American Forestry and Forest Management — An Introduction[1]

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Summary

Some general aspects of American forestry are discussed. This is followed by a brief outline of forestry in the Pacific North West and the Lake States and some aspects of management in these two regions examined.

INTRODUCTION

The first essential step towards an understanding of American forestry is an adjustment to one's scale of thinking. There are 650 million acres of forest land in the United States and over half of this area is in private ownership. As one would expect in such a vast country, there is a very wide range of vegetation types — from sub-tropical swamps to sub-arctic tundra. In this short paper it is impossible to present a comprehensive picture of American forestry. Consequently, I intend to consider a few aspects of American forestry which may be of interest to the Irish Forester. In so doing it is hoped to provide a background for the two papers which follow.

GENERAL CONCEPTS

The National Forests

A few words now on the National system and its adminstration. There are 151 National forests totalling over 180 million acres and they are administered by the U.S. Forest Service, which is an agency of the Department of Agriculture. The National forest system was formed in relatively recent times, with the setting aside of the Yellowstone Park Timberland and Reserve in 1891.

These forests are now organised into 10 regions, with a Regional Forester as the administrative head. Next in rank is the Forest Supervisor, who is the manager of a National forest (average area 1 million acres). Each forest is sub-divided into Ranger Districts (equivalent to the "beats" in the Forestry Commission) each of which is staffed by a District Ranger, who is the "on the ground" manager in charge of all technical work. He can be considered as the equivalent of our Forester, except that the area under his charge is usually about 100,000-400,000 acres. All technical staff from the Chief of the Forest Service to the most junior District Ranger must have a college degree in forestry, or a related subject and there is no Forester grade in the Service as we understand the

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term. All timber in the National forests is sold standing to private wood processing firms or contractors and in recent years the revenue from produce sold has been in the region of $100 million annually.

Multiple Use

One of the first and most important forestry concepts that the Irish Forester is likely to encounter in America is that of Multiple Use. The principle of Multiple Use is interwoven into the policy of the Forest Service and dominates the thinking of most American foresters. The multiple use of forest land has been applied in the United States for a number of years but was only given full recognition by Act of Congress in 1960. This Act directs that the five basic renewable resources of the National forest lands shall be utilised in the combination that will best serve the people of the United States. The renewable resources are named as Watershed, Timber, Range, Recreation and Wildlife. The emphasis is on positive management and utilisation of these resources rather than preservation.

When there is an abundance of natural resources and few people, there is little need for multiple land use but when an increasing population must rely on an unchanging or indeed diminishing resource base then the need to make the most effective use of these resources is self-evident. Thus multiple use helps to overcome the problem of scarcity. It tends to resolve conflicts of interest and competition for resources and promotes balanced resource use. An important point to remember, however, is that under this system of management it is seldom possible to get optimum production of any one resource, because of the concessions that have to be made to accommodate other resources. For example, in a forest managed for the production of timber, recreation and wildfire, one may have to forego the maximum production of timber in order that the other two uses can be accommodated.

Let us now look at the principle of multiple use in relation to our own Forestry Division. Until very recently it could be said that our forest lands were managed for the production of only one resource — namely timber. However, with the establishment of Tollymore Forest Park in 1955 and the appointment of a Wildlife Investigation Forester this year, we appear to be moving imperceptibly into multiple use management of our forest land. As the pressure of population on our resource base increases, then multiple use management is likely to become more widespread in our Division.

Recreation

The application of multiple use management is not without its problems and I would like to illustrate this with reference to recreation. The problem is that of how to determine the proper balance or combination between the five main types of value that forests can provide. This has been referred to by Dr. Vaux of the University

of California as "a national problem of primary importance . . . for determining the future trend of many forest based industries". In recent years, for an increasingly important part of the commercial forest area of the United States, the production of timber and recreation have come into sharp competition for the use of land. This situation is likely to intensify, as the demand for recreation is rising more rapidly than the demand for wood. In 1959 there were 81½ million recreation visits to the National Forests and a recent projection forecasts 230 million visits in 1975 and 600 million by the year 2000.

There is no convenient existing system whereby these two forms of land use alternatives can be balanced, as the normal laws of supply and demand to not operate. A further difficulty is that the various uses often have intangible values which are difficult to express in monetary terms. It is argued by some people that the traditional policy of free recreation on public lands is obsolete and that the problem could be alleviated by a reasonable system of charges on the recreationalist. Where recreation use is light, a policy of free recreation can be justified. In some areas in the United States, however, recreational facilities are inadequate to meet present levels of use and there is a danger that the recreational values themselves may be destroyed by over use. A system of charges would tend to reduce recreation demand and have a rationing effect and at the same time provide funds for additional developments rather than drawing on the general taxpayer. More important, however, this charge system would give the owners of private forests an economic incentive to develop recreational facilities on their land.

In our Forestry Division, recreation is virtually free although we do make nominal charges for car parking, camping and caravanning. This policy is justifiable at present but as the level of use increases, as indeed is the case at Tollymore Forest Park, it may be desirable to introduce a system of charges which would tend to divert recreationists to Mourne or Rostrevor forests or to a private estate. Charges for camping and caravanning are particularly important as nominal charges in Forest Parks would undoubtedly preclude the development of sites by private individuals.

Research

Without wanting to impinge on Mr. Gallagher's paper, I would like to stress the strong link between research and forest management in the United States. Wherever I travelled, I was conscious of the importance which the forest manager attached to research. This is shown in the research organisation of both the Forest Service and private industry. The Forest Service has nine fully equipped experiment stations which work in close co-operation with the Forest Regions mentioned earlier. The recently established Forest Research Centre of the Weyerhouser Corporation at Centralia, Washington,

is indicative of the importance which private industry attaches to research. This research centre is staffed by 17 highly qualified workers under the direction of Dr. G. S. Allen, who formerly held the chair of Forestry at the University of British Columbia. Dr. Allen in a recent report of the work of his centre sums up the whole attitude to research in America as follows:

> "These are no ivory tower people delving into the unknown for sheer excitement but down to earth trouble shooters working largely in the forest in close co-operation with the tree-farm field-staffs. Their job is to recognise problems, find solutions and tailor the latter for practical application. The objective is to point the way to practices that will enable the Weyerhouser Company to grow better forests more economically".

In this country research is still regarded as something of a luxury rather than an essential investment to provide a sound foundation for management decisions. In our Forestry Division our research organisation consists of one Forest Officer (part time only on research) and one Forester who is mainly engaged on field work. In addition, some research work is done in co-operation with other Government Departments. One wonders, however, if our present research organisation is adequate to serve an industry with an investment to date of around £12 million.

THE PACIFIC NORTH-WEST REGION

Introduction

Virtually all the remaining old growth timber in the United States is in this region. There are 121 million acres of commercial forest land, which represents 25% of the nation's total commercial forest land but they carry 70% of the nation's saw timber volume. The development of forest industries has contributed in a major way to the expanding economy of the western states and is in some areas the mainstay of the economy. In Oregon for example, 20% of the total labour force is directly employed in the harvesting and processing of forest products, with many more being employed in servicing and facilitating this primary industry.

Prior to the end of the last war forestry in this area was mainly a matter of logging old growth timber and forest management or the principle of sustention were virtually unknown. Since then, and more particularly in the last ten years, more attention has been focussed on sustained yield management.

Reforestation

Traditionally areas of old growth timber were logged and little thought given to regeneration. This often resulted in more valuable species like Douglas-fir being replaced by western hemlock, re-generating from stool shoots, or the more valuable sites being colonised by alder. However, with the increase in stumpage values

during the last 15-20 years, more thought has been given to regeneration and to date over 1½ million acres have been planted. Current practice in the Douglas-fir region is to plant about 600 trees per acre immediately after logging but this is often supplemented by natural regeneration. As there is no ground preparation, establishment costs are low, averaging about $30 per acre. However, the investment of capital in reforestation is viewed cautiously in relation to potential trends in future demand and supply of forest products.

One of the methods of reducing reforestation or afforestation costs is to increase the planting spacing and in this connection I visited an interesting Douglas-fir spacing experiment at the Wind River Experimental Forest in southern Washington. The experiment was established in 1928 to test spacings ranging from 4 ft. × 4 ft. to 12 ft. × 12 ft. As one would expect average diameter increased with the wider spacing and the trees in the 12 ft × 12 ft. spacing had notably larger branches. The top height also increased in the plots with wider spacings but I suspect that this may be due to site differences. The advantages of wider spacing quoted were that trees reached a merchantable size earlier and the volume of small sized material (unmerchantable in this area) which is normally removed in early thinnings is minimised.

In our Forestry Division some thought has recently been given to the question of increasing our planting distance from the traditional 5 ft. × 5 ft. Indeed, replanting at Baronscourt Forest has been done at 10 ft. × 5 ft. and at Lough Braden Forest planting on blanket bog is at 7 ft. × 7 ft. The reduction in establishment costs coupled with growth being added to fewer stems are important advantages of wider spacing especially in areas where stands are being grown for the production of smallwood material with no thinning. In areas being managed for the production of saw timber wider spacing would also tend to eliminate the unproductive early thinnings, although pruning of final crop stems would be essential for quality saw timber. It is, therefore, felt that there is a strong case for an overall policy of wider spacing up to 10 ft. × 5 ft. or 7ft. × 7 ft. (870 trees per acre) but that more research work is required before wider spacings than this can be justified. An important aspect of this research work should be a comparison of the costs of ground preparation, planting, weeding, beating up, brashing, pruning, etc., for each of the different spacings on trial.

Thinning

Thinning is probably the major silvicultural practice characterising intensive forestry. In the Pacific North-west region thinning is a relatively recent concept and only a very small acreage has been treated to date. It is estimated, however, that there are about 5 million acres which are suitable for thinning in the Douglas-fir

region alone. The main reason why thinning has not been practised in the past is that it was uneconomic — in other words the costs of logging operations exceeded the price offered for the produce obtained. Commercial thinning, however, is bound to become increasingly more important as the old growth forest is depleted and as markets and methods of utilisation improve.

As the recent trend in our Division is towards no thinning in certain circumstances, it may be of interest to look at some of the considerations which have influenced the thinking of foresters in the Pacific North-west.

The first basic principle is that thinning should only be undertaken when it will yield a direct economic return — a commercial thinning, so called. It is recognised that a pre-commercial thinning may be worthwhile in that the value of the future crop may be ultimately increased. This, however, is often difficult to appraise and is not generally accepted.

Secondly, it is recognised that regular thinnings can channel the growth potential of the site on to a few of the best and most vigorous trees — in unthinned stands the increment is spread on all the living trees in the stand. Therefore, at the end of the rotation stands which have been thinned regularly are made up of a few high quality stems which demand a high stumpage value because of the higher value of the produce per cubic foot and the cheaper logging costs of large material.

Thirdly, thinning is important in the harvesting of mortality, resulting from suppression or occasionally from disease or windthrow. With the short rotation in Ireland the salvage of suppressed trees may not be important as these trees will be small but when stands are left unthinned for 100-150 years as in the Pacific North-West, mortality is an important consideration. For instance, it has been estimated that with Douglas-fir grown on a high quality site, on a rotation of 100 years, regular thinnings would increase the International board foot yield by 24 per cent. Under our conditions the salvage of windthrow in unthinned stands may be a more important consideration.

Fourthly, thinning has an important role in the genetic improvement of stands which are being regenerated naturally. Thinning removes all trees of poor phenotype and develops the seed bearing potential of the final crop trees.

Finally, two less important objectives of thinning are to reduce the fire hazard and the prevention of fungal and insect attack.

Undoubtedly, there are many important advantages in thinning stands but these all hinge on the operation yielding an economic return. I, therefore, submit that, in our Forestry Division, unprofitable thinning should be discontinued. On the other hand, it is imperative

that our logging techniques should be investigated and improved so that the costs of thinning may be reduced.

Contorta Pine

Before leaving the Pacific North-West a short comment on contorta pine would not be out of place. During my study tour in this region I was particularly interested in finding out as much as possible about this species. It has a remarkably wide geographic range from lower California to Alaska, and from the Pacific coast inland to the Blck Hills of South Dakota. There is a great range of variation within the species and it shows a markedly differing reaction to different sites. This, together with the possibility of hybridisation with other species of pine would seem to offer great possibilities to the geneticists to produce a suitable tree for use in this country.Natural hybrids of lodgepole pine with Jack pine (*Pinus banksiana* Lamb) are found in Alberta, Canada, and in both the Pacific North-West and the Lake States geneticists have been crossing these two species by controlled pollination. It is hoped to produce a hybrid with the vigour of the lodgepole parent and the superior form of bole of the Jack pine. To my knowledge the Forestry Commission have not yet done much work on contorta pine and this hybridisation would appear to be a rewarding avenue for further research. In general I was impressed by the prominence given to genetics in forest research in Aemrica. This is looked on as a good investment as geneticists feel that in time they can do as much for quality timber production as they have now achieved in cereals.

In this Forestry Division little or no attention has been given to genetics and, indeed, even our seed orchards scheme has been unsatisfactory. Is more research not required?

THE LAKE STATES REGION

Introduction

This region comprises the states of Minnesota, Wisconsin and Michigan. The forests of the Lakke States were virtually unexploited until the beginning of the nineteenth century. The opening of the Erie canal in the early 1800's gave impetus to westward migration and as the new settlers arrived forests were cleared to provide farmland and for lumber. Furthermore, as the eastern forests were depleted of white pine (*Pinus strobus* Linn.), the large lumber companies turned to the Lake States. Throughout the remainder of the nineteenth century and until the end of the first world war, this region was ruthlessly logged and was the main lumber producing area in the United States.This was pure exploitation of the forest resource and no thought was given to the future regeneration of the forests. Extensive fires were common, the most famous being the Peshtigo fire in 1871, which was the most calamitous in American history. It burned over 1,280,000 acres in the state of Wisconsin, homes,

towns and settlements being swept away and 1,500 people lost their lives. Land which had been logged and burned was mainly colonised by aspen/birch in mixtures and less commonly by Jack pine. The aspen/birch forests, which are now pole sized were at first regarded as weeds but now form the basic resource of the large pulpwood economy of the Lake States region.

In all, there are over 68 million acres of forest land in the three states of Minnesota, Wisconsin and Michigan. Most of the stands are of pole size and management is more intensive than in the Pacific North-west. Only a few small remnants of the original virgin forest have been preserved. Most of the production is pulpwood and the small proportion of sawlogs produced are not of the highest quality. Sawlogs are processed in numerous small sawmills which are quite unlike the large-scale, highly mechanised mills of the Pacific North-West region.

Black Spruce (*Picea mariana Britt St and Pogg*)

While in the Lake States, I spent a large proportion of the time in studying the management of Black spruce which occurs extensively on the peat swamps of Minnesota. It is found in almost pure stands on about $1\frac{1}{2}$ million acres of productive swampland in the north of this State. It also occurs in mixture with Jack pine, balsam fir, aspen and birch on the upland soils. It is an important pulpwood species, as even mature stands are only of pole size and the wood is white, non-resinous and has long fibres. Another interesting use of this species is for Christmas trees and about $2\frac{1}{2}$ million are cut annually. They are cut primarily from the tops of 10-20 ft. trees on sites that are too poor to produce pulpwood. Does this not suggest a market for stands of checked Sitka spruce ! ?

Black spruce is a rather slow growing species, typical stands being no more than about 50 ft. in height and 9 ins. diameter at Breast Height at 100 years. The Forestry Commission Yield Tables (1953) indicate a Top Height of 70 ft. for Quality Class V Sitka spruce at 50 years. Management is therefore very extensive and any capital investment is kept to a minimum. Stands are generally left unthinned— final felling and regeneration being carried out at 100-150 years depending on the quality of the site. I had hoped to learn of new extraction techniques for use on wet bogs but discovered that extraction in these swamps is no problem as it is done in the winter months when the ground is frozen to a depth of about 3 feet. As I visited the area in July I was unable to see any logging operations. In recent years more attention has been given to the natural regeneration of black spruce and I want now to deal with this in more detail.

Regeneration of Black Spruce

The regeneration area that I visited was located on peat 2-5 ft. in depth which had been formed over the silts and clays of a former glacial lake. The surface peat was raw and acid (pH 3.5-4.5) but decomposition and pH increased with depth. The ground vegetation under the spruce stands was remarkably comparable to similar habitats in this country. Typical species of moss noted were *Hypnum schreberi, Hylocomium splendens, Polytrichum* sp. and on the poorer sites various species of *Sphagnum.* On some sites various species of *Carex* and *Vaccinium* were also present. The stands were of pure black spruce, more or less even aged, with a mean height of 50-70 ft. and previously unmanaged.

Various cutting methods were applied in order to assess the best method of regenerating these stands by natural means. The main treatment were as follows :—

1. Clear felling narrow strips.
2. Clear felling in small patches.
3. Shelterwood system.
4. Group selection system.

This study was initiated in 1948 and results to date indicate that the two clear felling methods are the most effective in regenerating stands of this type. The strips were cut about 1 chain wide and 6-10 chains long, oriented north-south and separated by 4-5 chains of standing timber. Clear cut patches were $\frac{1}{4}$-$\frac{1}{2}$ acre in size. In both cases the initial cut removed about 1/5 of the total area of the stand. The shelterwood system was also effective in providing good regeneration but the risk of the shelterwood trees being windthrown is high. The group selection system was not promising because reproduction cannot make satisfactory growth in the heavy shade associated with small openings.

The nature of the ground covering has an important influence on the germination and development of seedlings. In this study feather mosses, raw litter tnd slash were poor seedbeds whereas germination was good on disturbed peat, burned duff and on *Sphagnum.* The area occupied by *Sphagnum* increases after cutting due probably to increases in light and soil moisture. Although seedlings germinate well in clumps of *Sphagnum* they are often engulfed and killed where the *Sphagnum* is growing fast. The normal practice is to burn slash after felling thus increasing the seedbed area, as about 10 years are required for it to disappear naturally.

In the regeneration of these stands it was stressed that the cost of regeneration must always be related to the quality of the site. From an analysis of costs and expected returns it had been calculated that on the poorer sites investment is unprofitable at discount

rates above 2%, whereas, on the better sites regeneration costs of 50 dollars per acre yielded a 2% return even allowing for high land values. This would suggest that on the infertile blanket bogs currently being planted in our Division we should adopt an extensive management regime with investment per acre kept to a minimum.

In our Forestry Division only a very small area has been clear felled, with the exception of clearing fairly extensive windthrow. Cleared areas have been re-afforested by planting. Little thought has yet been given to methods of felling and the regeneration of our future crops. It will be, perhaps, thirty years before many of our stands reach rotation age, but I feel that now is the time to anticipate future problems and attempt to solve them. Has natural regeneration any place in our forestry practice — what felling methods will minimise the risk of windthrow and erosion ? These are important problems which can only be solved by long term research.

Windthrow is prevalent in black spruce areas. Recent studies of this problem have yielded two interesting trends. Firstly, that stands of black spruce are less susceptible to windthrow on peats over 2 ft. deep than on upland soil or shallow peat. Secondly, that the risk of windthrow is greater in stands that have been thinned than in uncut stands. This perhaps lends some assurance to our decision to adopt a no thinning regime in some of our deep peat areas.