by pipeline.

The point to note is that the engineer, like everybody else concerned,, should be 'in the picture' regarding the link-up of forest roads, conversion centres and mills. Only then can local planning be made (and adapted, if necessary), to fit into the overall scheme.

Economics.

A good forester is not a man who grows trees and produces timber —but, rather, a man who does it economically. Thus, the method chosen to carry out any action towards one's aim must be the cheapest, provided the standard is satisfactory. The three most important aspects within the compass of the engineer are :—

- (a) The cheapest form of road construction which will carry the loads safely. This he does by designing to minimum standards.
- (b) The density of forest roads which will ensure the cheapest extraction. This he calculates for the area concerned.
- (c) The cheapest form of off-the-road extraction without causing damage. This he practices and carries out investigations into new methods.

The Timber Movement diagram (Fig. II) clearly indicates how the economics of all these three aspects influence the economy of the forest in general. In the study of standard, location and method there is plenty of unexplored ground between engineer and forester which requires development.

Protection.

The Achilles' heel of the engineer to an antagonistic forester (if there is such a person) is Forest Protection. If all else fails the engineer can be accused of imperilling the forest to a succession of major catastrophies.

By laying out the road lines prior to planting, thereby avoiding having to cut through an existing plantation, he can help to lessen the chances of windblow. A knowledge of the causes of windblow would be most valuable in the actual planning of a road scheme.

During and after extraction the timely removal of timber and the



Figure II. The means of transporting and processing timber is correct only when the sum of A, B, C, D, E, F and G is a minimum.

cleanliness of the floor are fairly obvious principles of forest hygiene. The physical care necessary during extraction and, indeed, for all engineering work is equally obvious and just as important. Examples of unwilful damage caused by engineers include the destruction of tree tops by careless blasting; damage to crops and soil by the movement of machines and plant; the erosion of soil because of faulty drainage works; and spoiling the amenity value of particularly pleasant areas by opening up quarries or constructing to an ugly design. There are many other damaging effects of an engineer's work but the vast majority of them could be avoided by encouraging the engineer to take an interest in the protection and amenity value of the forest.

It has always been a surprise to me to find that engineers are disassociated completely from fire protection. The road plan, the timing of its construction, the design and location of dams and fire towers and the actual fire-fighting plan and its implementation are all of direct concern to the engineer.

Anyone who accuses me of trying to sell engineers to forestry might be forgiven but, in actual fact, that has not been my intention. Rather, it has been just the reverse. It is to ask you to sell or give away forestry to the engineers. Despite their shortcomings, if engineers are shown the whole picture they will understand and, in return, will love and care for the forest. It was also my intention to encourage the forester to allow his engineering instincts and interests to intermingle with his silvicultural knowledge. Failure, on his part, to do that may possibly limit his views to a narrow, flat and dull picture instead of opening up a wide, exciting and stereoscopic image.

What of the future? To foresee that there will be change is simple but to forecast the details of the change almost impossible. Man's scientific progress is 'snowballing' and it is probable that the important changes in forestry will come from outside the industry.

Although timber is replaceable it is not vital. There are many indications that the change which is taking place in wood utilisation will accelerate. As a fuel it has been almost superseded. As a building material it is losing its importance. In spite of the greater magnitude of the building programme in Britain, less timber is being used each year, chiefly because of the increased use of concrete and plastics and the trend in design to flat roofs. In the furniture industry new materials are being introduced and smaller quantities of solid timber are being used. It is in its broken down form that wood is finding an outlet of increasing importance. There is a school of thought claiming that a forest will soon be valued in terms of its cellulose content. Research into the breakdown of wood might possibly be more profitable than the growing of big trees. If that is true, and every indication points that way, it must have a marked effect on the managements of forests and consequently on the methods of extracting the crop. (Forgive the heresy), but might it not be true that the European management systems may have outlived their usefulness. Only an engineer, ignorant of

forestry, could afford or dare to suggest such a thing—please forgive me. I foresee our forests limited to two or three short-rotation softwood species, managed to give the maximum cellulose yield. There will be complete mechanisation in which the trees will be patch-felled and dropped into the hoppers of local factories to be broken down into chips, pulp and cellulose.

Much later still the importance of wood will give way to other more easily produced materials. The purpose of the forest will gradually change from timber production to amenity and soil conservation. The clamour for scattered hardwoods instead of dense echeloned conifers will assert itself at the time when man's material requirements are satisfied. But before that time there will be an era of intensive forest management for which the plans should now be made.