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FORESTRY AND PULPWOOD FORESTS¹

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THIS paper will aim to point out how one of the most important manufacturing industries in Canada, namely, the Pulp and Paper Industry is dependent on living organisms—trees.

FIRST PAPER MILL

A few years before the middle of the Nineteenth Century a mill located at St. Andrews, Quebec, made the first paper from wood pulp in Canada. However, this was only the beginning of a process, and it was not until about the year 1887 that the first modern pulp and paper mill, as the industry is known today, was established at Grand Mere, Quebec, by the Laurentide Company.

SIZE OF INDUSTRY

From this beginning in the St. Maurice Valley, Quebec, the growth of the industry in the two eastern provinces, Ontario and Quebec, has been phenomenal. In 1940 the last year for which accurate returns are available, 103 pulp, pulp and paper and paper mills were operated in Canada. Furthermore, the Pulp and Paper Industry has headed the list of Canadian industries in net value of production since 1920, in wages and salary distribution since 1922, and in gross value of production from 1925.

CAPITAL INVESTMENT

In 1940 the capital invested in the manufacturing part of the industry, with no allowance being made for the capital invested in the woods, was \$643,000,000. This capital investment was divided among the provinces as follows:

Quebec	52.6 per cent
Ontario	29.2 per cent
British Columbia	8.2 per cent
Other Provinces	10.0 per cent

PRODUCTION

According to Mr. Robinson, the retiring president of the Canadian Pulp and Paper Association, the total production of all the mills in 1941 amounted to 10,000,000 tons of material valued at nearly \$400,000,000. This value represents the sum of the values of pulp made for sale in Canada, pulp made for export and paper manufactured, and includes the cost of materials and supplies. The production of standard newsprint in Canada is now three times the production in the United States and forms approximately 72 per cent of the total North American production. The remainder—book, writing, fine tissues, wrapping and board are increasing but as yet are mainly intended for the Canadian market.

¹ An address delivered before the Royal Canadian Institute, Toronto, March 14, 1942.

The total production of pulpwood in 1940 was approximately $8\frac{1}{2}$ million cords, or equivalent to a pulpwood forest covering an area five miles wide stretching from Toronto to Montreal. Of this amount 18 per cent or $1\frac{1}{2}$ million cords were exported.

OUTLOOK

This industry which has been for the last twenty years the most important in Canada exports pulpwood products and paper valued at \$260,000,000, or $1\frac{1}{2}$ times more than the total gold production of Canada. This gives you a very clear conception of where the Pulp and Paper Industry stands in the economic life of Canada. This industry is the principal contributor in sustaining balance of trade with the United States and is extremely important and vital to our war effort.

AID TO WAR PROGRAM

The most important thing confronting the people of this continent at the moment is the production of materials required to win the war. In the last war the Pulp and Paper Industry played a major role, but it is destined this time to play an even more essential part in maintaining our ability to purchase our military requirements of planes, of tanks, of steel, of armament for our successful fight against the dictator nations. In addition to this important aspect the Paper Industry is producing a product from wood pulp that goes into the manufacture of war materials, namely, shells, high explosives, naval mines, land mines, London detectors, radio equipment and gaskets for tanks and planes. All army supplies and food are packed in paper product containers. Finally, hospital supplies, particularly absorbents and dressings, are made from wood pulp.

OTHER USES

Many other products are produced by the Pulp and Paper Industry for secondary use such as building boards of all types, pure cellulose pulp of high alpha content for rayon manufacture and other products such as cellophane. These things are outlined to express mainly the scope of this present large industry, one producing products greatly in excess of Canadian consumption. This is very important considering the large market to the south and that this market is capable of much greater development.

BASIC ON FORESTRY

This huge industry is ours today because of our heritage, namely, cheap hydro electric power and pulpwood forests. Such forest areas are still vast especially in Canada, but so were the white pine forests of Canada, New England and the Lake States forty years ago. It is evident that the white pine forests were exploited like the ore of a mine and dwindled to a very small remnant.

However, in the pioneering days of Canada it was necessary to open the country and clear the land for the very existence of the early settlers, and naturally forests were destroyed to meet a greater need. Furthermore, there was the stage of exploitation because low-priced lumber was a vital factor in early community life and the lumberman did supply this necessary, enormous demand. These early logging practices were the result of conditions of the times. Nevertheless, it is unfortunate in carrying out this policy that lands absolutely unsuited for agricultural purposes were left devastated and will

be unproductive for many generations. Today we are much more deserving of criticism for wasteful methods than were the early lumbermen if we do not employ every means placed at our disposal to improve the forests and place them in the best possible producing condition. We, the people of Canada, to whom these great pulpwood forests belong should be alive to the question of the management of our heritage.

We in Canada have always had forests to deal with and we cannot think of a Canada without forests. The idea of forest culture, of definitely using land to produce crops of timber after a manner similar to farm crops has not as yet become implanted in the Canadian mind. Since the first settlement the forest resources have been treated as a mine, harvesting the crop, but taking no steps to insure a next crop from the same land. This would mean the eventual disappearance of Canada's greatest single manufacturing industry and the end of our great heritage.

The magnitude of the Pulp and Paper Industry and its significance in our economic life compel a different use of forest land in the near future. This confronts every Canadian with that fundamental duty which is forestry.

FORESTRY

Forestry is defined by our neighboring foresters to the south in a very broad way as "the management of wild lands so that maximum benefit may result". However, in this country where our greatest single manufacturing industry is built on the product of forests, I do not feel the definition expresses entirely the conception in the Canadian forester's mind. As trees are living organisms which start from seed, grow, become old and die, I prefer to define this greatly misunderstood word "forestry" as "the use of land to produce crops of timber after a manner similar to farm crops, or putting in order and keeping in order a forest business".

MANAGEMENT OF PULPWOOD FORESTS

The task before the technical foresters in the Pulp and Paper Industry is the regulation of cutting so that the relative wood position remains constant as to quantity and cost, because these stands of timber which are at present of greatest merchantable value are past their period of growth. Each year individuals fall victims to insect enemies and fungous diseases. Other more rapidly growing members can only by their growth barely offset this mortality. That is, nature is at a balance, new growth is only replacing loss, or, in other words, the forest is mature. On these mature forests at the time of cutting and directly against the available pulpwood must be written off the capital expenditures and carrying charges. The value of these areas can only be raised by higher prices for the ultimate product.

Therefore, to overcome this and insure any mill with an annual supply of wood of average position over a period of time, cutting cycles must be so arranged that each year's cut does not vary in length of distance. In addition, the wood has to be cut so that satisfactory new growth is established which will continue to produce wood if protected from fire and other damages.

In eastern Canada the pulpwood forest consists of two main merchantable species—spruce and balsam—and, to a more limited extent, jack pine. However, mixed with the spruce and balsam are trees of lesser value—birch, poplar and maple. These species are at present only used in relatively small

quantities, and as they occur in the pulpwood stands are considered weed species. Furthermore, spruce is generally more desirable than balsam because the yield of pulp is appreciably higher per cubic foot of pulpwood. Hence, in producing the second pulpwood crop, foresters are endeavouring to eliminate the weed species and maintain or increase the percentage of spruce in the new stands.

Spruce as well as balsam occurs in mixed or pure stands of even or uneven ages. That is, the individual pulpwood trees in any forest may be spruce or balsam mixed with hardwood trees, jack pine, cedar or tamarack, or the stand may be all spruce or balsam. Correspondingly all the trees may be of one age or different ages.

In order to better understand the natural or so-called virgin forest, a little time might be given to its origin. We think of fires which have been so destructive as something new. We consider insect attacks, fungous diseases and storms with mass blow-down as problems of the present. Granted that all these problems have increased enormously with the settlement of the country, yet fire, fungous diseases and insect attacks have always happened and the pulpwood forests of today are the result of all these factors. That is, the forest growth following a large fire one hundred years ago is even-aged today while an older forest where the trees have grown, matured and died to be replaced by others is uneven-aged with seedlings, saplings, poles and mature trees all present. This is the composition of the forest where every acre is different and creates the complex problems of pulpwood forests and forestry.

Most of the pulp and paper mills in eastern Canada are located near a forest area granted by the Provincial Governments which theoretically, if handled properly, will at least maintain an annual cut up to the capacity of the mill. On these areas the first task is to divide the forest into watersheds or cutting blocks which are large enough to produce economic cordage. This, fortunately, is quite possible because wood is either water driven, trucked or hauled by rail to the mills, and thus readily permits dividing an area into delivery units. Through each cutting unit or watershed an analysis of the forest is necessary not only to determine the total volume of wood and the composition of the various forest stands but also the ages and types of forest. That is, in the skilful allocation of the annual cut all these differences of age and type must be taken into account in order that some method or system may be applied to a growing, constantly changing living forest.

CUTTING SYSTEMS

In the various types of mature forests which are the result of varying climatic conditions, soil composition, distribution, catastrophes and other factors which may have affected the forest, methods of cutting have to be used that will assure the establishment of a forest succession similar to or better than the one preceding the cutting operation.

In the uneven-aged spruce and balsam stands where all ages are present from the small seedlings to the mature trees, the cutting practice commonly applied is to remove the old and middle-aged trees, leaving only the young and vigorously growing portion of the stand. As a rule this method is regulated by a diameter limit and no trees below a specified stump diameter are

cut. The cutting interval varies under different climatic and forest conditions, but generally in these stands the period between the present and future cuttings is estimated at from thirty to forty years. This short cutting cycle is achieved by taking only a percentage of the stand at any one time, thus allowing two or three cuts during the normal life of a tree in this forest. However, the minimum diameter system of cutting does not always result in a proper succession. Due to its peculiar tolerance to shade and root competition balsam generally increases in the younger age classes at the expense of spruce.

In the uneven-aged stands of mixed softwoods and hardwood, the same system of cutting to a diameter limit is used with a similar cutting interval. The result of this method of cutting in these forests is even poorer than it is when there are pure softwoods. Balsam increases its proportion over spruce in the seedling class and, moreover, as the merchantable pulpwood trees are cut, the residual weed trees take advantage of this liberation by increasing in size and occupying more growing space. More than ever they over-top and crowd the younger trees and reproduction of the desired species. So it is evident that cutting to a strict diameter limit will result in a new stand lower in quantity and quality.

In the even-aged conifer stands which vary in composition from pure spruce to pure balsam and may grow on swampy flats, slopes or even rocky hillsides, a system of clear cutting rather than selective cutting is applied. This is because the shallow root systems of spruce and balsam leave any residual stand very susceptible to wind throw. In carrying out this method all the merchantable timber is cut in unit strips forty to one hundred feet wide and up to a half-mile in length with intervening blocks of timber left for the purpose of seeding in the cut-over area.

After cutting these stands the establishing young forest does not necessarily follow rules. Often pure spruce stands result, or perhaps practically pure spruce with an understory of balsam. The balsam understory survives the cutting shock and establishes at the expense of the spruce. Also, after clear cutting, mass growth of vegetation often occurs which over-tops and crowds out a large percentage of the new forest. The spruce and balsam seedlings of this new forest are under two inches in height at the end of the first season's growth and require as much as ten years to grow two feet.

REPRODUCTION

In establishing seedling growth following logging there are two major essentials, namely, seed supply and a receptive seedbed so that the fallen seed can germinate and establish sufficiently well to withstand the summer drought. Generally in cut-over areas, the governing factor in the regeneration of pulpwood lands is the seedbed conditions as usually there is abundance of seed. For example if a mature pulp stand is burned by a hot fire usually very fine reproduction follows. The fire is sufficiently severe to prepare proper seedbed conditions, and yet does not destroy the seed source due to the protection afforded by the cone scales. If, however, the first fire is followed by other fires, the succession is usually a stand of weed trees as the source of seed of pulpwood species is destroyed although the seedbed may remain favourable. Furthermore, if the slash on a cut-over area burns,

the resultant stand is unsuitable for pulpwood because the source of spruce and balsam seed is destroyed by fire. The problem is to establish favourable seedbed conditions in the different forest types being cut for pulpwood. How to do this successfully and yet economically is something that must be worked out in detail under carefully controlled conditions of forest investigative work. This requires research that includes studies of the different pulpwood species, the spruces—white, red and black,—and balsam, as to their seedling habits, characteristics of their seed and the factors influencing the germination of the seed—soil, moisture and light. This is not the adoption of European forestry practices or revolutionizing our logging methods. It simply means to substitute the knowledge we have and apply scientific effort to produce the desired species by changing those practices in our present cutting methods which prevent reforestation by nature.

FOREST CULTURE

The policy followed by the Kimberly-Clark Corporation and its subsidiary companies is one of removing the more mature trees, leaving the young, growing stock. In these young forested areas growth again becomes important while nature is not balanced but busily producing wood capital each year. These young wooded areas are the bases of the raw material for the industry twenty or forty years hence.

In handling young growth, increasing the yield and lowering the age of merchantability is attained by giving better growing conditions to individual trees. This can be accomplished by eliminating from the struggle for essential water and sunshine non-merchantable species and thinning out trees of merchantable species to increase the foliage volume of the remaining individuals. The tree crown must be the governing factor in allotting the clear space available to each member, as root position can only be assumed.

With a general consideration of the essential requirements for increased wood production from young growth, a more specific application to the various types of young wood is possible. In this endeavour the Pulp and Paper Industry should be correlated with the growing capacity of the area on which each mill is established.

Growth of these young stands has been emphasized because the key to all forest management is the knowledge of growth. One of our great national errors is the assumption that nature made the forests we are now cutting and, if fire is kept out, she will provide forests for the future. To leave the second crop of spruce entirely to nature and make no use of our knowledge of forest growth is, as one great teacher stated, "an insult to man's intelligence".

Today the business of production of pulpwood crops is of the greatest importance in the Pulp and Paper Industry. If this is true, and I sincerely think it is, then producing the second crop of timber, or forestry, is of vital importance to every Canadian. We have throughout Canada numerous Dominion and Provincial experimental farms solely for the guidance of farmers in crop rotation. This, in keeping abreast of times when scientific research along practical lines is so basic to all industry, is very commendable but in this country, where most of the land is suited only to growing timber and where the greatest crop is spruce, there is a great lack of definite know-

ledge relating to our forests. Consequently forestry demands the same serious thought on our part as agriculture.

Forestry principles are the same the world over. Their application varies with forest conditions and the economic factors pertaining to the country concerned. In this country it is very necessary that research be carried on to obtain data on the practical application of the various cutting systems, promotion of the growth of young stands, reduction of waste, determination of silvicultural practice for different pulpwood types, and the relation of all methods to natural regeneration experiments for securing reproduction. Studies of density, growth and yield, and methods to reduce fire hazard are also very essential.

FIRE

This subject of pulpwood forests cannot be concluded without some reference to the forester's greatest enemy—fire. This menace has always been with us but increased activity in the forest has increased the danger. The advent of technical personnel has improved the methods of curtailing and combating this hazard. That is, the old ranger system has gone and has been replaced by an efficient tower system or plane control. Either of these systems, or a combination of the two, is very efficient from the standpoint of detection—thanks to the foresters. Still the fire problem, from the standpoint of suppression, is a long way from solution and will require continued study.

WOODLAND PROBLEMS

Nature is consistent but with a consistency of eccentricities and nowhere do these peculiarities show to greater extent than twenty or thirty years after the logger. For this reason we have confronting us in forestry a number of questions concerning the pulpwood forests of today and the second crop.

These problems are:

1. To obtain an adequate supply of cheap wood in order that our industry can continue to meet competition in world markets;
2. Adequate fire protection to mature timber, young growth and recently cut-over areas;
3. Improvement cuttings, thinnings and artificial regeneration, that is, intensive applied forestry to those lands strategically located to transportation routes so that low cost areas are again brought into production;
4. Increased expenditures on forest investigative work in order that the forest can be improved by the application of better scientific forest practice to our commercial operations.

CONCLUSION

In conclusion I would like to remind you, again, where the pulpwood forests stand in the economic life of Canada. This important position can only be guarded by practising forestry. I have endeavoured to leave with you the impression that pulpwood is a crop and should be treated as such in the continuous use of forest land. The Provincial Governments who now handle our forests will be able to improve their methods just as fast as this conception of continuous use is accepted by the people of Canada.