REGENERATION IN MANITOBA

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ABSTRACT

Surveys have shown that after normal logging operations in Manitoba, the regeneration of white spruce, jack pine and black spruce was not sufficient to provide future well-stocked stands. Other studies, in Manitoba and elsewhere, have determined many of the factors affecting regeneration, and of these the two important ones subject to some degree of control appeared to be seed supply and seedbed conditions. By modifying the seed supply and seedbed conditions excellent regeneration of all three species has been obtained under experimental conditions. The costs involved in these treatments were less than those normally associated with artificial regeneration. It is suggested that the recommended treatments to promote natural regeneration be introduced in current logging operations carried out on an operational scale.

INTRODUCTION

It is almost impossible to make broad and at the same time accurate statements on a subject as complex as that indicated by the title—"Regeneration in Manitoba". As you might expect, the total number of individual statements that could be made on this subject is the product of the number of tree species times the number of factors that can affect regeneration, all multiplied by the number of foresters in the Province. So you must realize that in trying to make any summary of the situation I am sticking my neck out a long, long way.

Manitoba, in common with all regions that have an interest in continued forest production, has regeneration problems. Manitoba's regeneration problems are probably more difficult than those of the Lake States or any of the eastern provinces. The results of Canada's only comprehensive nation-wide regeneration survey lend support to this statement (Candy 1951).

The principal reason why Manitoba's regeneration problems are more difficult than those of some of her neighbours is climate. The bulk of Manitoba's forest area receives less than 20 inches of precipitation annually and variations of several inches from normal are quite common. The climatic moisture region is classed as "dry subhumid", and as such it is a transition zone in which small changes in moisture can be expected to have considerable effect on vegetation (Anon. 1960). Obviously this effect is going to be particularly noticeable on regeneration in the seedling size class. This is why, in Manitoba, no matter how perfect our forest practices become (and we still have a long way to go) regenerating a stand will always be a gamble in which the weather will hold the high cards.

Probably I have already gone too far in making general statements, so from now on I shall try to be more specific. To begin with I should say that my remarks will be concerned only with so-called natural regeneration,

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that is, the type that arises, after cutting, from the seed of the previous or the residual stand. Then I should admit that little information is available on the regeneration situation in the northern half of the province, as studies have generally been confined to the southern and presently exploitable portion of Manitoba's forests. Consequently, most of my remarks will concern the latter area. I shall narrow the field somewhat further by discussing only the three most important commercial species, namely white spruce (*Picea glauca* (Moench) Voss), jack pine (*Pinus banksiana* Lamb.) and black spruce (*Picea mariana* (Mill.) BSP.).

WHITE SPRUCE

White spruce is Manitoba's most important commercial tree species, and the regeneration of white spruce after logging has long been recognized as our most important silvicultural problem. Surveys of white spruce reproduction and studies of the factors affecting it have been carried on for over forty years. These studies have produced a considerable volume and variety of information. However, the general conclusion of most of the surveys has been that white spruce regeneration after logging is not adequate to provide future well-stocked stands (Fernow 1916, Millar 1921, Tunstall 1944, Phelps 1946, Bedell 1948). I should hedge a bit here by saying that some recent investigators evidently believe that if a long enough regeneration period is permitted (say 30 years) white spruce regeneration (plus advance growth present before the cut) will be sufficient to produce a stand as heavy as the one originally cut (Waldron 1959). However, the most optimistic forester would probably have to agree that regeneration does not normally occur immediately, in quantities sufficient to utilize the productive capacity of the site.

Rowe (1955) has provided an excellent account of the factors affecting white spruce regeneration, and of these the principal factors over which we have some control appear to be seed supply and seedbed conditions. Currently, most white spruce sawlog operations are carried out on a marked-tree basis, which should mean that adequate provision is now being made for a seed supply. However, studies have shown that unless a suitable seedbed is prepared, regeneration either does not occur, or does not survive in sufficient quantities (Phelps 1949, Waldron 1961).

Experimental seedbed preparation has been carried out with the Athens plow and with a bulldozer blade, and of these the latter appears to be the more promising tool. Excellent regeneration has been obtained on an experimental scale and operational tests are now underway. The tests involve both clear-cutting in strips and shelterwood cutting, with seedbed treatment carried out by a fire-line plow in the former case and by bulldozer blade in the latter. Both machines appear to create suitable seedbed conditions, and, although it is too early to make a final assessment of regeneration success, initial stocking of treated areas is high. The cost of seedbed preparation has been about \$11 to \$12 per acre, which seems quite reasonable in view of the costs normally associated with artificial regeneration.

JACK PINE

Jack pine is the number two species in Manitoba's "big three", and the regeneration of jack pine has been under study in the province for at least

ten years and, as you know, for a much longer period in the Lake States. In a review of the literature (most of which originated in the Lake States) Cayford (1957) indicated that the general conclusion of most investigators was that harvesting of jack pine has rarely resulted in successful restocking of the species. And again the two principal factors were said to be seed supply and seedbed conditions.

It has been found that temperatures between 120° and 140° F are required to open the usually serotinous jack pine cones, and that in the absence of fire these temperatures can only be achieved by placing the cones close to the ground. Seed dispersal from lopped and scattered cone-bearing slash has been found sufficient to satisfactorily restock a cut-over area. Other studies have shown that mineral soil provides the best seedbed and that satisfactory regeneration occurs only on areas that have been clear-cut (Eyre and Le Barron 1944). On the most common jack pine sites the Athens plow has proved to be an effective tool for seedbed preparation.

The results of all these studies suggest a rather simple method of obtaining jack pine regeneration, that is, clear-cut, scarify (either before or after logging) and lop and scatter the slash, taking particular care to ensure that the cone bearing branches are well distributed over exposed mineral soil.

The foregoing method is just now being tested on an operational scale in Manitoba, although I understand that it is already in use on commercial operations in the Lake States.

BLACK SPRUCE

Black spruce, the last of the three species I shall discuss, has been much less intensively studied than either of the other two; consequently the regeneration picture is less clear for it. However, the conclusions reached in Manitoba studies closely parallel those made elsewhere.

Johnson (1956) made an examination of black spruce regeneration in eastern Manitoba. His conclusions were that regeneration after cutting was a failure on the upland and swamp border sites but that there did not appear to be a regeneration problem in the swamps, largely due to the presence of advance growth.

As a result of a study of clear and partial cutting, Cayford (1961) recommended that black spruce should be clear cut on swamp or swamp border sites. He also suggested that on wet sites piling or burning of dense slash accumulations might increase stocking. In Minnesota both Roe (1946) and Heinselman (1959) have demonstrated the detrimental effects of slash accumulations on black spruce regeneration. Jarvis (1959) concluded that in Manitoba on moist upland sites some form of seedbed treatment would be necessary in order to obtain black spruce regeneration.

To summarize these findings: it would appear that on all sites black spruce stands should be clear cut (probably in strips or patches), heavy slash accumulations should be piled and/or burned, and on swamp border and upland sites some form of seedbed treatment such as bulldozing should be carried out.

To date these treatments have not been carried out on an operational scale; so reliable cost figures are not available.

SUMMARY

Obviously the foregoing is an almost ridiculously abbreviated and oversimplified picture of the so-called "natural regeneration" situation in Manitoba, and of the recommended procedures for obtaining regeneration of the three most important species. However, the following points seem reasonably clear:

- (1) Regeneration is generally inadequate regardless of cutting method.
- (2) Research has provided considerable information on the factors affecting regeneration.
- (3) Of the factors subject to a measure of control, seed supply and seedbed conditions appear to be the most important and most easily modified.
- (4) By modifying these factors excellent regeneration of all species has been obtained on an experimental scale and in some cases on an operational scale.
- (5) The costs per acre of the recommended treatments are only one-fourth to one-half those commonly associated with artificial regeneration.

SUGGESTIONS

Although further improvements in equipment and techniques are needed, sufficient information is now available, I believe, to warrant the introduction of treatments such as seedbed preparation in regular commercial operations. Of course these measures would have to be introduced gradually, and suitable arrangements would have to be made between the operator and the owner (in this case the province) regarding the responsibility for doing the work and for bearing the cost. If an operator was not equipped to do the job, or if an adjustment in stumpage price could not be made to cover the cost, then presumably the work would have to be done by the forest service. In some cases the treatment costs might exceed the stumpage returns, and in these instances it might not appear economical to carry out the required treatment. However, costs of \$20 to \$40 per acre are commonly incurred for artificial regeneration, and even expenditures of this order can not guarantee success. It would appear that the cost per acre of the treatments necessary to promote natural regeneration might be considerably lower than that required for artificial regeneration. If so, then with a limited forestry budget, more emphasis might perhaps be placed on the former.

Manitoba is currently reforesting (artificially) over 1,000 acres per year, and tentative plans have been made to increase this rate to about 20,000 acres per year in the fairly near future. The scale of this program is certainly justifiable in view of the fact that there are approximately 1,250,000 acres of productive forest land in the Accessible Forest Zone that are not stocked with trees of any kind (Gill 1960). Obviously, for this land there is no choice; artificial regeneration is the only answer. However, it would seem that in order to prevent this backlog of non-stocked land from increasing, natural regeneration should be obtained wherever and whenever possible. This might require some changes in traditional cutting and slash disposal methods, and in most cases it would require some actual investment in seedbed

preparation. Another obvious requirement for a program of this kind would be the routine examination of all cut-over areas to assess the results of treatment.

As I suggested at the beginning of this paper, we certainly do not have all the answers, and, even if we did, under Manitoba's difficult climatic conditions success could not be guaranteed. Nevertheless, I think the time has come to apply the present knowledge of regeneration silviculture to actual commercial operations, and I believe the successes will outweigh the failures. In this way progress can be made toward the solution of Manitoba's regeneration problems.

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