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THE CUT-OVER LANDS OF LAKE COUNTY

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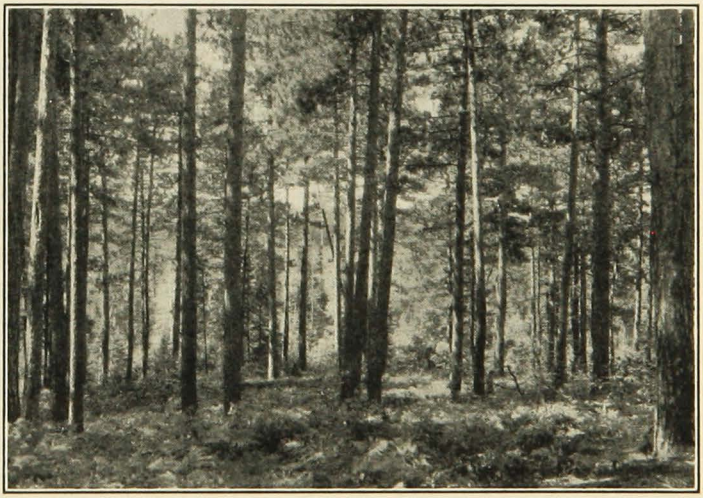

UNIVERSITY FARM, ST. PAUL

THE CUT-OVER LANDS OF LAKE COUNTY

T. SCHANTZ-HANSEN

INTRODUCTION

The purpose of this study is to picture in a general way the present condition of the cut-over lands of Lake County. It is in no way a study of individual tree species, or of yields of specific areas or soil types, but rather a numerical study of the second growth, the tree species present, the density of stocking and the age of the existing stands. The facts presented are of value in indicating some of the production and utilization problems foresters will encounter in the future.

Some years ago, a statistical study was made of the second growth on cut-over lands in St. Louis County.[1] St. Louis and Lake counties adjoin each other and are somewhat alike in soil, topography, and development, except for that portion of Lake County which lies along the north shore of Lake Superior. In general, therefore, the condition of the cut-over lands in the two counties might be expected to be quite similar. The survey of the cut-over lands of Lake County was made in 1922.

HISTORICAL AND DESCRIPTIVE

Lake County has a total area of 1,549,780 acres, of which 206,420 is water surface in the form of lakes and 1,343,360 acres is land surface. It was established in 1856, and Beaver Bay, the first white settlement, was the original county seat. In the early days water transportation along the shore of Lake Superior was the principal means of communication. The present county seat, Two Harbors, is in the southeast corner of the county. The only common carrier railroad in the county passes through it, and its natural harbor is far superior to any other along the coast line of the county. It was not until 1866 that the state government appointed a board of county commissioners.

Table 1

Population of Lake County by Decades, 1860 to 1930*

1860	245	1900	4,654
1870	135	1910	8,011
1880	106	1920	8,251
1890	1,299	1930	7,068

* From U. S. Census Reports.

[1] Hansen, T. S. The Cut-over Lands of St. Louis County. Minn. Agr. Expt. Sta. Bull. 203, 1923.

The development of Lake County has been slow. This is clearly shown by the rate of increase in population. The population reached a maximum of only 8,251 in 1920, almost half of which was in the city of Two Harbors. The decrease in population from 1920 to 1930 is, doubtless, partly the result of the so-called agricultural depression.

Lumber and Iron

The somewhat rapid increase in population after 1880 was largely brought about by the development of the iron mines in St. Louis County at the eastern end of the Vermillion range. The Duluth and Iron Range railroad located its shops and ore docks at Two Harbors. In 1884, 62,000 tons of ore were shipped from this point. The need for an adequate personnel to handle the railroad and the shipping equipment, rather than any development in the county itself, therefore, probably explains the increase in population.

There has been no great mining development in Lake County. The low-grade magnetic ores of the Mesaba range extend into Lake County, but there has been no commercial development of these ore bodies. Some prospecting and drilling has been done, but as yet no valuable mineral deposits have been located.

This lack of known commercial iron ore has influenced the economic development of the county. By comparison with St. Louis County, its taxable values are low and its industrial development has been slow. It has been forced to depend largely on forest resources as a source of tax revenue and a basis for industrial development. Because of limited transportation facilities, no saw-milling centers were ever developed within the county. The first saw mill of which there is a record was established at Beaver Bay in 1860 by Wieland Brothers. The mill was operated until 1885. It employed approximately ten men when running full capacity, and had an output of 22,000 feet of lumber per day. All the lumber was shipped by water from Beaver Bay. Portable mills within the county have cut a considerable quantity of fire-killed timber that could be salvaged in no other way.

However, the bulk of the forest products cut in Lake County was shipped outside of the county for manufacture and use. Knife River for years was an important shipping point for pulpwood bound for Wisconsin and Pennsylvania mills, and for logs destined for the mills at Duluth. According to Cheyney,[2] up to 1923 about 2,898,000,000 feet of timber had been cut in the county. It is estimated that less than half of this was saw logs. The rest was largely pulpwood, with a small

[2] Cheyney, E. G. Forest Resources of Northern Minnesota. Unpublished ms.

amount in poles, posts and ties. This figure is in all probability quite conservative, since it does not include the cut of portable mills.

Transportation

Lake County is not bountifully supplied with either railroads or roads. In 1884 the Duluth and Iron Range railroad began hauling ore from the Vermilion range to Two Harbors. The first locomotive for this road was shipped to Two Harbors by water. Eventually Two Harbors was connected with Duluth by this road, which touches only the southeastern part of the county and is the only common carrier in the county.

In 1901 the Duluth and Northern Minnesota railroad was begun, extending eastward from Knife River. This road, primarily a logging road, served as a common carrier for 20 years. When the timber adjacent to it had been cut it was found financially impossible to continue it as a common carrier. Permission was obtained to discontinue it, and it was purchased by the Weyerhaeuser interests at Cloquet. The steel was taken up except at the upper end of the line, where about nine or ten miles of track was used to carry logs and pulp from Cook County through Lake County, to Hornby Junction in St. Louis County, and thence to Cloquet.

In addition to these railroads, a branch of the Duluth and Iron Range railroad runs from Wales to the Greenwood Lake district. This is exclusively a logging branch and does not serve as a common carrier.

Several roads are found in the southeastern part of the county, but the interior and the northern parts are without roads. State Highway No. 1 follows the shore of Lake Superior through the county. At Finland, a road runs westward to Ely, in St. Louis County. These are the main arteries of travel. They are fed by short and poorly developed roads along old logging rights-of-way and tote-roads.

Agricultural and industrial development has not needed a more extensive road system.

Agricultural Development

Because industries did not develop in the county, agriculture developed but slowly. No large local market is available to stimulate agricultural development. In a cut-over area where the clearing of land is a slow process a local market is a necessity. Without doubt, the quality of the land has had much to do with its slow rate of development. A considerable area of good, tillable land is found within the county, but it is often broken up by extensive areas of rock outcrop and stony land, which are much more striking in appearance.

Table 2

Agricultural Development in Lake County from 1900 to 1930*

Year	Number of farms	Land in farms, acres	Percentage of total land area in farms	Plowland, including plowable pasture, acres	Percentage of total land area improved
1900	19	2,435	0.18	243	0.02
1910	210	22,279	1.65	2,381	0.18
1920	208	26,739	2.00	3,749	0.28
1925	444	32,394	2.40	6,257	0.47
1930	298	23,108	1.71	5,843	0.43

* From U. S. Census Reports.

The transportation facilities provided by the Duluth and Northern Minnesota railroad, and the local market for produce created by the establishment of many logging camps, caused a large increase in the number of farms from 1900 to 1910. By 1920 the number of logging camps had begun to decrease. This undoubtedly influenced agricultural development for the decade, 1910-20, because the number of farms remained practically the same. For the five-year period from 1920-25 the number of farms almost doubled. This was largely the result of an active campaign for land development and of a demand for summer homes in the region. By 1930 this development campaign had been almost counterbalanced by the so-called agricultural depression. The number of farms dropped to 298 and the farm area decreased nearly 10,000 acres. The total improved land area, however, decreased only 0.04 per cent. This shows that the newer, poorly developed farms were abandoned.

In 1930 only 1.7 per cent of the total land area was in farms; an additional 0.7 per cent had been in farms in 1925. Only 0.43 per cent of the land area can be classed as improved. This indicates that much of the land is probably marginal in character. The rate of agricultural development will undoubtedly remain slow because it is dependent almost entirely upon local markets. There is little likelihood that these local markets will increase appreciably in the immediate future.

CHARACTER OF THE LAND

The Minnesota Geological Survey[3] divides Lake County into seven different surface formations. Surface formations are not soil types, but because a surface formation is the result of definite geologic and physiographic influences the soil characteristics within a given surface formation are somewhat similar. There are, to be sure, variations, but some

[3] Leverett and Sardessen. Surface Formations and Agricultural Conditions of Northeastern Minnesota. Bull. 13, Univ. of Minn.

formations are predominantly agricultural land, while others are predominantly marginal agricultural land, and still others predominantly forest land. In considering the forest conditions existing on the cut-over lands of Lake County the above classification will be used. Since each class will eventually present a different problem, they are considered separately.

Table 3

Classification of Surface Formations in Lake County

Surface formation	Agricultural land	Marginal agricultural land	Forest land	Unclassified
	acres	acres	acres	acres
Lake washed till-clay	47,300	.....	.....	.....
Lake washed till-sand	28,600	.....	.....	.....
Rock outcrop	.....	.....	623,100	.....
Moraine sand	.....	.....	191,200	.....
Till boulder plains sand	164,200	163,200	.....	.....
Outwash gravel	.....	45,300	.....	.....
Swamp	.....	.....	.....	68,200
Total	240,100	208,500	814,300	68,200
Per cent of total land area	20	14	61	5

The areas of the surface formations were obtained by planimetering the map of Lake County. The land and water areas were obtained from the United States census reports.

The classification of the soils as forest, marginal agricultural, and agricultural is based on general field observations taken during the survey. It is very general and based largely on the opinion of the writer. Detailed surveys and changes in economic conditions will doubtless somewhat alter the classification.

There were 6,257 acres of improved agricultural land in the county in 1925. The classification given in Table 3 shows 240,100 acres of potential agricultural land. There were, therefore, 233,843 acres of potential agricultural land as yet undeveloped. Through the period of 1920-25, improvement was carried on at the rate of 500 acres a year. At this rate of improvement it would take 465 years for even the best land to be utilized for agricultural purposes. Only 0.5 per cent of the area of the county is improved; 34.5 per cent is unimproved and uncut, and 65 per cent cut-over. Of the total area, 20 per cent is classed as agricultural land, 75 per cent as forest and marginal agricultural land, and 5 per cent goes unclassed.

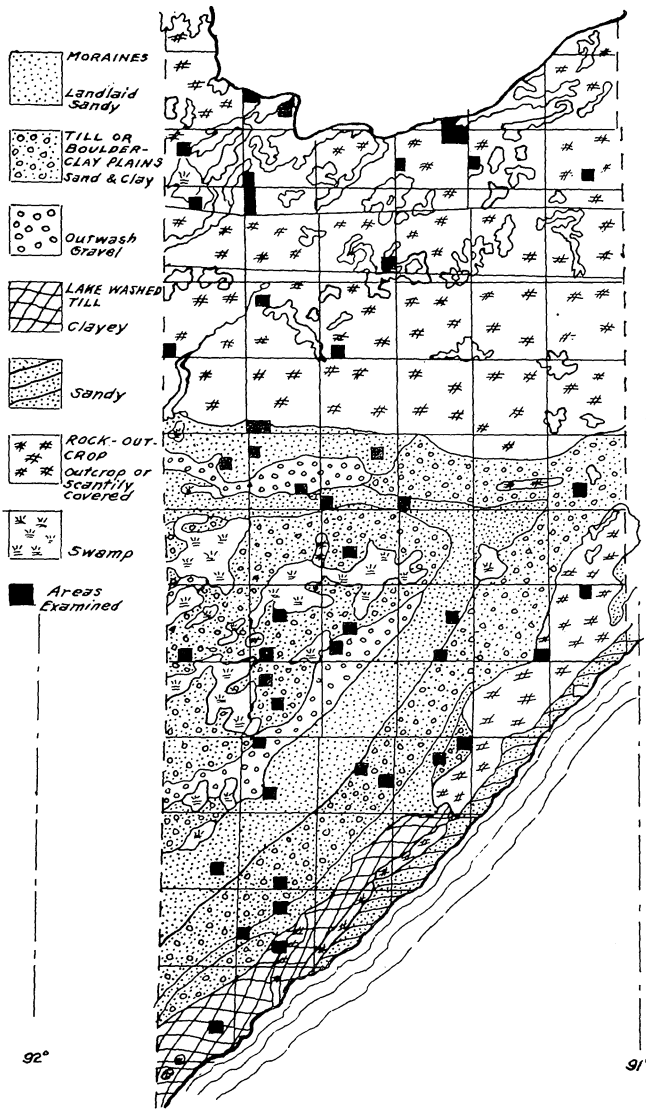

Fig. 1. The surface formations of Lake County (Leverett and Sardessen)

OWNERSHIP OF LAND

Of the 1,343,360 acres in the county, the state owns 154,492 acres or 12 per cent; the federal government, 348,363 acres, or 26 per cent; private interests, 557,600, or 41 per cent, and the state, through tax delinquency, 282,905, or 21 per cent.

In other words, virtually 59 per cent—including the tax delinquent areas—is in public ownership, leaving 41 per cent to bear the tax burden. The fact that 38 per cent of the area is in state and federal ownership assures some degree of forest permanency for that portion of the area. The tax delinquent land, now aggregating 21 per cent of the area, is rapidly increasing and necessitates the finding of some productive use for the land. It appears that agricultural development cannot possibly utilize the available land for years to come. Two logical uses suggest themselves—recreation and forestry. Fortunately, these two uses may be combined. Forest practice will increase the recreational value of the area.

STANDING TIMBER

It is difficult to secure complete and adequate figures on the standing timber in the county. Neither the organized nor the unorganized townships have been cruised for taxation purposes.

Cheyney[4] estimates that there is still standing 2,903,000,000 board feet of timber, including all products. Fifty-three per cent of this is spruce, 17 per cent balsam, 17 per cent pine, 3 per cent popple, 2 per cent birch, 7 per cent mixed hardwoods, and 1 per cent merchantable second-growth.

Cheyney[4] estimates that 66 per cent of the upland and 40 per cent of the swamp land has been cut over. This would leave an uncut area of 374,874 acres. Using Cheyney's figure for standing timber, this area has an average stand of 7,700 board feet per acre.

RECREATIONAL VALUES

Probably no other resource possessed by Lake County presents such possibilities for immediate returns as the recreational values. The shore line of Lake Superior, the inland lakes, the attractive streams, all are potential sources of income. The development of the recreational values is not incompatible with the use of the areas for forest purposes. In fact, the two uses supplement each other. Without an adequate stand of trees there is a marked decline in the recreational possibilities of any area.

Summer homes, by increasing the taxable value of the land, and tourists can do much to bridge the gap between the present condition of cut-over lands and their rehabilitation either by natural or artificial means.

[4] Cheyney, E. G. Forest Resources of Northern Minnesota. Unpublished ms.

METHOD OF STUDY

The surface formation map published by the University Department of Geology, in making this survey, was used as a base map, tho its use met with some difficulty. Some areas classified as morainic formations are so poorly drained that they are easily confused with the swamp formations. Representative cut-over areas were selected by means of a preliminary inspection and sections of cut-over lands within these areas were examined intensively. An attempt was made to select sections entirely cut-over. These sections were crossed twice by parallel lines a half-mile apart, each line being a quarter of a mile from the section corner. The lines were run either north and south or east and west, as local topographic conditions dictated.

At five-chain intervals on these lines, plots one-chain square were laid out. All the reproduction on each lot was counted and tallied by species and size. Ages of the various size-classes were determined either by felling specimens or by means of an increment borer. Complete notes on the ground cover, surface conditions, and character of the soil were taken. It was impossible in enough instances to learn the year in which the area was cut, the method of slash disposal, the number of times the area has been burned over, and the date of the last fire to warrant drawing conclusions from the data.

A total of 46 sections was examined. This represents about 2 per cent of the land area of the county or 3½ per cent of the cut-over area. This is a sufficiently large percentage from which to draw general conclusions as to the condition of the entire area.

In the following analyses of second growth the stands were divided on the basis of both age and species. Three general age classes were used, i.e., seedlings, saplings, and poles. The seedlings were from 2 inches to 10 feet tall and averaged about 7 years old; the saplings were from 10 to 20 feet tall and averaged about 15 years old; the poles were more than 20 feet tall and less than 4 inches in diameter and averaged 30 years old.

Three types of stands were used: Hardwood stands, containing less than 10 per cent conifers; mixed stands, containing from 10 to 60 per cent conifers; coniferous stands, containing more than 60 per cent conifers.

Seedling age stands with from 1000 to 2000 trees per acre, sapling age stands with from 800 to 1500 trees per acre, and pole age stands with from 500 to 800 trees per acre were considered satisfactorily stocked. Stands with less than these numbers were considered understocked; with more they were considered overstocked. It must be re-

membered that these figures have been selected arbitrarily as representing stands that might be considered satisfactory from a commercial standpoint. They do not bear any relation to the true normality of the various species as it is understood in forest practice.

CONDITION OF CUT-OVER FOREST LAND

Forest land in Lake County amounts to 61 per cent of the total land area. This is the part of the county which is of primary interest to the forester. It is the part that can be expected to remain as forest land through almost any probable future economic changes. The physical character of the land is such that its use for other purposes is precluded.

The two surface formations included in the forest land are rock outcrop and moraine sand. The rock outcrop is the most extensive of all surface formations found in Lake County. It has a net area of 623,129 acres, nearly 50 per cent of the land area of the county. The largest body of this formation lies in the northern half of the county. A smaller belt is found along the shore of Lake Superior. The granite ledges lie close to the surface. Where fire has not burned over the area there is a scanty covering of duff and soil of organic origin. The topography is rugged, at points almost mountainous in appearance. An intensive examination was made of 2 per cent of the cut-over area of this type.

The moraine sand has a net area of 191,244 acres. The soil varies from coarse gravel with boulders and hilly topography to almost level sandy plains. Three per cent of the cut-over area of this surface formation was examined intensively.

General Conditions

The first requisite in studying cut-over forest lands is to get a general picture of existing conditions. It is essential to know something of the types of forest growth in a broad way, how much of the area is barren, and how much of it is non-productive.

There has been a considerable change in the character of the forest since cutting. The original stand of this area was largely coniferous. In the second growth, hardwood stands are found to occupy 38 per cent of the rock outcrop and 36 per cent of the moraine sand. Mixed stands occupy 36 per cent of the rock outcrop and 20 per cent of the moraine sand, while conifers occupy only 7 per cent of the rock outcrop and 22 per cent of the moraine sand. There is a distinct similarity in the general type of second growth on both types of forest land. Hardwood stands predominate. Since these hardwood stands are largely birch and

aspen, they are in all probability the result of fires that have burned over the area since cutting. The moraine sand has a larger proportion of coniferous stands than the rock outcrop. This is due to the fact that jack pine, itself a "fire tree," is more common on sandy soils than on the rocky soils and also to the fact that fire is particularly hard on white pine, which was the common tree on the rock outcrop. If the mixed and coniferous stands are considered as a whole, we find that conifers are an equally important constituent in the stands of second growth on both surface formations.

It is especially striking that only 2.3 per cent of the rock outcrop and 3 per cent of the moraine sand is barren. This is a relatively small percentage. Expressed in acres, however, it means an area of 20,000 acres.

It is not only desirable to know something about the general type of forest growth, but also about the age of the stands. This gives an indication of the length of time which must elapse before the second crop is ready for harvest.

The rock outcrop surface formation has about 65 per cent of its second growth in the seedling stage; the moraine sand surface formation, about 50 per cent. The proportion of sapling stands is about the same on both formations—20 to 22 per cent, while the moraine sand has about 30 per cent of its stand of pole age, as against about 18 per cent for rock outcrop. This shows either that the cutting has been more recent or that fires have been more prevalent on the rock outcrop surface formation.

Table 4

Proportion of Age Classes and Density of Stocking in Hardwood Stands on Cut-over Forest Land on Sandy Moraine and Rock Outcrop Surface Formations

Hardwood stands	Sandy moraine	Rock outcrop
	per cent	per cent
Seedling Age	65	58
Overstocked	15	8
Satisfactorily stocked	33	37
Understocked	52	53
Sapling Age	25	26
Overstocked	35	27
Satisfactorily stocked	50	70
Understocked	15	3
Pole Age	10	16
Overstocked	50	50
Satisfactorily stocked	40	40
Understocked	30	10

Character of the Stands

A further analysis of the forest growth is necessary in order to get an adequate picture of its character. It is necessary to know something

about the proportion of age classes in the various types. This gives an indication of which type of growth will be first available as a source of raw material. It is also necessary to know something about the density of stocking on the area, to determine whether planting or thinning will be necessary to make the area fully productive.

Because the hardwood stands are largely the result of fires, and fires have recurred periodically, the seedling age predominates. Many areas suffered and continue to suffer successive burnings which tend to keep them constantly in this age class. Similar conditions prevail on both surface formations. The heaviest understocking was found in the seedling stage. As these stands grow older the understocking will be somewhat less, since in all probability more of the trees will survive in the more lightly stocked stands than in the denser. A sufficiently large area of all age classes is understocked to indicate the need for a planting program.

Table 5

Proportion of Age Classes and Density of Stocking in Mixed Stands on Cut-over Forest Lands on Sandy Moraine and Rock Outcrop Surface Formations

Mixed stands	Sandy moraine	Rock outcrop
	per cent	per cent
Seedling age	47	69
Overstocked	12	28
Satisfactorily stocked	38	56
Understocked	50	26
Sapling age	9	22
Overstocked	..	24
Satisfactorily stocked	..	44
Understocked	100	32
Pole age	44	9
Overstocked	33	41
Satisfactorily stocked	27	18
Understocked	40	41

Table 6

Proportion of Age Classes and Density of Stocking in Coniferous Stands on Cut-over Forest Lands on Sandy Moraine and Rock Outcrop

Coniferous stands	Sandy moraine	Rock outcrop
	per cent	per cent
Seedling age	35	57
Overstocked	..	30
Satisfactorily stocked	..	35
Understocked	100	35
Sapling age	16	6
Overstocked	25	..
Satisfactorily stocked	50	50
Understocked	25	50
Pole age	19	37
Overstocked	32	25
Satisfactorily stocked	36	64
Understocked	52	9

In general, the mixed stands occur on areas which have not been burned as heavily as those occupied only by hardwoods. This is indicated by the presence of a larger proportion of conifers. Understocking seems to be present in all age classes, possibly because of less suckering in aspen resulting from repeated fires.

The coniferous stands are usually found on the areas that have been free from fire or burned very lightly. For this reason there is a much larger proportion of the pole age than in the other types of stands. There is a considerable variation in the density of stands, since they have not been subjected to the unifying influence of fire. The resultant stand has been influenced more by available seed supply and other natural causes which determine the survival of reproduction.

Number of Trees per Acre

The average stand per acre is of more interest when considered with the density of stocking. It does not give an idea of the extremes. In most cases, as would be expected, the younger age classes show a much larger average number of trees per acre than the older age classes.

Table 7

Average Number of Trees per Acre by Age Classes and Types of Cut-over Forest Land on Sandy Moraine and Rock Outcrop Surface Formations

	Number of trees per acre	
	Sandy moraine	Rock outcrop
Hardwood stands		
Seedling age	950	1125
Sapling age	1450	1325
Pole age	925	775
Mixed stands		
Seedling age	1050	2050
Sapling age	525	1300
Pole age	750	0
Coniferous stands		
Seedling age	675	2600
Sapling age	900	700
Pole age	750	675

Character of Age Classes

Originally the cut-over area was largely coniferous. Its conversion to hardwood species has been brought about largely through burning and cutting. In time, if fire were prevented, nature would doubtless re-establish the coniferous stands, but the natural process would perhaps require hundreds of years.

While the difference between the seedling and sapling age stands is not so marked, there is a distinct increase in the proportion of coniferous

trees in the pole age. This is probably due, in part, to the less burning of these stands, but the natural conversion also has played its part.

Table 8

Proportion of Various Types in Different Age Classes on Cut-over Forest Land on Sandy Moraine and Rock Outcrop Surface Formations

	Sandy moraine	Rock outcrop
	per cent	per cent
Seedling stands		
Hardwoods	56	46
Mixed	20	48
Coniferous	24	6
Sapling stands		
Hardwoods	64	57
Mixed	10	37
Coniferous	26	6
Pole stands		
Hardwoods	20	35
Mixed	30	42
Coniferous	50	23

Composition of Stands

It is necessary to know something of the species of conifers which enter into the make-up of the second growth.

Table 9

Frequency of Occurrence of Coniferous Species in Second Growth on the Rock Outcrop Surface Formation Based on the Number of Plots in Which Species Appear

Species	Mixed						Conifer					
	Seedling		Sapling		Pole		Seedling		Sapling		Pole	
	Pred.	Assoc.*	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.
	per cent		per cent		per cent		per cent		per cent		per cent	
Spruce	21	61	9	56	22	40	41	35	75	..	45	45
Balsam fir	17	28	48	17	50	5	6	35	..	..	..	9
Jack pine	58	28	35	26	28	28	53	23	25	50	55	45
Northern white pine	..	33	8	35	..	28	..	23	..	..	..	9
Norway pine	2	13	..	35	..	5	..	12	..	..	..	9
Tamarack	1	12	..	21	..	22	..	23	..	75	..	27
Northern white cedar	1	2	..	4	..	..	..	12	..	..	..	..

* Pred. = predominate species; Assoc. = associate species.

As a whole, jack pine and black spruce appear more often than the other species, followed by balsam fir. On the rock outcrop surface formation, jack pine and black spruce are predominant. Norway and northern white pine are found largely as associated species, but in most cases are not present in sufficient numbers to influence the type of stand.

Table 10

Frequency of Occurrence of Coniferous Species in Second Growth on the Moraine Sand Surface Formation Based on the Number of Plots in Which Species Appear

Species	Mixed						Conifer					
	Seedling		Sapling		Pole		Seedling		Sapling		Pole	
	Pred.	Assoc.*	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.
	per cent		per cent		per cent		per cent		per cent		per cent	
Spruce	13	33	..	33	12	41	5	53	..	50	6	30
Balsam fir	33	27	100	..	6	23	71	18	..	..	6	17
Jack pine	33	13	..	..	65	30	12	5	67	33	83	11
Northern white pine	7	13	..	..	12	41	..	5	16	17	..	11
Norway pine	..	13	..	..	5	30	..	5	17	16	5	12
Tamarack	7	7	..	33	..	8	..	..	..	..	..	..
Northern white cedar	7	20	..	..	..	..	12	35	..	..	..	..

* Pred. = predominate species; Assoc. = associate species.

On the moraine sand surface formation, jack pine and balsam fir are predominant, with white or black spruce ranking third. The soils of this formation are light and quite sandy. Under normal conditions jack pine would appear in the original stand, and, being a good reproducer even under adverse conditions, would be prominent in the second-growth stands.

Except for minor variations, the composition of the second growth on these two surface formations is similar to that on the same formations in St. Louis County.

CONDITION OF CUT-OVER MARGINAL AGRICULTURAL LANDS

The marginal lands of Lake County are of almost as much interest to the forester as the forest land. With 239,130 acres of agricultural land and only 23,108 acres in farms, of which 5,843 acres have been improved, sufficient time to raise several forest crops will elapse before marginal agricultural lands are needed to produce food crops.

The marginal agricultural lands are found in two surface formation—till boulder clay plains and sand mixture and outwash gravel. The till boulder plains are ground moraines left by the glaciers and are composed of sandy clay soils. Where the boulders are not too plentiful, the soil is of good quality for agricultural purposes. Half of this surface formation is agricultural land. Outwash gravel plains are the outwash aprons left by glacial streams. The soils vary from fine sand to coarse gravel.

In general, the character of the cut-over forest on marginal agricultural lands is similar to that on the forest land. There is a predominance of hardwood reproduction on these surface formations, and the greatest proportion of the stands is in the seedling stage. There is some increase in the proportion of conifers in the older age classes.

Table 11

General Character of the Second Growth Forest on Marginal Agricultural Land, on Till Boulder Clay Plains, and Outwash Gravel

Character of second growth	Till boulder clay	Outwash gravel
	per cent	per cent
Hardwood stands	41	51
Mixed stands	11	17
Coniferous stands	19.6	17
Swamp	21	6
Muskeg	2.7	9
Barren	3.5	0

Table 12

Proportion of Age Classes in Second Growth Stands on Cut-over Marginal Lands on Till Boulder Clay Plains and Outwash Gravel Surface Formations

Age of stands	Till boulder clay	Outwash gravel
	per cent	per cent
Seedling	79	86
Sapling	9	14
Pole	12	0

Table 13

Proportion of Age Classes and Density of Stocking in Hardwood Stands on Cut-over Marginal Land on Till Boulder Clay Plains and Outwash Gravel

Hardwood stands	Till boulder clay	Outwash gravel
	per cent	per cent
Seedling age	86	85
Overstocked	12	42
Satisfactorily stocked	23	21
Understocked	65	37
Sapling age	10	15
Overstocked	20	0
Satisfactorily stocked	33	75
Understocked	47	25
Pole age	4	..
Overstocked	68	0
Satisfactorily stocked	16	0
Understocked	16	0

Table 14

Proportion of Age Classes and Density of Stocking in Mixed Stands on Cut-over Marginal Lands on Till Boulder Clay Plains and Outwash Gravel

Mixed stands	Till boulder clay	Outwash gravel
	per cent	per cent
Seedling age	82	85
Overstocked	10	10
Satisfactorily stocked	0	22
Understocked	90	68
Sapling age	18	8
Overstocked	0	0
Satisfactorily stocked	100	60
Understocked	0	40
Pole age	0	7
Overstocked	..	16
Satisfactorily stocked	..	33
Understocked	..	51

Table 15

Proportion of Age Classes and Density of Stocking in Coniferous Stands on Cut-over Marginal Land on Till Boulder Clay Plains and Outwash Gravel

Coniferous stands	Till boulder clay	Outwash gravel
	per cent	per cent
Seedling age	59	90
Overstocked	22	0
Satisfactorily stocked	26	10
Understocked	52	90
Sapling age	6	10
Overstocked	0	0
Satisfactorily stocked	0	100
Understocked	100	0
Pole age	35	0
Overstocked	38	..
Satisfactorily stocked	31	..
Understocked	31	..

Table 16

Average Number of Trees per Acre of Different Age Classes by Types on Cut-over Marginal Lands, Till Boulder Clay Plains, and Outwash Gravel

Stand and age	Average number of trees per acre	
	Till boulder clay	Outwash gravel
	per cent	per cent
Hardwood stands		
Seedling age	825	2175
Sapling age	925	900
Pole age	0	850
Mixed stands		
Seedling age	740	1150
Sapling age	1080	725
Pole age	0	540
Coniferous stands		
Seedling age	500	1160
Sapling age	800	325
Pole age	0	1000

Table 17

Proportion of Various Forest Types in Different Age Classes on Cut-over Marginal Land on Till Boulder Clay Plains and Outwash Gravel

Age of stands	Till boulder clay	Outwash gravel
	per cent	per cent
Seedling stands		
Hardwoods	61	59
Mixed	24	20
Coniferous	15	21
Sapling stands		
Hardwoods	65	57
Mixed	22	28
Coniferous	13	15
Pole stands		
Hardwoods	26	0
Mixed	56	0
Coniferous	18	0

On the till boulder plain surface formation balsam fir is the most common species, while on the outwash gravel surface formation jack and Norway pine, as well as balsam fir, are important species.

Table 18

Frequency of Occurrence of Coniferous Species in Second Growth on Till Boulder Clay Surface Formation Based on the Number of Plots in Which Species Appear

Species	Mixed						Conifer					
	Seedling		Sapling		Pole		Seedling		Sapling		Pole	
	Pred.	Assoc.*	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.
	per cent		per cent		per cent		per cent		per cent		per cent	
Spruce	9	31	..	80	..	71	12	83	..	67	7	46
Balsam firm	55	35	100	..	36	21	87	25	100	..	85	8
Jack pine	..	..	..	..	..	21	..	1	..	..	..	8
Northern white pine	..	1	..	80	57	..	..	16	..	..	8	46
Norway pine	..	..	..	..	..	42	..	..	..	..	..	..
Tamarack	5	9	..	10	..	7	1	21	..	..	..	..
Northern white cedar	5	7	..	60	7	28	..	17	..	33	..	46

* Pred. = predominate species; Assoc. = associate species.

Table 19

Frequency of Occurrence of Coniferous Species in Second Growth on Outwash Gravel Surface Formation Based on the Number of Plots in Which Species Appear

Species	Mixed						Conifer					
	Seedling		Sapling		Pole		Seedling		Sapling		Pole	
	Pred.	Assoc.*	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.	Pred.	Assoc.
	per cent		per cent		per cent		per cent		per cent		per cent	
Spruce	20	50	..	67	..	..	..	75	..	..	..	..
Balsam fir	70	..	..	33	..	..	100	..	..	..	..	..
Jack pine	..	10	67	33	..	..	..	12	..	..	..	..
Northern white pine	..	10	..	67	..	..	..	..	..	..	..	..
Norway pine	..	..	33	..	..	..	..	..	..	..	..	..
Tamarack	10	..	..	..	..	..	..	..	..	..	..	..
Northern white cedar	..	20	..	67	..	..	..	13	..	..	..	..

* Pred. = predominate species; Assoc. = associate species.

SWAMP SURFACE FORMATION

The data secured on this surface formation were not as clear-cut or satisfactory as that on the other surface formations. This was due, in part at least, to the variation in cutting methods in swamps. In many instances stands were not cut clear, and smaller sizes or undesirable species were left. Both the size and the species left varied from season to season with changing economic conditions. For these reasons, and because the area examined was not large enough to give a true picture of average conditions, a discussion of this surface formation has been omitted.

GENERAL SUMMARY

Because of its location, limited industrial development, and character of soil, Lake County must depend upon forests and agriculture for its future development. Its agricultural development is in a large measure dependent upon the local markets afforded by logging camps and summer tourists. Without forests, neither the logging camp nor the tourist will be found.

The fact that 38 per cent of the county area is in public ownership assures a continuous forest production on at least a considerable portion of the area. The large area of cut-over lands and the increasing amount of tax delinquency present a vital problem to the community. At present only 41 per cent of the area carries the entire tax burden. It is important that the 21 per cent now delinquent, as well as a large portion of the non-delinquent lands, become productive. If these lands cannot be made to carry their share of the load, a serious handicap will remain on the agricultural and industrial interests of the county.

The first step in making these lands productive is a knowledge of the present condition of the area, the tree growth that is present, the species, number of trees per acre, and the age of the stands. A knowledge of these factors gives an insight into the problems that must be met in making the area productive.

At first glance the situation seems unusually hopeful. Only two per cent of the area has been classed as barren. Expressed in per cent it seems relatively small, but in acres it means that 20,000 acres must be reforested. To this must be added an unknown area of understocked stands which may require some planting. Forty-four per cent of all the stands are understocked, many of them seriously so. There is a nucleus of stands which must be built up through proper handling, either by natural means or by planting.

Table 20

General Character of Cut-over Land on All Surface Formations

Character of stands	Per cent
Hardwood stands	39
Mixed stands	26
Coniferous stands	14
Swamp	15
Muskeg	4
Barren	2

Table 21

Proportion of Age Classes on All Types of Cut-over Land on All Surface Formations

Age class	Per cent
Seedling	71
Sapling	15
Poles	14

Table 22

Proportion of Age Classes and Density of Stocking by Types and Age Classes on All Types of Cut-over Lands on All Surface Formations

Age and stocking	Hardwood stands	Coniferous stands	Mixed stands
	per cent	per cent	per cent
Seedling age	75	61	73
Overstocked	17	16	19
Satisfactorily stocked	28	21	36
Understocked	55	63	45
Sapling age	17	9	15
Overstocked	29	15	17
Satisfactorily stocked	52	38	46
Understocked	19	47	37
Pole age	8	39	12
Overstocked	41	35	35
Satisfactorily stocked	35	39	24
Understocked	24	26	41

Table 23

Average Number of Trees per Acre by Types and Age Classes for All Classes of Cut-over Land on All Surface Formations

	Average number of trees per acre		
	Hardwood stands	Coniferous stands	Mixed stands
Seedling age	1220	1120	1170
Sapling age	1150	820	910
Pole age	745	650	740

Table 24

Proportion of Types in Various Age Classes on All Classes of Cut-over Lands in Lake County

	Hardwood stands	Coniferous stands	Mixed stands
	per cent	per cent	per cent
Seedling age	57	16	27
Sapling age	59	11	30
Pole age	21	49	30

Thirty-eight per cent of the area is in birch and aspen; 32 per cent birch and aspen, mixed with conifers; while 15 per cent of the area is coniferous reproduction. Nature has, of course, not placed the various stands on the proper sites. Many of the present stands of reproduction will have to be converted to other species to make the areas fully productive.

The present wood-using industry is based on the fast-disappearing virgin stand, most of which is coniferous. The presence of these so-called inferior species brings up a complicated problem in utilization. In order to make any progress, the present stand must be utilized. If an industry based on this type of raw material is developed, should it be permanent or temporary? If a permanent industry, how much of the area will be needed to assure a continuous supply?

The presence of a considerable area of second growth in no way simplifies the forest problem, but rather complicates it. Nature has merely provided a starting point from which the solution must be worked out.