

SPECIES SITING

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Introduction

It is not intended to discuss here the physical and biological factors that go to make up site because they will be well enough known to you. The selection of species is nearly always a compromise between the ecologically ideal and the economically acceptable. It is no use growing trees ideally adapted to every site, if this results in the production of material of low utility, and if tending and harvesting are thereby made unduly difficult.

Generally accepted principles

In any consideration of forest subdivision and siting there are certain generally accepted dicta. The first two are usually regarded as fundamental, the others as highly desirable:

- (a) Major sites should be planted to the utilisable species best suited to grow on them.
- (b) The compartment is the smallest permanent unit of forest management. As such it should possess boundaries that are permanent – obvious natural features such as streams and prominent ridges, and possibly the more permanent artificial features such as major forest roads.
- (c) Site differences must be sufficiently important and extensive to warrant separation.
- (d) Permanent sub-compartments should be avoided.
- (e) Planting to site should not be done without full appreciation of extraction problems which could result.

The first principle is an obvious essential of sound forestry, but we should not overlook the qualifications: *Major* sites and *utilisable* species. The second is also very important but often more or less in conflict with the first. Its application is usually bound up with the other three principles, around which the vexed questions of desirable compartment size and the existence of sub-compartments hinge.

The third point of the degree and extent of site differences warranting distinction will obviously vary from forest to forest, being affected not only by the nature of the land but also by the intensity of management and refinement of local forest practices. In any extensive forest there must be a considerable lumping together of minor site variations, and the species chosen must have sufficient tolerance to accommodate itself to these differences. In farm planting on the other hand stands are usually smaller, making possible a more exact matching of species and sites.

Compartments and sub-compartments

In the past too much deference has been paid to an idea that the

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area of a compartment must fall within a rather rigid size range, usually about 50 to 250 acres, regardless of the topographic and site pattern of the forest. Such a concept may be well enough on forests with extensive homogeneous sites such as the Kaingaroa or Canterbury plains, but elsewhere it has placed the forester in the dilemma of choosing between mis-siting much of his forest or creating many permanent sub-compartments which in fact, become the units of management. If there is to be a happy marriage between the silvicultural essential of correct siting and the management-imposed compartment unit, a wider range of compartment size is essential. At present about 20 acres seems to be regarded as the minimum, but I see no reason why we should not have them as small as 5 acres, if they do not create difficulties in working which would nullify the advantages of better siting. Some will say that such a small area is not an economic logging unit. This may be fair comment on some economically marginal forests being worked today, but on those we are now creating a more discriminating use of limited areas of elite site should result in a much higher stumpage allowing, if necessary, higher extraction costs.

The features which normally are regarded as desirable permanent compartment boundaries often, by their very nature, do not delimit sites. A stream may divide rather than bound an alluvial flat. A ridge may mark a significant aspect difference, but perhaps more often divides a single site characterised by steep slopes, excessive drainage and exposure. Consequently we should be prepared to locate our compartment boundaries where changes of site occur and, as far as possible, where they will facilitate working. Division on these lines will often not coincide with any natural feature. Physical features, roads, and even firebreaks running through compartments, would appal the New Zealand forester of a generation ago, who considered that a compartment should be completely surrounded by a firebreak and preferably a road as well.

Siting and extraction

The final dictum that siting should be done with full appreciation of extraction problems is, I suspect, likely to provoke more discussion than all other siting considerations. The value of a forest crop cannot be measured in terms of timber quality and volume alone; extraction costs and the possibility of damage to other stands must be taken into consideration. But let us beware of adopting extraction costs as the criterion of siting, of allowing logging problems that *could* arise to outweigh loss of productivity that is inevitable with bad siting. After all, who can be sure of the techniques of extraction 30 or 100 years hence. Logging considerations assume their greatest importance where the tree crop is economically marginal. Perhaps this is why the claims of the logging engineer are heard so loudly at the present time. However, in laying out our forests we must constantly bear in mind how thinnings and final crop will probably be taken out. Where a change of species is silviculturally desirable on mid-slope, can this be made on a suitable and justifiable road route? Will there be any

insurmountable difficulties in thinning? If the severance cannot be a road, will it be possible at maturity to log the upper compartment upwards by hauler and the lower downwards by tractor? In steep country one should consider whether logging will be to each ridge or across the valley. If the latter, one must decide whether the opposing aspects can be safely sited to the same species, or at least ones that could be managed on the same rotation.

Limiting factors

In species siting an appreciation of the limiting factors, whether ecological or economic, is essential. These should be recognised in the selection of an afforestation area. An assessment of the general site quality and its potentiality in meeting the requirements of the district is obviously the dominant consideration. It must be decided whether to compete with farming for land of relatively high forest productivity, or to withdraw to the marginal zones where hardier species must predominate and financial returns be much lower or, to put it another way, where the district's timber supply will be more expensive and perhaps less certain. Decisions on the siting of forests lie in the field of forest policy, and beyond the scope of this paper. However, the forester is apt to be faced with a parallel issue within his forest. Should he attempt to bring even the most difficult sites into production or by-pass them, possibly returning later? This problem can assume great importance on steep, heavily covered land such as inland Taranaki.

Limiting factors will vary from forest to forest. Soil and climate severely restrict the range of species that can be grown on the Canterbury plains or on coastal sand dunes. In a more favourable environment more weight can be given to the kinds of timber the market requires and the time factor in producing it.

Influence of ground cover

In some forests use of the best species for a site is made very difficult and costly by the presence of vigorous ground cover. Heavy bracken, broadleaf indigenous growth, gorse, and volunteer pines may necessitate the use of faster growing species to avoid exorbitantly costly release cutting. How far one should go in taking the easy way out is debatable, but usually rank weed growth indicates a site capable of supporting a fast-growing species such as radiata pine, and conversion to the preferred species may be possible after the first rotation.

Siting and protection

In the interests of forest protection, particularly from disease and insect damage, it is desirable to avoid large continuous areas of a single species. The desired break-up is usually possible without deliberate mis-siting owing to the existence of compartments suited to alternative species. The protection advantage of having appreciable differences in age in adjacent compartments of a species is rarely feasible during the establishment phase. Larger animals may be the limiting factor in the successful growth of some species, or at least warrant an arrangement of siting to minimise their depredations. Thus

opossums prefer slash pine to loblolly making it preferable, other things being equal, to site slash stands away from forest margins., patches of native bush, or other sources of opossums. In farm planting susceptibility to opossum damage is even more important and frequently limits the choice of species.

Mixtures

Mixtures of species call for more skilful and intensive management but have several advantages in siting. The least that can be claimed is that there are two strings to one's bow. But more important is the case where one has site differences that cannot satisfactorily be separated. Here a mixture of species adapted to different parts may eventually result in a group structure, using the area much more effectively than could either species alone. The mixture of slash and maritime pines on Tairua Forest is an example. Increased resistance of mixtures to disease and insect attack is another advantage; as also is the amelioration of a site by use of a nurse species.

Site categories

In preparing a siting plan for a new forest, it may first be best to distinguish a few broad site categories rather than assigning a particular species or mixture to every compartment. Such broad grouping will readily reveal the probable proportions of major species or groups of species. As there are usually some compartments that can be used almost equally well for two or more species, adjustments may safely be made to approach more closely that proportion of major species that the objects of management require. However, later conversion to another species may be planned so that, having achieved the short-term objective of supplying a high proportion of short-rotation species, the desired long-term distribution of species may be achieved in the second rotation. In planning the siting of a minor species, the need for continuity of planting to ensure continuity of supply and retention of a market should be borne in mind.

Aids to siting

In conclusion we may consider aids to the forester in undertaking a siting survey. Topographic maps are most desirable but lacking them, aerial photographs – stereoscopic pairs rather than a mosaic – are a valuable aid to the delineation of sites and roads which must be considered together. Aerial obliques give a quicker and clearer impression of topography but are rarely available. Detailed soil maps are of great value where edaphic factors may be critical, particularly where it has been impossible to make a sufficient study of the soils to be able to correlate them closely with topography on aerial photographs. In recent work on Ngaumu Forest, where drainage conditions are an important site factor, a map grouping soils with similar drainage status has proved helpful. We have already seen that a knowledge of intermediate and final extraction methods is desirable. But more important still is an understanding of the behaviour of the possible species on comparable sites in the neighbourhood. If

such direct comparison cannot be made, a thorough study of the natural, or even the modified, vegetation usually reveals some guides to siting.

Acknowledgement

The writer has been greatly assisted by D. S. Jackson and H. H. Wilson in the preparation of this paper.

THE EFFECT OF PLANTATION LAYOUT ON EVENTUAL LOGGING

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Planning for the eventual utilisation of a forest is essentially a long range objective. The lengthy rotation of most forest crops makes it difficult to foresee the economic position or to visualise accurately the utilisation practices at the time of harvesting. Consequently planning of forests must be flexible and must follow broadly based lines. Lately there has been considerable emphasis given to developing forests large enough to be economic units. It is essential also that compartments within those forests should be made large enough to be economic logging units.

In the establishment phase of most forests the forester has in the past been inclined to neglect the importance of catering for eventual extraction. The resultant layout may appear to be forester's dream but often proves to be a logger's nightmare. The forester, striving for maximum use of the land available, gives site quality major consideration, and he attempts to grow the species most suitable to each separate location. This intensive forestry approach can be uneconomic and impractical at the harvesting stages in a relatively undeveloped country such as New Zealand.

Design of forest compartment layout needs to be a compromise between the forestry ideal and harvesting economy; therefore eventual extraction should be envisaged in planning forest layout. Since topography is the most important and the only unalterable feature affecting extraction, compartments should as far as possible be designed as complete topographic units. This becomes more important as the compartment decreases in size.

Major road location is a most important feature in the early stages of forest layout. In the past these roads have often been located to suit immediate needs with little thought given to later usage. Eventually the harvesting phase is by far the most important road user, the ton/mileage of logging trucks greatly exceeding all other uses combined. This fact alone should ensure that harvesting problems are given major consideration in locating a permanent road network. In particular, all arterial roads should conform to the accepted principles for