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THE NEED OF BASIC RESEARCH FOR THE SOLUTION OF OUR FOREST PROBLEMS*

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I N the practice of forestry, we are chiefly concerned with the production of forest crops, with their initiation, development and care. Trees and forests are living, growing things, therefore the greater body of knowledge basic to forest crop production is biological in character. It is the chief object of forest research, then, to disclose that fundamental biological data which will aid man to manage forest lands to his best advantage.

Just how our forests will be handled is still a matter of doubt but there is no doubt in the minds of foresters as to how they should be handled. They believe our forest lands should be so treated that they will always remain in a productive condition in terms of the commercially valuable woods. To this end forest treatment should develop along three lines and in this paper it will be assumed that the development will take place along those lines, namely that (1) our forests are to be felled in such a manner that, wherever possible, natural regeneration of the desired species in the desired quantity will follow as a direct result of the logging operations, (2) they are eventually to be handled so that their yield will be increased in quantity and improved in quality and (3) that large areas having been depleted of their commercial growing stock will need to be reforested by planting.

I will proceed to outline what silvicultural research seems necessary to lay the foundations for a policy that will enable foresters to carry out these three objectives of silvicultural practice or, in other words, will maintain our forest soils in their highest productive capacity—at least for those soils that lie within the radius of reasonable transportation costs of their forest products to the mills.

1. Our forests are to be felled in such a manner that, wherever possible, natural regeneration of the desired species in the desired quantity will follow as the direct result of the logging operations.

What fundamental data, then, are necessary for the successful attain-

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ment and control of the natural regeneration after the felling of the present crop? Logically the place to begin the research is with the seed itself. It is well known that the production of seed on most of our commercial trees is periodic but we have very little authentic data on that periodicity. We need to know whether to expect full seed years at two-three, four or five-year periods. Of course we have a year's warning in the case of the pines but not for the other conifers. We should also know the amount of seed to expect on a given area in a normal seed year in relation to the species, number of trees, their age and condition of health. If foresters are to be successful in obtaining adequate natural regeneration, it is absolutely essential that they should know what, under normal conditions, the effective dispersal area is from the mother tree. So far as I am aware the British Columbia Forest Branch is the only organization in Canada that has made a carefully planned and executed investigation of this problem.

Now that we have the seeds on the ground resting in their germinating bed, many unsolved but fundamental problems present themselves. To mention only a few of them: What percentage of the seed actually germinates in the natural seed bed? Laboratory germinating tests under optimum conditions of moisture and temperature give us little or no clue to what happens in nature where conditions in most cases are probably far from ideal. When the seeds have germinated what percentage of the seedlings succeeds in establishing anchorage and absorbing contacts with the mineral soil, or, in other words, what are the effects of leaf litter, moss cover, compacted humus layers, hardness or looseness of the mineral soil in the final establishment of the seedlings? We all know that after the seedlings are established in the soil, they suffer great decimation in their early years and we may suspect that it is due to drought or disease or frost, but we do not know—at least not from carefully recorded data. The important problem of how long a crop of seed may remain buried in the duff and still retain its germinating capacity is yet unsolved.

In our human relationships we are giving increasing attention to the young from the standpoint of their mental and physical welfare and the methods of tending are based upon intensive fundamental research. The great mortality among children in our grandfathers' day was considered an act of God. We are still in that state of mind in regard to the young trees which are to make our future forests, only we say that the great decimation of seedlings is due to nature's law and let it go at that. When we accept that attitude of mind, we disregard a basal precept of forestry, namely, the control and direction of nature's forces in the forest to the benefit of man. Without this precept there is no justification for the existence of the profession. To determine what the

future commercial forest shall be, we must guide and control it in its initial stages, hence my plea for more fundamental research on seed production, seed dispersal and natural seed beds as they occur in the forest.

The next step in the logical organization of silvicultural research should be the study of the life habits and reactions of our commercially valuable trees. As we all know most trees are very sensitive in their reactions to environmental factors and they vary greatly in growth rate, root development, natural pruning and in susceptibility to disease. If we are to modify the behavior of trees so as to produce more valuable and more economically managed forests, we must know how the individual components of those forests behave in nature; otherwise we shall go at the thing blindly and without intelligence. At present we do not know how our trees behave in relation to their inherent qualities and their environmental factors. So far as I am aware no complete study of the life history of a commercial tree has been made in Canada—at least none has been published. For such information we are entirely dependent upon foreign literature. Some of this information, to be sure, is concerned with trees that occur in Canada but our climatic and some forest developmental conditions differ from those in the countries in which the studies were made, therefore we run the risk of making serious mistakes in applying without modification the life history of a tree gained in another country.

A knowledge of the life history of our commercial trees, then, is essential to an intelligent practice of silviculture. It becomes of still greater importance, however, when we wish to know how a given species behaves when associated with another species in a forest. The greater portion of our forest areas are composed of a mixture of species. This fact brings many complications and difficulties to a forester who is endeavoring to get the highest yield possible from his forest, because trees do not behave in mixture as they do in pure stand. Each kind may make identical or different demands on its environment. In either case each may crowd his neighbor or in turn, be crowded by him. The presence of different kinds of trees for neighbors may entirely change the trend of development. Therefore, in the management of a forest, we are not dealing with single trees but with an association of trees which we usually call a forest type. Since the same species may behave differently in different types, it becomes necessary for the purpose of management to classify types and this is the third step in any logical organization of silvicultural research: The classification of forest types.

As you know, we have such a classification at the present time for most of the commercial forested area of Canada but it has been made by many different people who, although they have generally used the same kind of a

measuring stick, that of cover, they have not all used the same unit of measurement, therefore their types are not comparable even within a climatic region. Only with much more definiteness than we now possess as to what actually constitutes a certain type, can we, with intelligence, apply growth and yield data, or any other silvicultural data beyond their own particular locality. It may be neither possible nor desirable to apply growth and yield data with mathematical accuracy from one locality to another within the same type but there is no doubt that we can make closer and more useful comparisons than we have thus far been able to do. Our inability in the past undoubtedly in a large measure has been due to the fact that we had no standard of comparison for the two forested areas between which we were attempting to apply the data. We need to analyse our forest types more thoroughly in search of a more definite basis for classification. Through an assessment of the composition of stands, the character of the herbaceous vegetation and the quality of the soil by statistical methods, such as are employed by European investigators, we could bring similar types closer together and set the dissimilar types farther apart. The result at least would be an approximation to standardization which would give us, in turn, wider applicability to the data derived from silvicultural research.

2. Our forests are eventually to be handled so that their yield will be increased in quantity and improved in quality.

This assumption is based largely on the first, that if foresters through the data collected by well-organized and intensive research, can control the natural regeneration of the commercial species after cutting, the result will be more completely stocked stands than nature, unaided, would produce. This in itself would mean a greatly increased yield and it may be as far as we need to go from a forestry standpoint in the treatment of very extensive areas of forest land—assuming of course that this additional young growth were properly protected from fire. However, within a given climate, as you all know, the productivity of the forest chiefly depends upon the soil and the conviction is growing among foresters that they never really can become masters of timber production until they know a great deal more than at present concerning forest soils, especially their biological relationships. Forest soils should take an important place in any silvicultural research program.

It was hinted in the paragraph above that the attainment of an adequate natural regeneration of the commercial species after logging might be all that was necessary for extensive areas of our forested lands. To bring this about would be a great accomplishment. It would certainly put a different face on the fear of exhausted supplies and it would greatly change the aspect of the serious economic problem of the idle or low yield lands following in the

wake of our present lumbering methods. However, even if this much desired object were brought to pass, there still would be extensive areas on which there would be an opportunity for research as a basis for increasing the quantity and improving the quality of the yield. I refer to the effect of different degrees of thinning on the yield of the stand. This kind of work has probably advanced farther than any other in the realm of silvicultural research in Eastern Canada. Because of the difficulty in applying the results, not many thinning experiments have been made in mixed stands. Most of our forests, however, are in mixed stands, therefore the interpretation of the results thus far acquired from the thinning experiments, to the lumberman is quite restricted. The present need is the development, probably through the use of statistical methods, of a technic that will be applicable to stands of a wide range of mixture.

An indirect method of increasing yields through research is to be found in the investigation of the fire hazard resident on the forest floor during the summer months. This investigation in Canada is a model of scientific approach to a problem. It has great possibilities and should be encouraged.

3. Large areas having been depleted of their commercial growing stock will need to be reforested by planting.

Resort to forest planting on a large scale within a naturally forested region is an acknowledgment of a mistake in the land treatment of the past for, as a rule, we plant in Canada only where we have cut too heavily, have burned too severely or have tilled too unwisely. It will be noted that an exception of prairie planting was made by inference in the sentence above. Outside the prairie regions the statement will hold and it involves ill-treatment and in many cases abuse of land. The latter in turn makes the planting problem all the more difficult because in practically every site some factor necessary for the best development of a particular kind of tree is out of balance, existing either in excess or deficiency. In many cases we have gone about our planting programs too heedlessly and have apparently been more concerned in covering the area quickly with a forest than with its yield in terms of the quantity and quality of the wood. We must never forget that a forest plantation lives a long time. Any mistakes we make, if one may use the expression for the sake of emphasis, will stare us in the face long after we are dead—and the public which foots the bills will take notice. Therefore we are in great need of well-organized research in our planting problems such as the adaptability of trees to certain sites, the influence of soils, particularly sub-soils, on development, the behavior of mixtures, the effect of different degrees of spacing and the control of disease and insect pests. Some of the plantations are being thinned and now is the time to begin experiments

in thinnings. Some of the plantations are old enough now so that a record of their accomplishments should be published as a stimulus to additional planting on the part of the public.

In conclusion, I wish to speak about a delicate subject and that is the lack of co-operation among the forest research organizations in Canada. In normal times eight governmental organizations, four forestry schools, four pulp and paper companies and two associations, eighteen organizations in all, carried on some kind of research work in the forest. How much does one organization know of what the other is doing? Each group, shall we say, is working away in its own little cells without much knowledge of what is going on in the hive as a whole. Publications are all too infrequent. Probably several hundred reports on collected data are filed away and rarely see light. One of only two inferences can be drawn. Either they are not worth publishing or not sufficient effort has been made to get them published. Either case is one to be remedied. If governmental funds are not available, there is no doubt that the editors of the Forestry Chronicle would be glad to publish summaries of such reports.

Several organizations may be working on practically the same problem, but there is little or no contact between them. This is a short-sighted policy. There is no investigator who cannot be helped by another in the same field. In fact, co-operation here would no doubt save otherwise wasted energy, time and money. If distances are too far to travel, co-operation could be gained by correspondence.

One other matter in this connection is the most delicate of all, namely, the apparent lack of co-ordination in the organization itself. In too many cases each problem seems to be an end in itself. When it is finished it may be dropped and another one taken up. Forest research literature is full of broken threads. I know because I have contributed to some of them myself. We will never advance forestry very far by the solution of individual and unrelated problems. The solution of each problem should be only one step towards the final goal of some definite silvicultural practice such as successful regeneration after cutting or the highest yield per acre on a given site. One problem, or a series of problems, closely correlated to a definite goal is worth more than fifty unrelated problems carried on as though each were of equal importance.

The linking of research problems more definitely with forest management entails close co-ordination between the administrative and the research agencies. A good administrative and a good research officer are seldom combined in one individual, therefore for either to be really successful, there must be accord of view and co-operation in practice between them. Without these,

forest research in this country will fail of its possibilities and in consequence actual forest management will be long delayed. Failure to comprehend this fundamental fact is delaying our progress.

A corollary follows upon the axiomatic statement of the preceding paragraph and that is we need many more demonstration areas of silvicultural practices where the public can see them in the ordinary course of their travel without taking a day's journey into the wilderness. The public directly or indirectly pays for all of the forest research work, but they only rarely have an opportunity to see the results of their investment. It is safe to say that forest planting has been sold to the public. Why? Chiefly because they have been able to see the results of planting as they travel along the highways in practically every province of the Dominion. How many times can the public see, even in the older settled parts of the country, a well managed farm woodlot, an example of the different methods of thinning young stands, or of natural regeneration as the result of definite cutting methods? Very rarely, if at all. Within the timber limits themselves, scattered over the entire country, we have a large number of experimental areas, but how much effort do we make to get the lumbermen and interested governmental officials to visit them and to have the objects of the areas explained? Very little and only spasmodically.

In order to gain public support for forest research, we must do at least two things: We must produce experimental areas that teach a lesson and we must invite the public to see them.

I have endeavoured to outline a program of basic silvicultural research in preparation for the probable trend of forestry in this country. I have purposely laid the greater stress upon the biological aspects of our problems, such as the life histories of trees and the life histories of stands for I believe that we should investigate the first stages of the creation of forests first. It goes almost without saying that we will save ourselves much trouble and will be more successful in the final results if we start the forests in the right direction when they are young. I believe that the poor stocking of our forests from the standpoint of commercial species or of wood volume is one of our greatest problems in forestry and this is all the time becoming more pronounced under the present methods of treatment, which, as a rule, make no provision for the future crop by natural regeneration. Our present attitude is to accept what nature undirected may give us. In the greater part of the country only rarely, and then only on relatively small areas, does she give us an adequate regeneration of the commercial trees removed by logging. It is probable that she will do this in time, but length of time is the critical factor of the situation. As a rule it will take a span of time equal to the life of

several generations of men for nature unaided to clothe the cut-over areas with the original commercially valuable forest. During the greater part of the period thousands of square miles of cut-over land at the very back door of our mills will lie idle or will be of low yield value. Such idle or semi-idle areas within the radius of cheap transportation will work incalculable injury to the lumbering industry and thus eventually to the welfare of the state. I believe that every year we shall become more conscious of the economic burden of idle and low yield lands within easy reach of markets. It is the duty and privilege of the forestry profession as far as possible to remove the causes of the occurrence of such lands and to rehabilitate those that require human direction and tendance. All research work should be guided to these ends. Hence the necessity for a greater development of research on seeds, seed dispersal, natural seed beds and forest soils.

Up to the present time in the country as a whole research work in the forest itself has been more or less drifting without a clearly discerned goal, without organization and without a unified driving force. It is far behind in these respects other organizations for research. Foresters could study with profit the organization and the programs of the National Research Council, the Ontario Research Foundation and the Forest Products Laboratories. Unless the situation is improved soon, we shall be hopelessly in the rear and will, by so much, retard the progress of our profession. These are difficult times indeed, but we should not let them discourage us. We should work all the harder for our country and our profession. The need was never greater. The public probably has never been in a better mood for constructive action in laying more solid foundations for all business activities and this should certainly apply to what, in normal times, was our second largest wealth producing business. I cannot help feeling that the public are not sufficiently informed as to the necessity of research in keeping our forest industries going. They very well appreciate its necessity for agriculture but not for forestry. We have only ourselves to blame for that. Practically every forester should be a crusader for research as the keystone of his profession. When the public are convinced of its necessity, the means for carrying it on will be forthcoming.