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LAND TRANSPORTATION IN WOODS OPERATIONS

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Sound forest policy cannot be established and maintained without correct and complete understanding of pertinent fundamentals.

FREQUENTLY speakers are inclined to attach an exaggerated importance to the subject of their discussion. While guarding against this natural tendency, I still wish to point out, and even to emphasize, that under our conditions land transportation of wood in the course of logging plays an outstandingly important role in our forest management. This is true from the point of view of immediate profit as well as from that of the future wood supply.

My thesis is that under our physical and economic conditions *land transportation is the most important factor in all principal phases of forest management, i.e., in silviculture², in protection and in logging. Our success or failure in forestry is very largely determined by this factor and by our judgment and skill in controlling it.*

I. LAND TRANSPORTATION AND LOGGING

Decreasing of the cost of wood production through more efficient and cheap logging is desirable to all concerned, with a possible exception of the least efficient group of lumber jacks. It tends to benefit the timber owner (The Crown), through increase of the actual stumpage value; it also tends to increase the earnings of the operator and of wood-using industries; and it tends to reduce the cost of the product to the consumer. We need cheaper logging even in good, but particularly in bad, times, like the present. How could this economy be achieved?

Best of all, through increasing the efficiency of land transportation, because

¹This paper represents my *personal* views.

²Most of you will probably disagree with this, but I hope to prove it in the latter part of this paper.

it usually represents the largest item in the cost of logging; and because it lends itself more than any other phase of logging to constructive modifications. Wide variations in local conditions exclude standardization and continually call on loggers' ingenuity. We all know a good many cases when very great economy in logging was achieved through certain successful changes in transportation practices, and quite as many cases of enormous waste of money and of wood, through loggers' backwardness or mistakes.

In the following I refer mostly to the pulp and paper industry, which is the main wood-using industry of this Province.

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Normally the cost of wood as rough material is approximately one-third of the cost of newsprint.

The cost of pulpwood at the mill comprises its cost on the stump, plus the cost of its cutting and transportation, subdivided approximately as follows:

- (1) Wood proper (stumpage, ground rent, protection, depletion charges, etc.) 25%
- (2) Logging—
 - (a) Preliminary work (forest surveys, camps, toting, etc.) 7%
 - (b) Cutting proper¹ 15%
 - (c) Land transportation (including improvements).... 27%
 - (d) Water transportation (including improvements).. 13%
 - (e) Supervision, overhead and miscellaneous 13%

Total 100%

These figures are typical for Quebec, although of course the distribution of the total cost of wood into its component items varies in different operations within wide limits. With items (a) and (e) properly pro-rated, *the transportation cost represents approximately one-half of the total cost of wood and about two-thirds of the entire cost of logging.* Of course, speaking of transportation, we include such intermediate stages of work as the loading and unloading of wood.

Graph I gives an example of the amount of labour required for various steps of work in pulpwood logging.

In our typical logging operations, wood is transported overland in most cases only from the stump to the nearby streams or lakes, often over a distance of a mile or so, and from this point is waterdriven to its destination, frequently over 50 or even 100 miles; in addition some towing may be required. In spite of this, land transportation usually is of much greater importance than water transport, both from monetary and technical points of view.

Sometimes transportation of wood in the course of logging consists of many diversified steps. Immense variation of local conditions and practices do not readily permit generalizations, yet, *characteristically, transportation comprises three stages: (1) assembling of single logs into small groups; (2) intermediate transport over various feeders; and (3) delivery of wood to the destination over a main route.* We shall call these stages respectively primary, intermediate and final.

¹Cost of cutting as usually given includes cost of some initial stages of transportation such as carrying 4' wood to the pile and piling it; also cutting of skidding trails. Cost of cutting proper as given here is less than that for only 4' wood and greater than for long logs only.

With 4' wood, primary transportation is done universally by manual labour. Cutters carry, throw or drag bolts which weigh usually about 50 lbs. and sometimes as much as 300 lbs. apiece a distance of from 25 to 50 feet. Long logs (12 to 16 feet) commonly are skidded out by a single horse a few hundred feet and piled to await sleigh haul, unless hot-logging is practised. It is characteristic of the primary stage that transportation is done directly over the forest floor with the dodging rather than the removal of obstacles in the way.

For intermediate stages of transportation a variety of means is used, such as horses with log carriers of different types, tractors, chutes etc., but sleigh haul very greatly predominates. Under ordinary conditions one-quarter of a mile is regarded as a short distance, one mile about the ordinary, and three to five miles or over a long haul.

The final stage of wood transportation is usually river drive over distances ranging in many cases from 30 to well over 100 miles. Less frequently it is sleigh haul to the rail by horse or by motor power.

The efficiency of wood transportation strikingly increases by stages from the stump towards the destination, since at first we deal with single logs moved by hand over unprepared ground; then with much larger quantities of wood transported over small or large feeding lines constructed to reduce the cost of transportation proper; and in the final stage the whole mass of wood is gradually moved over the same main route, in the preparation and maintenance of which, if necessary, considerable money can profitably be invested to decrease the unit cost of transportation.

Transportation of wood by hand only 100 paces in the first stages may cost per cord as much or more than transportation by horse over one mile in the second stage or 100 miles of easy river drive in the last. This is not an exaggeration.

The appalling inefficiency of our primary transportation of wood by hand is often probably unavoidable. Our local conditions as compared with those in other timber regions are rather unfavourable for an assembling stage since our wood is too small and the stand per acre too light to permit the economical use of more effective means. At the same time, predominating types of our forest and forest bottom are comparatively unfavourable for this work.

Thanks to the abundance and character of waterways, the final stage of transportation is greatly facilitated by our local conditions.

While in spite of the progress achieved, there is room enough for improvement in all stages of wood transportation as practiced, this applies particularly to the intermediate stage. Here we capitalize on making winter conditions our ally; but much greater advantage should be taken of a great variety of available methods.

Topography is a particularly important factor in this connection. The territory in Quebec where logging is conducted now and is likely to be conducted in the near future, may be classified approximately as follows: flat ground about 30%; rolling 35%; rough 30%; and "inaccessible" 5%. On many limits all these conditions are to be found within short distances, sometimes within the range of one logging camp.

This calls for a wide diversification of transportation methods and logging equipment, but in this respect our loggers and particularly our jobbers often fail through the lack of versatility. They have, for instance, a tendency to

depend too much on horse draying and sleigh haul, even under such adverse conditions as those for which horses are quite unfit. You will find horses working on gradients of 40%, 50% and even steeper, precariously sliding down on their haunches with a load behind, or barely able to climb up with clumsy and heavy sleighs or drays, perhaps the same as those used on level ground.

Chutes are inadequately used and in some localities where they are badly needed there are no loggers familiar with their construction; on the other hand, several pulp and paper companies in Quebec have done some successful experimenting in improving upon conventional designs, and one company is quickly and continually increasing the use of chutes. There is need in rough country for a greater and better use of snubbing devices, for gravity or even power "inclines," better location and construction of roads, for more light, flexible and strong types of log carriers and a good many other things which the time limit does not permit me even to mention.

Mountain logging is for most of our loggers a stumbling block because in former years they were accustomed to operating in comparatively flat country and to leaving wood on steep slopes as "inaccessible." Recently, however, many woods operations have been moving from easy ground into hilly and even mountainous territory. Because of this, and because of taking only the "cream" and leaving wood in more difficult locations to rot on the stump is, and quite justly, more frowned upon, the problem of efficient mountain logging continually increases in its importance.

An instructive example of logger's versatility in land transportation, provoked by difficult topographic conditions, is given in Fig. 2, representing a part of Mt. Adams operations of Finch Pruyn & Co. in New York. Here within an area of less than 1 sq. mile¹, without resorting to the use of machinery, wood is being transported overland by 10 different methods, consistent with the variety of the ground, as follows:

- (1) "Stump piling."
- (2) Hand rolling (on very steep ground) in 4' lengths.
- (3) Hand rolling (on very steep ground) in tree lengths.
- (4) Skidding with chain 16' logs in bundles (to be crosscut in 4-ft. lengths)
- (5) Trailing 16' logs, dogged tandem (seldom)
- (6) "Chaining" 4' wood on very steep ground.
- (7) Bobbing wood, with bundles dragging behind to act as brake.
- (8) Hauling wood on trailing racks.
- (9) Sleigh haul over snow or iced roads.

¹With differences in the altitude exceeding 1000 ft.

- (10) Gravity chutes:—ordinary, up to 4000 ft. in length; and short "hand chutes" used in connection with hand rolling.

Even on flat or rolling ground, horses not always are the best means for intermediate transportation stages. Where the size of the operation and the length of haul warrant this, tractors often can be used to better advantage. Evidence is accumulating that motor trucks can be used for sleigh haul with good success and on long hauls can favourably compete with tractors because of much higher speed.

Much money could be saved through better planning, location, construction and maintenance of logging roads; through better correlation of the preliminary work and of transportation proper with most favourable seasons in the cycle of logging operations; also through improvements in our loading and unloading methods. However, I must be brief.

To conclude on this aspect of our problem, I will mention that *we depend for land transportation of wood in the course of logging most of all on manual and horse labour, to a much smaller degree on machinery, and the least of all on the force of gravity. From the point of view of economy and efficiency it would be very desirable to reverse this order. This will be done when in the bush brains will be placed on a par with muscles.*

II. LAND TRANSPORTATION AND FOREST PROTECTION

Previously I stated that *transportation is of supreme importance in forest protection.* The following considerations should serve to demonstrate this.

The feasibility of protection is determined by the transportation possibilities. From a commercial point of view we cannot afford protection of such forests of even high intrinsic value as are now and are likely to remain for a long time inaccessible for exploitation because of prohibitive transportation cost of timber. Justified intensity of forest protection is commonly also dependent on transportation.

The cost of forest protection in a given case is to a great extent determined by the available ways and means of transportation and by its cost. This applies to all stages of protective activities; in case of fire protection, for instance, to the installation of the service, detection of fires, communication and suppression.

The effectiveness of forest protection also is dependent on transportation.

The degree of hazard in the forests under exploitation is greatly influenced by the logging practices which in turn, directly or through cutting (as will be explained later), are dependent on transportation. This applies for example to severity of culling, to the amount and distribution of slash left on cutover land, to the practicality of its disposal, and to the amount and conditions of trees left standing.

When much timber is killed by fire or by insects, or is blown down, the practicality of the salvaging operation is usually dependent on transportation. Enormous quantities of wood and of money may be lost or saved in such instances, depending primarily on whether extraction of this timber can be economically arranged before it deteriorates.

Protection and care of new growth on logged off areas to insure future wood supply may be feasible commercially only if these areas are made continually accessible through adequate and permanent transportation facilities; they also increase the prospective value of this new growth.

Proper forest sanitation, imperative under intensive management, is impossible without effective transportation dependent on permanent forest roads.

While aerial transportation is rapidly gaining in its value to forest protection and our waterways are of great importance, transportation by land is of particularly great moment.

III. LAND TRANSPORTATION AND SILVICULTURE

The future of our forests on areas under exploitation is being shaped now; it is shaped by our logging practices. Transportation, and particularly land transportation in the course of logging, is responsible for the character and value of future forests much more than any other controllable factor. This is one of the fundamentals of commercial forestry, even if the fact is not widely recognized.

Damage or destruction of seedlings, advanced reproduction, or seed trees by certain methods in primary or even intermediate stages of transportation of wood, may very seriously affect the regeneration after logging. This is obvious.

The following considerations of still greater significance are, however, comparatively involved. I must invite you patiently to trace a definite and very important though somewhat obscure connection between cutting, transportation in logging, and natural regenerations of our forests. Artificial regeneration of cutover lands can be left out of this discussion because, however desirable, under our economic conditions it does not, now, and for a long time to come is not likely to amount to much. The most effective as well as the cheapest reforestation, and, in fact, the only kind we can afford on the required enormous scale, is to help nature to do its own reforestation after cutting instead of retarding it by unfavourable logging practices.

Only occasionally we deal with forests that will quite satisfactorily regenerate with desirable species after cutting, no matter which of the many possible cutting systems we would apply, or, on the contrary, will quite refuse to regenerate. *In at least nine cases out of ten the character and commercial value of the future forest can be moulded at will by intelligent choice between*

various silvicultural cutting methods. We don't see them frequently in the bush, yet we know them at least from the textbooks on silviculture.

Normally there are two main considerations in selection of a cutting method: profitable logging, and silviculture, these two representing respectively our present and future needs. In Quebec, for obvious reasons, the first consideration decidedly dominates. Our cutting practices vary from taking only the "cream" to clean cutting large territories; characteristically, however, we take what can be taken out at a profit and leave the rest.

The fact that in logging, cutting chronologically precedes transportation, causes an entirely fallacious conception that our transportation methods are determined by cutting methods. I wish to point out emphatically that actually the reverse is true: that under given economic and physical conditions our cutting practices are dependent on and are determined by subsequent transportation of timber.

When loggers speak of cutting "cheap" or "expensive" wood they usually refer to its accessibility and transportation cost, not to the cost of cutting proper. The cost of cutting proper as previously explained, is slightly more than only one-third of the transportation cost in logging. Moreover, a variation in cutting methods affects the cost of transportation much more than it affects the cost of cutting. We want, and quite legitimately, cheap logging; and the above are the actual main reasons why, for instance, group system, strip and selective systems as well as other methods of silvicultural cutting, even where definitely theoretically desirable, are not commercially practiced in Quebec.

Our land transportation in logging usually is based on a system of cheap, poor and decidedly temporary roads. They and the logged areas are abandoned right after logging, perhaps to be used again some day later, but most likely not in our life time. This system may be the best under the circumstances, yet it precludes the repetition of cutting at fairly short intervals; our comparatively light stands are also against such a practice.

The extreme importance of land transportation in silviculture may be effectively illustrated by the following statement of Dr. Schenck, an authority well familiar with the forestry situation on this Continent and particularly in Europe. ". . . . Americans seem to have overlooked the fact that there would not be any silviculture possible (in Germany) were it not for the existing system of permanent roads. . . . Were it not for roads built to last, there would not be any forestry, in Germany, in France or in most parts of Austria. . . . Selective cuttings repeated at short intervals . . . are unthinkable unless there are permanent roads. . . . A road system once

developed prevents clear cutting over large areas . . ."¹ According to a very recent statement of Dr. Schenck in his letter, about 10% of the gross current revenue from German forests is invested in construction and maintenance of forest roads.

These quotations support my argument almost too forcibly.

Because of the economic conditions, of course, we cannot introduce intensive forestry in Quebec right away, and probably a good many years will pass before it becomes here a common practice.

Yet this should not discourage us as *there is room enough in our woods operations for such feasible improvements as do not clash with economic necessities but favour forestry without infringing on the efficiency of logging.*

Right now we can make two good steps in the right direction, by recognizing that *the way to introduce silviculture into the bush is through logging and particularly through land transportation; and that such efforts are particularly desirable as favour both land owner and operator.*

IV. LAND TRANSPORTATION AND ADMINISTRATION OF WOODS OPERATIONS

Land transportation in our woods operations consists of (1) portaging supplies and construction material into the bush; (2) transport of workmen and of administrative staff in both directions; and (3) extraction of timber. So far we have been dealing only with the last item, but the first two are also of extreme importance.

Depending upon the conditions, usually from 25 to 40 lbs. of foodstuffs, forage, various equipment and materials should be portaged to the camps overland, for every cord of wood cut; this representing roughly $\frac{1}{2}\%$ to 1% of the weight of the wood produced. Portaging distances in many cases are in the neighbourhood, or even in excess of, 50 miles. Transportation in portaging is almost the opposite of that in logging. Here various materials at first are moved to the bush depots over the same main tote roads and then are distributed to individual jobbers camps over secondary portaging roads. Formerly both were extremely poor, but within the last decade, and particularly during the last few years, most progressive companies have built good main roads to their headquarter depots and and motor transport is rapidly superseding horses, often cutting former portaging costs in half or less. The second stage of portaging, done by jobbers, is still very inefficient as a rule, but even here some improvements are in view; they come through better control of jobbers, and in the most striking cases, through change to company operation with company supervision over toting to logging camps.

¹"Forest Utilization in Europe" by C. A. Schenck. N.Y. City, 1924. PP. 16 to 18.

Much money can be lost or saved in portaging but its efficiency means even more than that—it greatly affects the efficiency of labour and determines the standards of living in the bush. Cheaper portaging means better and cheaper food, better health and greater safety to the men, more work per man, better accommodations, and such conditions as would permit us to attract and keep a better class of woods labour.

Too often men have to walk to and from the bush, carrying their belongings, no matter how great the distance. Human physical energy is a cheap commodity, particularly at present, yet with good or fair portage roads a more efficient arrangement should be practical in many cases; at least during the periods when such traffic is very heavy.

With our woods operations very distant from headquarters and scattered over wide areas of wild country, administration and supervision can be only as efficient as are the available means of transportation. A snowmobile, for example, will often permit the woods manager or some other supervising officer to cover at least a double territory in half the time that would be required with a horse and sleigh. There is no doubt that in many cases improvements of bush roads have paid for themselves many times over through the resulting improvements in supervision.

Now to conclude: It is generally recognized that *progress in our woods operations is often retarded, if not paralyzed, by the lack of correct understanding of vital problems by those who are in authority to decide. We should strive to help them to realize, among other pertinent fundamentals, that transportation is the backbone of forestry and the master key to economy and efficiency in all departments of forest management.*

Many of our leading loggers and foresters here are brimming with sound constructive ideas. But to develop these ideas into better practice in the bush we need more thought, understanding, encouragement and financial support from those who have the higher authority.