PULPWOOD LOGGING*

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CONDITIONS in the Pulp and Paper Industry have changed so rapidly in recent years that it is well for the Members of this Forest Engineers Society to take stock of the present conditions and to consider whether they are taking full advantage of the opportunities offered by the changes which are taking place in connection with the logging of Pulpwood. It is with a view to drawing attention to these changes and emphasizing the new opportunities they are bringing to the Forest Engineer, that the following notes have been put together.

Early pulpwood operations were based on logging operations for sawn lumber. The log was the handling unit and the problem was to cut and handle the log to the saw mill. The chief problem was transportation and everything was dependent upon this factor. Since water transportation was by far the cheapest and often the only connecting link between the bush and the mill, the first operations followed the rivers capable of carrying the logs to the mill. First these operations followed the larger rivers which were naturally adapted to this transportation, and the trees handiest to such rivers were selected for cutting. Later as the search for accessible trees proceeded towards the sources of rivers which were naturally driveable driving capacity was improved by various forms of river improvement. The most important of these was the development of the dam and the use of impounded water to augment the natural flow of the river. At the same time this opened up possibilities hitherto unthought of on smaller rivers and led to the general use of dams for augmenting the natural flow of the streams whilst in use for driving the logs to the mill.

Meantime the problem of getting the logs from the stump onto the rivers for driving was being solved so that logs further and further away from the banks could be handled. It is quite conceivable that the first logging operations were carried on entirely by hand. With the increased use of the horse the question of moving the horse over the ground became more and more important as the distances increased. Snow conditions proved to be most favourable, not only for the movement of the horse but also for the movement of the logs, and logging operations have always been carried on almost exclusively in the winter. It is easy to imagine how the logs were first hauled over the snow without the improvements which are now so familiar to us, such as the bob-sleighs, double sleighs and double team hauling. The trees were cut and hauled out immediately on to the rivers.

For the actual felling of the trees first only the axe was used. Later the

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cross-cut saw was developed to economize labour in cutting and later to decrease the waste which accompanied the use of the axe. Recently the buck saw has been brought into use and is now used almost exclusively on pulpwood operations.

Pulpwood logging was so far confined to the cutting and transportation of the log, in exactly the same way as logging for saw mills was carried on. The different lengths required caused the first divergence in method. Instead of saw-log lengths, special lengths were cut for the pulpwood mill, but the final cut into short lengths to fit the magazines at the pulp mill was carried out at the mill. The pulpwood operator so far thought entirely in terms of saw logs.

In comparatively recent times pulpwood operations are becoming distinct from saw log operations and a special technique is being developed. As the wood supply becomes more remote from the mill the question of transportation to the mill becomes more important, also as the more accessible wood supplies become exhausted operations have to be pushed further and further towards the heights of land of not only the larger streams but also of their remoter tributaries, and means have to be devised for driving the wood to the mill. The most recent and by far the most important development in this connection has been the cutting of logs into 4-ft. lengths in the bush. This change has opened up territories hitherto regarded as inaccessible and has indirectly led to the extension of the logging period, so that to-day a favourite line of speculation for improvement of pulpwood logging operations is in connection with *all-year-round* logging operations instead of the purely *seasonal operations* which were carried out in connection with saw logs.

Parallel with this change in bush operations there has been a change in the supply of labour. The first workmen in the bush were men who had already cleared their own lands and built their own homesteads. These men probably brought with them some knowledge of logging methods from their native countries, but they were primarily farmers and they looked upon logging as a convenient occupation for the winter when climatic conditions were unfavourable for work around the farms. Hence in the early stages lumbering drew the necessary labour from the farms, but with the enormously increased demands for labour caused by the rapid development of the Pulp and Paper Industry this source of labour had to be augmented and logging became the primary occupation of a growing number of men. Indirectly immigrants especially from Scandinavia and Central Europe brought with them a knowledge of logging methods which they adapted to this country. At the same time trained men were sent to Europe to study methods and these have been applied here, so that to-day logging is becom-

ing a more specialized form of labour and there is a growing supply of experienced men available for bush operations. As yet little or nothing has been done along the line of directly training the men, though there is a great need for better technique in every branch of logging practice. This is forced upon the Industry primarily by economic pressure, but it must be borne in mind that silvicultural considerations are becoming more important and it is only through the Logging Department controlled by the Forest Engineering staff that these considerations and the Regulations of the Department of Lands and Forests can be effectively carried out.

As the method of logging has changed in the general manner indicated above so there has been a gradual evolution in connection with everything connected with logging.

The following examples are interesting in this connection:

1.—*The Survey*.—The first cruising was done by men who had spent their lives in the bush and who through actual contact with logging and experience in connection with the actual quantities produced by known areas, were able to proceed by analogy and give a pretty shrewd estimate of what was to be expected from any given area. As logging developed, however, and particularly with the advent of the Pulp and Paper Companies much larger areas had to be surveyed in advance and much more information was demanded in connection with the stand. Not only was it necessary to know what mature timber was on a given area but a general description of the stand, the rate of growth and its exploitability were all factors which had to be considered and reported upon. To obtain such information it became necessary to train men to carry out surveys along scientific lines, and this in turn gave rise to the foundation of Schools of Forestry and the training of Forest Engineers. The survey was, however, in the first place, used exclusively in connection with the valuation of limits for purchase purposes and for the making of woods inventories for Government purposes. Now, however, there is a growing demand for surveys with more data which can be used for logging purposes and logging surveys are becoming more important than inventory surveys.

2.—*Protection*.—In the old saw mill days the question of supplies of lumber was not seriously considered owing to the idea which prevailed that supplies were inexhaustible and also owing to the facility with which the mill could be moved from place to place. As soon as the easy wood was taken off one river the operator had only to look round for another river, move his mill and carry on.

With the advent of the pulp and paper mills the movement of the mill

became out of the question and the question of supply and accessibility became paramount. Mill owners tried to get control of areas sufficient in size and having on them stands of the right type calculated to keep the mill supplied in perpetuity. Once these large tracts were obtained the question of protecting them against fire became a very serious matter. We all know how Fire Protection Services have been developed and how these services are being steadily improved all the time. Fire protection has become a very important item in our Forest School curriculum.

At the same time protection against insect attacks and wind throw has received more attention.

3.—*Conservation*.—The need for supplies of merchantable timber in perpetuity has given rise to considerations of how best to conserve the sources of supply and more attention is given to cutting methods most likely to encourage natural regeneration and promote a quicker rotation of the required type of stand.

4.—*Utilization*.—As the supplies became taken up in the form of limits the holdings of each company have become more valuable in that the more accessible limits are all taken up and the holdings of any particular company have to be regarded as their sole supply. It is a natural step from this attitude to a more careful consideration of the methods of cutting with a view of obtaining the maximum amount of raw material out of a given stand of wood. More careful methods have been devised and companies are on the lookout for new methods of cutting and control so that they may assure themselves that they are getting the best out of their limits especially in view of the enormous investments involved.

5.—*Management*.—We have already seen how pulpwood logging has been gradually evolved from the saw-mill operations. In the same way we can trace the foundations of the present pulp-wood logging organization back to the saw-mill operation. At first the saw mill owner did his own operating. He was able to give full attention to his bush operation during the winter months and to concentrate on work at the mill after the drive in the spring and summer. The operation was purely seasonal and chiefly for this reason the men following bush work combined this activity with agricultural work during the summer months. They were farmers first, but they always looked to the bush for employment for themselves and their horses during the months when it was impossible owing to snow conditions to work in the fields. They developed a certain natural proficiency but no special effort was made to improve the efficiency of the logging operation from the point of view of the men and no consideration whatsoever was given to Forestry. Bush labour was always plentiful and the earnings of the men were not necessarily

regarded as their sole subsistence. As the saw mill industry developed, however, men with special aptitude for bush work began to follow bush operations as their main occupation, and it was from this class of men that the first pulp-wood logging staffs were built up. Men with natural aptitude for the work and for handling other men became Grand Foremen and Walking Bosses. At the same time the demand for sawn lumber increased so rapidly that the saw mill owner had to concentrate on the mill operation and the bush operation became separated. A separate organization was set up and so long as the organization could deliver wood to the mill at satisfactory prices, the mill owners did not concern themselves with the details of woods operations. They were controlled from a purely financial point of view and very little consideration was given to the question of future supplies. Accounting and organizing ability were the chief requirements of the woods managers, and the activities in the bush were left in the hands of the actual operators. Company operations changed in character and eventually gave place to the Jobbing-System which was in full swing when the pulp-wood operation suddenly developed. This system is so well known to us all that we need not describe it here in full. There are, however, certain features which should be noted in passing since they have a very important bearing on present methods and the future of the pulpwood logging industry.

(a) *The Jobbing System is Based on Contract Work.*

As the saw mill industry developed it became more difficult to supply the requirements of the mill from purely Company operations. With the advent of the pulp and paper mills it became still more difficult to get the required labour, so the woods management followed the line of least resistance and contracted their cut to jobbers, and the whole organization of the actual operation in the bush passed into the jobbers' hands. This was alright so long as the jobber made money, but contracting in the bush is so dependent upon weather conditions over which the jobber has no control that the companies soon found they were paying out profits in years when seasons were particularly favourable and bad debts when climatic conditions were particularly adverse. They don't seem to have minded this game of heads the jobber won and tails the Company lost, so long as the Pulp and Paper Industry was booming, but with the advent of the present depression companies began to enquire into the activities of the jobbers and now control methods have been developed so that at least the companies know something about how their money is spent, and what is the extent of the profits made and losses sustained.

The jobber split up his contract in turn contracting part to sub-jobbers

and these in turn contracted various phases of the work to individuals so that piece-work almost entirely replaced day labour.

(b) *The Chief Qualifications of the Jobber.*

Though a knowledge of actual bush operation was desirable this was by no means a necessary qualification for jobbing. The first requisites have been organizing ability and control of labour supply. The actual operation was in most cases left to the sub-contractors. The chief concern of the jobber was to make money. He had no interest whatsoever in Forestry and future rotations. Cutting regulations only interested him insofar as they must be complied with.

There is a tendency now-a-days to change this jobbing system for the following reasons:

(a) The economic conditions of the Pulp and Paper Industry are such that the cost of woods operations have to be brought down to bed rock. It has been found that this can only be done by putting in extensive control systems. These show how the operating costs are made up, and up-to-date companies are finding ways and means of cutting these down.

(b) Owing to the general depression the companies have to finance their woods operations themselves. In doing so they are controlling buying of supplies and equipment and paying men. Here again they found waste and abuse which they cannot allow to continue.

(c) Government regulations and the growing realization of the companies of the need for logging methods based on sound silvicultural principles has led to attempts to control the cut more effectively. As this control develops the companies find they are doing work which they have already paid the jobber to do. They find it is easier and far cheaper to take over the whole operation.

In view of the above developments it is easy for us to see that here lies the opportunity of the Forest Engineer, and the question arises whether we are taking full advantage of this opportunity. It would appear that we have taken a full and active part in connection with surveying, protection, and to some extent conservation, but it is not so certain that we have risen to the opportunities offered in connection with utilization.

Before proceeding to consider the popular trend in future pulp wood logging operations let us consider some of the purely engineering questions which have to be taken into consideration when organising a pulpwood operation.

Let us assume that a careful survey of the area to be logged has been made prior to the commencement of logging operations on the line and plot method and the amount of mature timber on the whole area has been accur-

ately determined. A key map of the limits has been drawn 1" to the mile and survey and contour maps 4" to 1 mile made showing the detailed distribution of the stand and the general nature of the ground surface with main river and streams accurately located.

Given such information, how is the modern logging operation organised and where do we as Forest Engineers fit in?

After a careful study of the survey report and maps the ground is carefully gone over with a view to getting first hand information as to the nature of the ground, the carrying capacity of the main river and tributary streams, and the general nature of the stand.

Then from the contour maps the whole limit is divided into working units and these marked off on the survey maps, so that areas can be measured and stand data worked out for each working unit.

In formulating the general working plan and from it deciding on the annual cutting programme the following questions arise:

1. Taking into consideration the general nature of the stand on the whole limit, is there any recent blow down or burnt timber which can be reached and salvaged before it deteriorates and becomes useless as pulp-wood?
2. Where are the bulk of the over mature and mature stands? These should be reached as soon as possible and logged before stands which are still growing and putting on paying increment.
3. What are the carrying capacities of the various streams which have to be used for driving wood either for economic or physical reasons?
4. In order to keep the personnel of the logging organization down to the minimum compatible with efficiency in control and supervision of the logging operation, the working units under operation at any given time should be spread over as small an area as possible.
5. What means of transportation are going to be used? If water transportation we must obviously group our logging organization round the navigable water available. If road systems we must decide where these can be placed and select from a possible choice of roadways the ones which will serve the logging operations as a whole most economically and effectively.
6. In opening up the limits a general working plan must be decided upon, and one of the first considerations especially now-a-days is to make such a working plan financially possible. Cost estimates covering the logging of the whole limit as well as estimates covering each year must be made in advance and care must be taken to keep initial expenditures down to as near average annual expenditure as possible. Hence one of the first problems is to find a natural starting place which will serve not only for immediate

requirements but will serve as a base from which future operations can be developed in the most economical manner.

7. What special silvicultural considerations have to be taken into consideration? How is the natural reproduction? Can this be safeguarded and aided by the use of special cutting systems? If so, how far are these feasible? Is the limit specially susceptible to blow down? If so, what cutting method is liable to lead to the least amount of damage and waste from this point of view? What are the hazards connected with insect pests and fire? How can these be best safeguarded against?

Having decided the general cutting plan a further series of problems open up, and to confine ourselves to the purely logging aspect of the question here are some of them:

1. How is the wood going to be cut? By day labour or by piece work? Is the company going to open camps and run them or is the cut going to be contracted out on the jobbing system?

2. How is the cut going to be controlled? This involves location and marking out of jobs. Specification of what has to be cut, and how the cut has to be carried out from the point of view of time, and cutting regulations. Locating of hauling road systems from the point of view not only of physical features and climatic conditions but also from the point of view of silviculture.

3. How is the hauling going to be controlled from the point of view of time and the placing of wood on lakes and streams for driving and piling for measurement?

4. Where is the labour supply? How can this best be conserved? Under contracting and piece work conditions men of equal ability should have the same earning capacity irrespective of cutting or hauling chance.

5. What can be done to increase the efficiency and stability of labour? What are the best tools available for given jobs? What steps can be taken to teach men how to work to better advantage? How can the men be given better prospects of steady all-year-round employment by modifying the operating programme.

6. What is the best season to do the cutting and hauling? Is it necessary to carry on these operations simultaneously?

7. How to choose the camp site in relation not only to the one year's cut but to serve the whole cutting unit and the whole series of activities involved including the hauling, driving and toting.

8. What improvements are necessary in connection with toting and driving? When is the best time to do these, what money may be spent on them and to what extent are they necessary?

Next there is an equally interesting series of forest engineering prob-

lems in connection with the transportation of the cut wood first onto the stream, then down to the mill. The following are typical examples:

1. What is the most efficient method of getting the wood from the stump to the mill? This immediately brings up the question of logging from the stump to the stream, and whether the wood can or should be sent to the mill in long lengths.

2. Where the streams will not carry logs, where is the best place to carry out the cutting into 4-ft. lengths, in the Bush at the stump or on the banks of the stream?

3. Are there any other considerations which become deciding factors in the question as to where the cutting into 4-ft. lengths shall take place?

4. What are the best methods of getting logs and 4-ft. wood from the stump to the streams? This leads to consideration of the location of hauling trails and roads, handling horses, skidding, logging sleighs, singe and double hauling, chaining, sluicing, flumes, inclines and snubbing.

5. What are the possibilities in connection with driving, both logs and 4-ft. wood? Location and construction of dams. What factors govern the economic limits in connection with improvement of streams for driving? How is the driving capacity of a stream figured out and how are locations for dam sites worked out.

6. The organization for the drive. Number of men to employ and their distribution over various streams to be driven. The time factor for starting and equally important when to quit. Distribution of supplies for feeding the men and tools and material for work on the drive. Control on the drive.

A still further series of problems present themselves in connection with road building for truck and horse transportation and camp building for depots, caches and logging camps, but those quoted so far serve amply to show the vast field which is open to Forest Engineers to make use of their training in connection with all phases of logging operations.

Having considered in this brief outline how present systems of logging have developed and having indicated some of the forest engineering problems which arise in connection with a pulpwood logging operation we shall now proceed to consider the present trend of operating methods.

In the following notes I propose to discuss a method of controlling a pulp wood operation of 150,000 cords of 4-ft. wood, all to be logged on one main watershed from small subsidiary watersheds most of which are driveable and drain hilly country which is difficult to log. The wood is driven off the small streams into the main river and reaches the mill the same year that it is driven.

The following is a rough line up of the logging personnel necessary for such a cut:

On an operation such as we are here considering each inspector would be a qualified forest engineer and would look after an average of 25,000 cords of wood. The district forest engineers would take care of 50,000 cords each. The quantities in each district may vary, however, depending upon the area over which the cut is distributed. Widely scattered areas require more personnel to look after them while closely grouped jobs can be more easily supervised. For our present purpose the scaling accounting and stores staffs are shown only in their general relation to the Logging Superintendent and Woods Manager, but it must be borne in mind that the district logging engineers have to work in the closest co-operation with these departments.

The Forest Inspectors—Their main duty is connected with the inspection of the cut. They must see that the cut is carried out in the area designated by the cutting programme, and in accordance with the cutting regulations. They are required to clearly indicate which trees or areas may be cut and which for Sylvicultural or economic reasons have to be left intact. In order to do this they must know the cutting regulations. Further they must see that trees are properly cut down at the stump, stripped of branches and cut into correct lengths. They must see that all the material available is utilized and placed in a correct position and that the job is properly laid out for trans-

portation. This involves location of skidways, landings, hauling trails, hauling roads and main roads. They must be capable of reporting on these questions to their district forest engineers. In addition they must be qualified to fill in accurately and intelligently cutting and hauling inspection reports such as are calculated to keep the Logging Superintendent and the Manager posted as to progress of the operation.

The District Forest Engineers.—They must be qualified to check up on their inspectors in every detail and in addition they must be able to lay out the jobs designated in the cutting programme, and to direct and control every activity connected with the logging operation from the stump to the termination of the Drive. This involves the following main activities:

1. The general line up of the job whether for Company Camp Foreman, Foreman Jobber or Jobber.
2. They must know the area of each working unit, the carrying capacity of the stream serving this unit, what stand the survey shows and how to check this as cutting proceeds from year to year.
3. Where to locate the camps or caps to log off the whole unit, what size camps to build and what buildings are involved. They must know the hygiene and general health regulations. How to line up the subsidiary toting roads into the logging camps in relation to caches and main roads. They must understand how to build these camps and roads so that they can control the actual construction.
4. How to locate main and subsidiary hauling roads and how to lay off just the area necessary to fill the contract.
5. The silvicultural and economic considerations which must be observed in order to utilize to the full the stand available and at the same time leave the area logged in the best condition possible for the regeneration and growth of the stand for the future rotations.
6. They must know what tools, material, van and food are necessary for each job and must see that these are available and are transported onto the job when and as required.
7. They must be qualified to carry out all stream improvements including location of dam sites, building of dams, arrangement of landings for the wood and the clearing of streams for driving. With this is bound up efficiency in logging off an area in a minimum of time, and controlling the actual driving operation.

The Logging Superintendent.—In the first place the Logging Superintendent must be qualified to make out a general working plan for the whole limit, so that the Woods Manager may know how far the mill requirements may be filled each year, and the general working plan must be drawn up in such a manner that operations can be carried on most economically and

efficiently compatible with sound silvicultural practice. For this he requires a sound training in forestry and the widest possible experience in logging practice. He must be able to survey the growing stock, estimate reproducing possibilities and growth and organize exploitation in such a manner that the limits are administered so that the maximum yield of pulpwood may be assured and utilized each rotation. He must further be able to prepare and work to financial estimates in connection with every phase of the logging operations.

The Logging Superintendent should also be the Chief Forester and each Logging Engineer should carry on the forestry work of his district with the aid of his Inspectors.

The Woods Manager.—The primary concern of the Woods Manager is to see that the mill is supplied with an adequate supply of raw material for its requirements. He must be specially qualified to appraise and secure the requisite limits, control the survey and see that the limits are administered in such a way that the mill has a perpetual supply. At the same time he has the difficult task of financing the operation, a function which involves not only an intimate knowledge of every branch of Forestry but also every possible phase of logging practice.

The Woods Manager starts the operation by advising the Logging Superintendent what is necessary to fulfill the requirements of the mill and indicates in the general financial programme just what can be allowed for the logging operation. The Logging Superintendent in turn advises the District Forest Engineers where the cut will be made and calls for detailed estimates of job costs for cutting, hauling, driving, camp building, river improvements and tote roads. These are in the first place compiled by the Logging Inspectors in conjunction with the District Forest Engineers. The Superintendent checks these, making up the annual cutting programme for the approval of the Management.

Once the annual cutting programme has been approved the jobs are shown to the Jobbing Foremen who are experienced woodsmen and have proved their ability to handle men and carry out a logging operation. Each Jobbing Foreman in conjunction with the Logging Superintendent selects a job and is given a price to work to. Any profit he may make is shared half and half with the Company at the end of the logging season, and in addition the Logging Foreman is given a guaranteed wage from the time the cutting starts until the hauling is finished.

The Inspectors in conjunction with the Jobbing Foremen mark out the jobs indicating where the cut is to be made and just what has to be cut or left standing, at the same time main hauling roads are marked out and banking grounds for the wood shown. By marking out the roads in this manner

sylvicultural consideration can be fully taken into account and properly cared for.

Meantime the District Forest Engineer organizes his improvement gangs to make tote roads into the various jobs and to build the various camps. From the general working plan and the annual cutting programme he knows how long his roads and camps have to serve and what size to build the various camps. Foremen in charge of gangs work under his direction and he is responsible for seeing that the jobs are correctly engineered and that they are carried out in accordance with specifications and estimates.

The time to start the cut in each camp is carefully decided when the cutting programme is made out and each Jobbing Foreman is advised when he has to come in and how many men he is supposed to bring with him. The logging staff when making estimates of job costs make up a detailed estimate showing amongst other details the average amount allowed for cutting, swamping roads and hauling, and the Jobbing Foreman is given a copy of this detailed estimate for his guidance and to work on. The cutting chances are priced in such a manner that men of equal ability have the opportunity to earn the same amount irrespective of the difference in cutting chance. The hauling chances are priced in the same way.

The Inspector must be qualified to size up and price the various chances and he must see that the men are protected against unjust prices and exploitation, by proper control of the Jobbing Foreman. The cutting regulations are made known to the men by means of notices and through the Jobbing Foreman. The Inspector must see that these regulations are properly carried out and he is responsible for seeing that all hauling roads are properly laid out and swamped, so that cutters may pile their wood in the right places for hauling. He must also see that the Landings on Streams to be driven for hauling. He must also see that the landings on streams to be driven for the drive.

The Scaling Staff measure the wood, visiting each job at regular and pre-arranged intervals, and they make up payrolls and collect information from which job costs can be made up.

During the process of the cut the District Forest Engineer assisted by his Inspectors carries out his improvement programme. Dams are built, stream cleared for driving and maintenance jobs are carried out. The cutting jobs and the improvements are planned so that they can be finished before the autumn is too far advanced, so as to avoid the bad weather and so as to give time to the preliminary work in connection with the cut for the following year. Wherever possible cutting ceases before the snow comes, so that no wood will be left lying under the snow and lost, and also to avoid leaving high stumps.

The hauling is all done by contract, each Jobbing Foreman letting his wood at prices laid down by the logging staff. At the same time it is definitely laid down in the hauling contract the amount of wood which has to be hauled per horse. This is important in connection with weather conditions. Usually it pays to haul as quickly as possible because in winters when there are heavy snow falls the snow soon accumulates beyond the point where it can be passed over by horse and sleigh without shovelling, and it costs money to shovel snow. For this reason a maximum of 200 cords per horse is usually laid down in the contract, the idea being to finish the hauling before the snow becomes too deep.

The Inspector must see that all wood is hauled and properly placed on landings. At the same time he must keep check on quantities hauled so that he may estimate whether the job is going efficiently and according to plan.

The drive is done entirely by day labour under the supervision of the logging staff. Estimates are carefully prepared in advance assuming normal weather conditions, so that Inspectors and District Forest Engineers can check progress during the drive. This operation depends entirely on weather conditions and these must be utilized to full advantage by most careful advance planning and organization.

The above brief sketch indicates sufficiently for our purposes the field of activity open to Forest Engineers in logging. Such a staff of Inspectors, District Forest Engineers and Superintendents would all be qualified Forest Engineers, and such an operation would give them all year round employment, as follows:

June 15 to October 15:

The cutting and improvement operations are run together from the middle of June to the middle of October with certain jobs possibly tapering off later. During this time the operating staff is fully occupied inspecting the cut, laying out hauling roads, building camps, tote roads and dams and making river improvements. At the same time they are giving constant attention to the silvicultural requirements of the stand, protecting reproduction and young growth by controlling cutting methods and the laying out of the hauling road system.

October 15 to November 20:

Jobs will be gradually closed down and staff will see that final preparations are made for the hauling. During this period when the leaves are off and the ground free from snow the jobs for the following year are explored in detail so that surveys may be checked, carrying capacity of streams gauged and dam sites located. Camp sites can be chosen and tote roads marked out and measured. By doing this work at this time of the year detailed programme estimates for the following year may be made out

for the use of the manager in preparing his mill delivery estimates which are the deciding factor in the annual cutting programme approval. Throughout the time from June 15th to November 20th the forestry work is carried out. Sample plots are laid out and all observations made. This work is combined with the supervision of the cut. Whenever peculiarities in growth conditions are detected during the process of the cut they are recorded at once. Stem analysis can be made and the state of the reproduction noted for checking purposes when the inspection is made the following spring. In this way records can be kept of the effect of logging on reproduction. As areas are cleared off survey quantities can be checked and their accuracy determined.

November 20 to February 1:

Hauling Activities: During this period the staff are busy checking up on the hauling and seeing that all the wood is hauled and correctly placed on lakes and streams for driving. As this work tapers off the toting for the drive and the preparations of drive camps have to be carried out.

February 1 to April 20:

Between these dates the cutting chances laid down in the general working plan three years ahead are carefully gone over with a view to Inspectors and District Forest Engineers becoming well acquainted with the nature of the stand and the general lay out of the jobs for the next three years. Towards the end of this period as the snow disappears, more attention is given to the cutting chances for the coming season.

Staff holidays are taken during this period.

April 20 to May 31:

Driving: During this time the Logging Staff is fully occupied with activities in connection with the drive. Special attention is given to the carrying capacities of the various streams and the behaviour of the dams. Streams to be driven in the immediate future are carefully observed with a view to gauging their carrying capacity and checking on proposed dam sites. It must be remembered that the actual driving activities are directed and controlled by the District Forest Engineers and their Staffs.

May 31 to June 15:

The drive activities are closed down and final preparations are made for opening the new cut. The inspection of the cuts for the previous year are started and all wood left in the bush is estimated and reported upon by the Scaling Staff.

For purposes of discussion I am concluding this paper by setting down a number of statements in connection with the future trend in Pulpwood Logging.

1. Owing partly to economic stress and partly to pressure in the form of

Government Regulations, Pulp and Paper Companies are finding they must give more attention to their woods operations. In their efforts towards more economy and efficiency they are calling more for men capable not only of controlling and running present operations but able to improve on present methods not only from the immediate financial point of view but also from the point of view of sound scientific forest management.

2. Owing to wasteful methods and general incompetence the old type of Jobber is giving place to Company run operations. This is calling for competent staffs and training in Forest Engineering is absolutely essential for those holding key positions.

3. The importance of logging in accordance with sound silvicultural principles is recognised by both the authorities and the limit holders. The authorities on the one hand seek to protect and perpetuate their forests but at the same time to utilise to the full the mature products which they produce. The limit holders on the other hand whilst they are primarily interested in extracting from their holdings their present needs they are becoming more alive to the necessity of preserving and fostering natural regeneration for future requirements. The interests of both parties are identical and these interests are most likely to be fully safeguarded when logging operations are controlled by trained Forest Engineers.

4. The demand for greater economy in logging is calling for more efficient methods and this in turn calls for better trained and abler executives, and more efficient labour. To build up and keep together an efficient organisation the Companies find they must get away from the casual and part time occupation idea and replace it by a permanent full time occupation. This is conducive to efficiency and attracts a better type of labour. For this reason pulp wood operations of the future will give all-year-round occupation to a more efficient and less numerous general labour, and a more numerous, better trained and more competent executive staff.

5. Silvicultural considerations and the necessity for greater economy in utilisation will call for prohibition of cutting under snow conditions, and for the cutting of more four-foot wood in the bush. For reasons already given above the limit holders will tend to spread their operation over the whole year, using a much more efficient set of men. They will also cut more four-foot in the bush as the more accessible supplies of pulp wood become exhausted.

6. There is no doubt that the cutting of four-foot wood in the bush leads to closer utilisation and makes much more wood accessible. The near future will no doubt see the unfortunate measure handicap under which four-foot wood at present labours removed.

There will be an increasing demand for trained Forest Engineers to fill

the executive positions in the bush. The requirements of Logging Superintendents, District Forest Engineers and Inspectors are such that more engineering details are called for and future cutting plans will be based to an increasing extent on carefully estimated details of costs. The bush operation will have to be brought more into line with the mill operation. Every phase of the logging operation will have to be budgeted for and worked to the closest possible estimate.

The making of these estimates and the control of the operation calls for specially trained men. The foundations of this training must be carefully laid in our Forest Schools so that the young Forest Engineer can not only quickly adapt himself to the present requirements of the logging operation but also use his initiative in improving these and in this way continue to justify his existence.

We all know the importance of logging in accordance with sound silvicultural principles. It is easy for us to become over enthusiastic about Forestry and to be impatient about the progress made in the practice of Forestry in this country. But unless we can bring our ideas down to present day requirements and keep them within the economic possibilities of the industries served we shall accomplish nothing and probably die of starvation in the process. We must get control of the logging operations and through that utilize the products of the forests to the fullest advantage, at the same time preventing wasteful and harmful exploitation. Once this start has been made it is up to the members of this profession to keep within the range of economic possibilities to devise ways and means of gradually building up a sound, self-supporting, perpetual Forest Industry.