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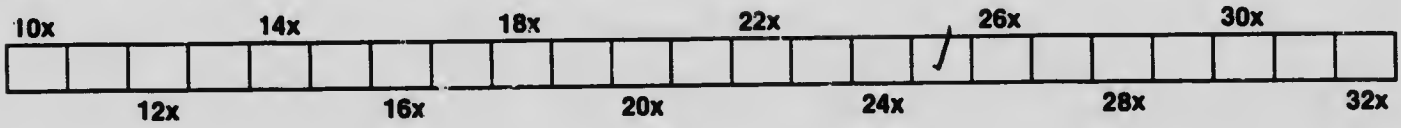

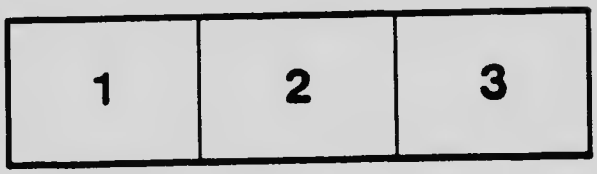

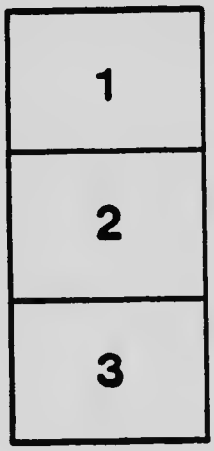

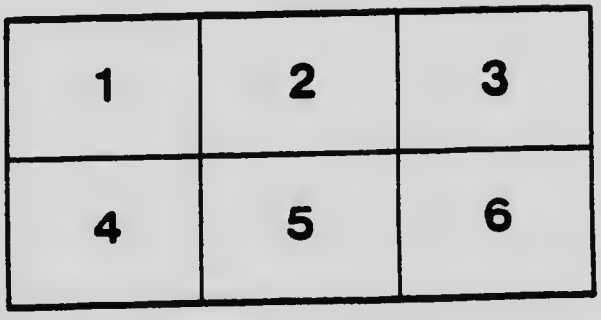

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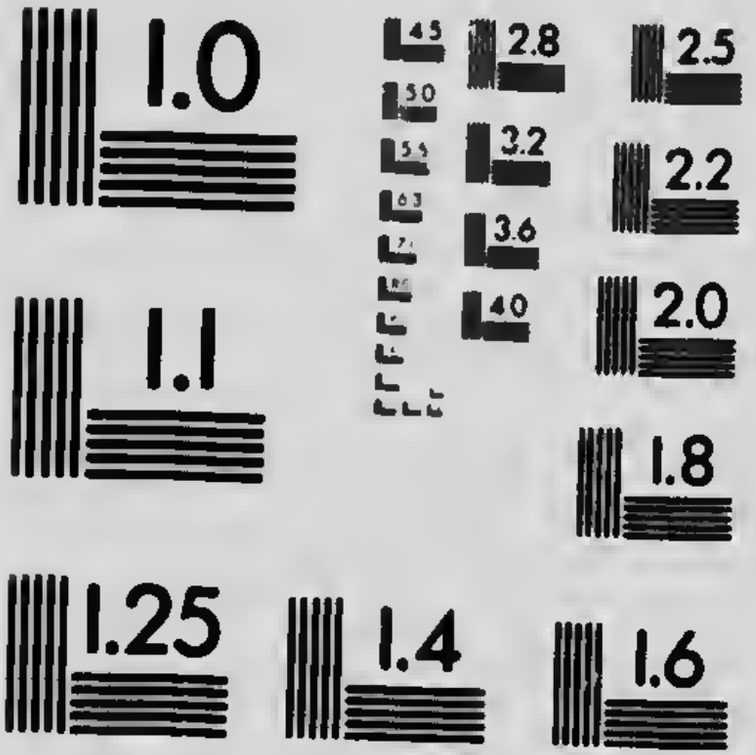

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COMMITTEE ON FORESTS

Classification of the Crown Lands of New Brunswick

BY

P. Z. CAVERHILL

Director of Forest Survey, Department of Lands and Mines, New Brunswick

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Director of Forest Survey, Dept. of Lands and Mines, New Brunswick

THE classification of the Crown lands of New Brunswick is the outcome of a movement that has been under consideration for a number of years. The Crown lands of the province, consisting of 7,750,000 acres, of which 6,500,000 are under license, constitute the chief source of provincial revenue. The value of the lumber industry is second only to agriculture and, at the present time, is upwards of $15,000,000.

Many changes have taken place during the development of the lumber industry. During the first half of the 19th century the white pine was our important timber tree. In 1825, we exported, as square timber, over 400,000 tons of this species alone but, for years, it has been nearly depleted. Hemlock, a few years ago valued only for its bark, is hard to get at $12.00 to $14.00 per M. for the round log. On spruce it was found necessary to reduce the diameter limit from 18'–10" to 16'–9". Thousands of acres of good timber land have been taken up under the pretense of agricultural development, only to be abandoned after desultory attempts at clearing and cultivating, and after the occupants had burned, possibly, thousands of acres of good timber. These signs of the gradual depletion of forest land led to a movement for definite knowledge of the condition of the public domain, and a classification of the land as to whether it was chiefly suitable for agriculture or forest.

The first concrete step toward the classification was taken in 1906, when the Public Domains Act was passed. It authorized a survey of the Crown lands, estimating the timber thereon, the annual growth and the cost of logging, also delineating the lands suitable for agricultural development. The Act also provided for the calling of a convention in the interest of forest protection. This convention met in February, 1907. Funds were not available, however, to carry out the survey, and the net result was the establishment of the Forest School in connection with the University of New Brunswick.

The Act of 1913, renewing the timber licenses, made provision for the classification at present being undertaken. For a time only desultory attempts were made to carry out the provisions for classifications, and it was not until last spring that field work was actually started.

Objects of Survey

As defined by the Act, the objects of the survey are: First, to report with as much detail as possible upon the character and quantity of the lumber, estimating the quantity of timber and the reproductive capabilities of the forest area. Second, to estimate as accurately as possible the annual growth of timber upon each area or tract. Third, to report upon the accessibility of the timber on each section, estimating the cost of logging on the different areas, and the cost of stream-driving to point of manufacture. Fourth, to report the location of lands deemed suitable for agricultural purposes, distinguishing them from other lands that might be regarded as especially suitable for the growth and reproduction of timber.

It was decided that a four per cent survey was the most desirable to obtain these objects; this consists of running strips through the timber at one hundred rod intervals (1,650 ft.) measuring the timber two rods (33 ft.) on each side along each strip, and tallying the trees by diameter classes and species. To obtain data of the soils, holes were dug at each one hundred rods along these strips, and notes on the character and quality of the soil taken.

Value of Contour Map

The making of a contour map was considered, but, as a large portion of our Crown lands is either gently rolling or level, a low contour interval would be necessary to show any detail. In dense spruce stands, of which our New Brunswick woods are largely composed, it is impossible for the topographer to trace and plot the contour for any great distance on either side of the line, and it becomes necessary to either run strips at much closer intervals than we are doing, or offset from the line frequently, either of which would add materially to the cost of the survey. Very few points other than on the railways have definitely determined elevations, and obtaining vertical control would require extensive traverses from points of known elevation, this also adding to the cost.

A topographic map, of sufficient accuracy to permit of the laying down of roads and the planning of an operation from the information contained thereon, would probably cost, under our conditions, 15 cents per acre, varying from that figure to 25 or 30 cents per acre in the west, where the country is more difficult.

Topography in New Brunswick does not bear the same relation to the logging operation as it does in the west, where it is frequently the determining factor in the method of logging, and upon the topography depends whether or not they can use horses, donkey engines, with fore-and-aft roads, or have to resort to the more complicated overhead, or sky-line, methods of taking out the timber. On almost all our sites, horses can be used, and topography affects only the haul and, to some extent, the stream driving. As a topographic map, therefore, would be of little service to the Dept. of Lands and Mines in shaping its future timber policy, or in the valuation of the Crown lands, it was decided that the additional expenditure was not justified.

Method of Survey

The main ground plan is made by running primary control lines and traverses of drivable streams, portage roads, etc.; these controls are about two and one-half miles apart, and are tied together every five to ten miles. Where straight base lines are used, old timber block lines are followed. This divides the area into rough blocks or divisions, irregular in shape and size, but sometimes in rectangular blocks. The interior of each block is mapped from notes taken along the strip. All control work is checked, so that the maximum error of closure is less than two per cent, and this is distributed throughout the traverse. Strip lines are tied to the base lines with an error not greater than four per cent.

The timber estimate is made by tallying all merchantable trees for a width of four rods along each strip, the tally sheets being so arranged that the timber is shown separately by species and diameter classes on each eight rods of the strip. This permits the showing in detail of the character of the stand and the type. From this tally, the estimate is made from local volume tables, changed according to locality, and constantly checked by measurement of all available "down" trees.

At the same time, notes are taken on condition of the stand, cost of logging, and condition of the stream for driving.

Annual Growth

Determining of the annual growth is possibly our hardest problem. We need to know as closely as possible what the actual annual growth is, as it will show us what the results of our present system of management will be, and, by a comparison with the potential growth of that site, or with the growth of similar sites under different systems of management, we can determine what steps are necessary that we may derive the greatest financial benefit from our timber lands.

Our forest land is largely covered with a stand of many-aged mixed species; trees growing under all sorts of conditions, and these conditions constantly changing; as, for example, when logging is conducted on an area, the light and soil moisture conditions, under which the remaining stand exists, may be entirely changed.

A white spruce, measured seven years after logging, showed an increase of 125 per cent in the increment. But, while individual trees show this rapid increase, much of the forest capital is removed with the logging, and the net result in any but our over-stocked second growth stands will be a falling off in the yearly increment.

Method of Study

By averaging a large number of acre strips, we were able to construct from our field sheets, an average or model acre, showing average conditions for any particular type. This gave the average number of trees by diameter class, per acre, of the different species, average height and contents, by species and diameter.

The growth per cent was obtained by boring into a large number of trees with an increment borer, and ascertaining the diameter growth for five-year periods for the past twenty years. The trees were taken at random, and recorded by types and diameter classes. Later, all trees of a diameter class on any particular site and type were averaged together, it being assumed that, if a sufficient number of trees were studied, an average could be obtained which would represent the average of that diameter class throughout the site. The growth per cent was then obtained for this average tree, and the per cent applied to the model acre.

This year we made only a beginning on growth studies, making borings in spruce, fir, pine and cedar. In all, some 2,500 trees were bored, and the results showed a growth per cent of from 0.6 per cent for cedar over 12 inches in diameter, to 3.6 per cent for white pine of 8 inches in diameter, or from 30 to 75 board feet per acre per year.

Next year it is our intention to supplement these figures by much more detailed studies, and it is hoped we will arrive at a very close approximation of the actual growth.

Agriculture

Perhaps one of the most important features of the survey is the classification and delineation of the agricultural lands, the objects being to direct future settlement to local[illegible] where there is the greatest opportunity for successful farming, and to prevent the denuding of purely timber land under the guise of clearing for agricultural purposes.

The success or failure of any agricultural community depends on four factors: First, climate; second, soil; third, personal; fourth, social.

Climate.—The climate in New Brunswick is generally favourable to agricultural pursuits; the winters, though long and severe, are followed by warm, pleasant summers with plenty of rain-fall; vegetation shows a remarkably fast development, although late spring and early autumn frosts limit the range of field crops to those developing and maturing in a little over three months.

Soil.—The soil is the factor with which this survey is chiefly concerned, and is, next to climate, the most important in limiting agricultural development. In the classification of soils on an agricultural basis two primary conditions have to be considered.

Character of the Soil

(1) Topographical Character.—Soil on gentle slopes, or up to a sustained slope of eight to ten per cent, is tillable; slopes to fifteen or twenty per cent are suitable for grazing. Steeper slopes or soils broken by ledges or boulders are unsuitable for any agricultural development.

(2) Physical Character of the Soil.—The physical character of the soil determines its moisture and fertility-holding capacity, as well as, to a large extent, the cost of bringing area under crop. It is more important than soil fertility, because fertility may be increased or destroyed by the manner in which the clearing and cropping is done, but the texture of the soil cannot be changed. We have, therefore, divided our soil into five types on this physical basis, viz., clays, clay loams, sandy loams, sand soils and swamp soils.

The clay soils are composed almost entirely of clay with their humus content. They are heavy, often wet, and without drainage; frequently, they will bake when under cultivation.

Clay loams are lighter soils, containing a heavy percentage of clay, some sand and humus. They are usually well drained, easily worked, and form our most desirable soils, as they do not need the initial expense of sub-drainage required by the heavy clays.

Sandy loams are the same as clay loams, but here the sand predominates. While they have fair fertility-holding capacity, especially if we have a more compact sub-soil, they are liable to respond quickly to periods of drought, and the crops become burned. Owing to the easily worked nature of these soils and the early warming up in the spring, they are desirable for intensive cultivation, but can be classed only as "fair" to "poor" for general field crops.

Sand soils consist of sands, or very light sandy loams with sand subsoils. They exist extensively on the Miramichi, and constitute what is termed the hungry or leachy uplands of the coal measures. Owing to their open, porous nature, all fertility is washed down below plough depth, and they lack both plant food and moisture.

While they can be farmed under intensive cultivation, with copious applications of fertilizer and an artificially controlled water supply, they are undesirable for the production of general field crops.

Swamp type soils are the undecayed or partially decayed vegetable matter of swamps and caribou barrens. They lack plant food, are poorly aerated and generally sour or acrid in reaction, always wet and, under existing conditions, are non-agricultural.

To be a profitable agricultural soil, the crop return must pay, at current rates, the cost of labour required to produce the crop, plus interest on the initial valuation of the land and on the capital required to put this land in a state of cultivation.

Roughly speaking, therefore, clay loam, clay soils and sandy loams can be classified as agricultural land, unless there are excessive quantities of surface or subsurface stone, or the cost of drainage is excessive.

Personal Factor in Agriculture

The third factor influencing the success of agriculture is the personal, and much of the success or failure is due to this factor. Frequently, failure is due to lack of understanding of the basic principles of agriculture, sometimes due to neglect to carry out those principles. The man who takes grain crops, year after year, without rotation, rest or fertilization, is mining his soil of its fertility, just as surely as the miner is mining his vein, and, sooner or later, must meet crop failure and soil exhaustion. Many of our abandoned farms are due to this personal element, and there is no doubt that if our early settlers had had someone to direct their efforts along logical lines, we would now have many prosperous communities where we have only waste land. This, however, is a question of education, and one which bears on the survey only in so far as results, some years hence, may be seen on lands classified as agricultural.

The personal factor, however, to a large extent determines the revenue required from the land. Some men are content to take a very small rate of interest on the capital charge, even a small wage for labour performed, because of personal appreciation of the site, family ties or other enhanced personal value. This, however, does not affect the opening up of new settlements for general colonization, and is only met with in cases where new land is required to take care of the overflow of older settlements.

The Social Factor

Modern civilization requires social life, and a farmer, as a part of our modern civilization, requires within his reach schools, churches and neighbours. These can be had only where land enough is opened for settlement to

permit of a community. This has a distinct bearing on the classification. For instance while isolated areas of good soil may occur, distant from any settlement, and where social facilities cannot be had by our future settler, it is not desirable to classify such land as agricultural, and open it for settlement, even though it could produce paying farm crops. On the other hand, relatively poorer land in the vicinity of established settlements should be classified as agricultural, provided its occupation will strengthen an existing community.

Just a word as to the use the information gathered will be to the Department of Lands and Mines in the future management of the Crown lands.

(1) It will give definite information of the quantity, quality and value of the timber on any area, from which a very close appraisal of the stumpage can be ascertained; it will show whether the department is receiving full value for the lumber cut or not, and stumpage rates can be adjusted accordingly. It will show the quantity and quality of species now of little importance because of lack of market demand, and we hope we will be able either to show that these species can be marketed profitably, or where the quantity justifies it, to induce industries utilizing these inferior species, to operate within the province, thus profitably utilizing material which, at present, is going to waste.

(2) The estimation of growth will determine whether or not the annual cut can be increased, or whether, to perpetuate the industry, restrictions should be placed on certain species to regulate the cut.

(3) The base map, showing as it does the roads, creeks, swamps, and main topographical features, as well as the types, will be a great aid in planning and carrying out any scheme of protection.

(4) The information on soils will permit of directing settlement to districts offering the greatest prospect of success, thus protecting both the future settler and the timber licensee, the latter at the present time having no assurance that portions of his license will not be taken from him under the Labour Act.

In conclusion, I would point out that, with the completion of the survey, we have not reached our ultimate aim. The soil conditions and topography are fixed and permanent. The timber conditions, however, are constantly changing. Therefore, as new areas are culled, as new fires occur or burned areas come again into maturity, it will be necessary to revise our maps from year to year. This calls for a permanent outside organization, to inspect and report on all logging operations, to submit detailed reports on all fire and

bug-killed areas, and, in general, to keep the office in touch with the actual changes in field conditions. It is hoped that, in the next year or two, our fire rangers and scalers will be welded into a permanent organization, which will give us sufficient force to carry out this work. We will then have available information showing the actual condition and value of any area of our public domain at any time, and be ready to deal with any question of policy that may arise.

Discussion

Senator Edwards: Would you include all clay soil as agricultural?

Mr. Caverhill: Unless there is need of drainage or excessive quantities of stone, which will add to the cost of clearing.

Mr. Snowball: How many parties had you out during the past summer, and how many in each party?

Mr. Caverhill: About three parties, of from four to nine men. One party had nine men. We had a forester, a technical man, at the head of each party.

Mr. Snowball: What experience had the forester, the head man in each party?

Mr. Caverhill: With the exception of one case, he was a graduate of a forestry school with several years' experience in cruising.

Senator Edwards: That is, before he studied?

Mr. Caverhill: No, after he graduated he had several years' experience.

Senator Edwards: With whom?

Mr. Caverhill: In one case with the British Columbia Government; in other cases for private parties. One man who took charge of a party was Mr. Roy, a land surveyor, but the second man in his party was a graduate of a forestry school. We did not put the graduate in charge because we did not think he had had sufficient experience in handling men.

Mr. Snowball: What was the experience of the other men in the party?

Mr. Caverhill: The second man was either a graduate or an undergraduate with three years' training in a forest school and several summers in the field, and the other men were woodsmen and men picked up locally. The parties marched in threes. Usually a second-class man went ahead with the compass, and another second-class man calipered one side of the strip; the main cruiser calipered the other side of the strip.

MR. SNOWBALL: Did you chain?

MR. CAVERHILL: We chained most of it. The compass man dragged the chain after him and one man snubbed behind.

MR. SNOWBALL: And the calipering was done by a forester?

MR. CAVERHILL: Yes on one side, and on the other side by a lumberman or one of the farmers in the vicinity.

MR. SNOWBALL: Did he call to the head man the record, or who recorded the record?

MR. CAVERHILL: The compass man recorded the records, the chief cruiser kept the topographic notes and the notes on the logging conditions, conditions of slash, etc.

MR. SNOWBALL: When they bored for growth did they bring the borings out?

MR. CAVERHILL: No. They were measured in the field, as it would be impossible to bring them out. The contraction due to drying would throw the record out of proportion.

MR. SNOWBALL: They did not bring you any for inspection?

MR. CAVERHILL: I was in the field a great deal when the boring was going on, which this year was a small matter. A party of two men will make two hundred borings in a day, and we only made 2,500 borings in the season.

MR. SNOWBALL: What volume tables did you use?

MR. CAVERHILL: As far as we could, we used Bradley's.

MR. SNOWBALL: Did Prof. Miller not prepare a volume table?

MR. CAVERHILL: Yes he prepared some; but they were based on only a small number of trees; where possible, however, we used them. We could not use them in the north, because the timber was of a different character than that on which they were made.

MR. SNOWBALL: What were Bradley's volume tables based on?

MR CAVERHILL: On the New Brunswick Company lands and they were the same as used on the Tobique.

MR. SNOWBALL: Would they not be liable to be excessive?

MR. CAVERHILL: I do not think so. From our checking we found them about the same as the trees we were working on, and measuring. Then we took them as the basis, and checked constantly; when we found that they overran, we reduced the volume tables accordingly.

MR. SNOWBALL: How do they compare with Prof. Miller's tables? Were they greater?

MR. CAVERHILL: A little. While Miller's tables worked on the Miramichi, we found Bradley's best in the north.

MR. SNOWBALL: Was your survey all done in the north?

MR. CAVERHILL: No. Part of our survey was on the Miramichi. There we used Miller's tables, but often we reduced them. When you get my report you will find quite a difference on the two sites of the Miramichi. On one site we had timber twelve inches in diameter, some of it seventy feet high and on the other the same timber was only forty feet high.

MR. SNOWBALL: How would you account for that?

MR. CAVERHILL: On the Bartholomew, some of it was short stuff, which came up after a fire. The taller stuff was the natural growth after logging. Taking the north, the twelve-inch to fourteen-inch stuff ran sixty-five or seventy feet, consequently, we could not adopt any volume table to conditions all over the province. For that reason we changed our volume tables and checked and adjusted in every locality. We used local tables too.

Senator EDWARDS: How much will the cost be per acre?

MR. CAVERHILL: Our cost per acre this year was four and one-quarter cents, about $27 a square mile. That included both field and office work in preparing maps, and also compiling final figures, down to an estimate by watershed.

MR. SNOWBALL: You must have had your help at a very moderate rate. I am not criticising you for doing it; I am glad to see it, as generally governments pay a high rate for help.

MR. CAVERHILL: We paid the regular wages the lumbermen down there pay for their help of the same character.

Prof. SHUTT: I am interested in the question of the soil survey. We did probably the first work in New Brunswick ten or more years ago, in determining, from a large number of samples, whether areas reported on should be opened for agriculture or reserved for lumbering. We were not able to satisfy the very large demands of New Brunswick and suggested that the province make a survey. This question of soil survey has been frequently discussed in Canada, and the success of what has been done has been splendid. It would be desirable to follow in the lines of our friends to the south in this matter. Therefore I desire information as to what this soil survey consists of, as to the frequency with which the soil samples are taken, how they are taken, to what scale, and also to what laboratory methods of analysis they are subjected, that we may know in the future what weight to place upon the results and reports of the surveys.

MR. CAVERHILL: So far as the taking of samples is concerned, we make a digging every twenty-five chains on each strip; that is, one on the corner of every block one hundred rods square. Then all diggings are examined in the field.

The diggings are usually twelve, fourteen or eighteen inches deep, depending on the character of the particular stratum of soil. In a large part of the Miramichi watershed, we get from eight to twelve inches of pure grey sand under possibly half an inch to one inch of partially decayed forest litter. Under such conditions we consider it useless going deeper because that grey sand makes the land unsuitable for agriculture. Where there are better soils, and a possibility of something below, we go to 14 or even 18 inches. Our field men give the character of the humus, forest litter and the first layer, three to four inches, whether sand or what it is, and so on down to plough depth. In this matter we have had co-operation with the Conservation Commission. Mr. F. C. Nunnick, of the Commission, and Mr. W. L. Graham, of the Dept. of Agriculture, brought back samples to Ottawa, had them analyzed and submitted a report to us. Their report corresponded exactly with our reports from the field.

That represents the laboratory work done on them, thus far, but, next year, we hope to get an agricultural expert to come down again, or, possibly, to employ an agricultural expert to go over certain of these sections to determine the real value of the land for farming purposes. At the same time we will try to have an agricultural expert go over and re-classify the land and determine any questions of doubt which arise in connection with our surveys.

DR. SHUTT: You have no means of distinguishing between clay loam, etc?

MR. CAVERHILL: Except by the one distinction between clay loams and sandy loams. The distinction is very arbitrary there.

Senator EDWARDS: Are you likely to undertake an investigation as to the advisability of converting a large amount of land in New Brunswick from attempted farming into forests?

MR. CAVERHILL: I am not in a position to answer that question.

MR. SNOWBALL: You say you took up the question of the cost of driving from certain localities to the mills. How do you get that information?

MR. CAVERHILL: We tried to get it from the lumbermen but we found them very conservative, and hard to get information from. In a few cases we have found out the number of men employed, and, knowing about the average rate of pay and the time for which the men were employed, we got close to the cost of the driving. The cost of driving, of course, depends on the season, and varies. The logging is different. The cost of logging is pretty generally fixed.