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LAND USE CRITERIA FOR CRAWFORD COUNTY, MICHIGAN

by

Clifford R. Humphrys

A THESIS

Submitted to the Graduate School of Michigan State College of Agriculture and Applied Science in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

Department of Soils

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THESIS

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NATURE OF THE PROBLEM

Lumbering has just swept through the pine and hardwood forests of Lower Michigan and is now taking its last stand in the Upper Peninsula. In its wake there are endless tracts of land reverting to the State by tax reversion. Scattered settlements of established farms and many abortive attempts at agriculture, nucleii of recreational interests are scattered in profusion throughout the whole cut-over region, and the investments of speculators have added to the complexity of the ownership pattern.

During the last few decades a considerable acreage of land has oscillated between private and public ownership. Federal and State forest units were set up to stabilize the ownership and use of some of this cut-over region, but the proper use for much of the area is still problematical, especially in terms of future planning.

It is thought that by studying the past use of land and the degree of success in its use, the trends in ownership, and the natural characteristics of the land, data will be compiled that will be helpful in planning future land use. If criteria could be established for the determination of the best alternative present and future uses for specific land areas, land planning may prevent serious mistakes and economic losses in the future both for the state and individuals.

In the preparation of this thesis, Crawford County, which is a representative county in northern Michigan, was selected and studied in an attempt to establish such criteria for land use.

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NATURE OF THE PROBLEM AREA

Crawford County was selected as a typical "cut-over" county of northern Michigan. Within the county there are several classes of ownership represented; these may be classified as State forest, National forest, State Parks, game refuge, industrial, agricultural, recreational and speculative.

History

Up to 1535 the Indians had occasionally used this area for hunting, fishing and a meager amount of agriculture. Their usage would be considered safe conservation, but it was so extensive as to be of little economic importance. From 1535 to 1750 fur traders frequented the area, using the Au Sable River as a transportation route. Fur trading tapped one of the first resources that was ever utilized intensively in the settlement of this country. No thought was ever given to the conservation of fur and in this particular region it probably would not have been practical, for the fur bearers were doomed by other types of utilization that was to follow; lumbering and agriculture. Eventually the major part of the fur bearing stock was cropped and in most cases only a sufficient breeding stock remained to perpetuate the species. Fur traders were undoubtedly the first publicity men of this northern country and through their stories of the tractless stands of virgin timber and endless waterways, other people became interested in this wilderness country and aided in its exploration, colonization and development. The potential resources were considered valuable even at that period, as evidenced by the continual struggle between France and England for the ownership of this northern country. Cartier claimed

this territory for the French Crown in 1535 and it was successfully held by the French until 1760. In 1760 it was taken over by the English and held until 1815, at which time it became part of the public domain of the United States.

Up until 1872 the area now designated as Crawford County was utilized only for its fur production. In 1872 the lumber industry had started its westward trek and lumbering began on a small scale. Grayling and Pere Cheney were the centers of lumber production in the county. Vast stands of red and white pine located along driveable streams made ideal logging "chances". In the early stages of lumbering, the logs were cut in the winter time and transported to the mills by spring drives on the streams. Eventually the easy "chances" along the streams were exhausted and railroads were built to carry the logs to the mill. This new form of transportation made possible the year-long operation of the mills which had heretofore suffered occasional shut downs when their yard stock from the spring drives had been diminished.

Today we feel quite justified when we accuse these early lumbermen of exploiting our national resources, but in their position at that period there was no indemnification for, or the slightest reason to recognize conservation. Lumber was being demanded for the rapid growth and development of the mid-western states and these pioneers bent their every effort to supply these demands. Their success is evidenced by the early history of the rapid settlement and development of the vast "grain belt" section of the central west.

Lumbering was a profitable enterprise for the real estate and

mill men during this golden period of logging when the Lake States represented the heart of the lumber industry. All the benefits did not flow to the capitalists who controlled finance, since the availability of cheap building material made possible a more rapid colonization of the whole north central region and the establishment of the nucleus of our present day development.

Lumbering gave us much, but its apparent inefficiencies have grown until they now appear to be ghastly mistakes. Many present day altruistical conservationists can glibly recite on the evils of former lumbermen and explain elaborate plans for "sustained yield" and proper silvicultural methods which would have, if applied to our former forests, supplied the whole world with an abundance of lumber and forest products for an indefinite time, but the fact remains that those forests were effectively utilized and performed a great service to our country. With the advent of our industrial expansion, lumber has begun to play an increasingly less important roll in every day life. New building materials are being utilized and the uses of wood in the manufacture of many items has decreased. Regardless of the decrease in lumber consumption, the use of wood in new forms has increased. The greatest use of wood at present, and it is constantly growing, is its use in the manufacture of paper. Plastic industries are becoming increasingly important and will probably offer a new outlet for forest products in the future. In view of these observations, it seems evident that forest utilization today must begin to adjust itself for the production of pulp and chemical wood and not exaggerate the production of lumber. The rise of jack pine and "popple"

from weed tree species to trees of ranking economic importance bear these points out.

RESUME OF PRESENT LAND USE

Forestry

All the industries in the county use wood as raw material, but most of the logs are shipped in from other sources. The flooring mill receives very few logs from Crawford County. The cabin factory obtains some of its jack pine logs from within the county. Its location near a good highway and a railroad enable it to purchase log stock from distant markets. The novelty works at Frederick is the only industry that secures all its raw material from the county.

Little pulpwood is being cut, for better returns can be realized by letting the jack pine grow until it is large enough to sell to the cabin factory.

Most of the forest land in the county lies within the boundaries of the State or Federal forests. Of that forest land held in private ownership, very little is being held with the expectation of gains through the sale of forest products; the recreational value is usually far greater than the timber value.

Agriculture

During the intense lumbering period, agriculture was quite sporadic. The mill towns and logging camps offered a ready market for farm produce for in those days the modern refrigeration and canning methods of food preservation were unknown and the fresh vegetable supply had to be produced locally. Hay for the logging teams brought an excellent price because it is bulky and high freight rates made it uneconomical to ship it long distances.

Lumbering is a rather nomadic industry and farmers that were one year ideally located in relation to a camp later found that the distance to the camp may have increased, due to relocation, to such extent that it would no longer be profitable for them to haul their produce and hay to the marketing point. It is quite probable that those farmers who happened to be located on good soil decided to change their farming system and remain on their homestead. Others, less well adapted in relation to soil conditions probably decided to "push on" with the logging camps and established new farms, better located to take advantage of the current demands.

This peculiar relationship of farm and market served as a practical means of testing the agricultural possibilities of the county. All types of soils and conditions were encountered by farmers who attempted to service the lumber industry with agricultural products. Many of these old farm locations have been overgrown by forest reproduction and it is now impossible to find them. The better farms have grown and are now components of stable agricultural communities.

Many people were induced by real estate men to buy "cut over" land for farm sites, but frequently the land was unsuited for agricultural pursuits and was abandoned after a few years.

Acre Value of Land in Crawford County

	Value	State Rank
1930 census	$21.47	82nd place
1935 census	17.63	77th place

Since there are only 83 counties in the State of Michigan, it would appear that Crawford County would be classed as a very poor agricultural county. This is true only on an average basis. There is so much poor land in comparison to the good agricultural land that the average acre value is very low.

General farming is the usual practice with recent trends toward intensive dairying. The Resettlement Administration of the United States Department of Agriculture purchased many of the sub-marginal farms in the county, thereby raising the average standard of the remaining farms.

Recreation

Recreational interests have increased decidedly during recent years. The majority of the cabins have been built along the banks of the Au Sable river and its tributaries and many serve the dual purpose of hunting and fishing camps. Relatively few cabins are found out on the plains and sand hills.

Lake side property has been developed to a point of stability. Lake Margrethe, the largest lake in the county, has about 150 cottages on it now and all available lots have been sold by the original sub-division owners. It is estimated that there are another 150 privately owned cabin sites, on the lake front, that are undeveloped as yet.

Residents on Shupac Lake, which is located in the northeast part of the county, have built several summer cottages for rental to vacationists or hunting and fishing parties.

Since 1937 Grayling has become a winter sports center of Michigan. Local business men began working on the idea 20 years ago.

It developed so rapidly that the State and Federal Park Services were persuaded to subsidize and plan its future development and permit Grayling Winter Sports Inc., to manage its operation.

Speculation

Speculators hold considerable acreage along streamways which they hope to dispose of in small lots for private cabin development or for hunting and fishing clubs.

Ownership

Since the lumbering era, land ownership has changed considerably in Crawford County. Previously, private interests held large tracts of forest land and only scattered tracts of the original public ownership and only restricted areas, suited for agriculture or recreation, are in private ownership. Speculative interests hold scattered tracts of"cut over" land with the expectation of gains from such potential land uses as oil and gas, water power, or recreational developments.

Objectives of the Study

1. Determination of the past use of land and the success of its use.
2. The identification of those land characteristics which have influenced the success or failure of the past use of the land.
3. The establishment of criteria to guide the possible alternate future uses for specific land areas.

Procedure

The following maps were drawn to supply the basic information for this study:

1. Natural Land Divisions
2. Agricultural Classification of Soils
3. Cover Map
4. Land Use and Intent of Ownership

NATURAL LAND DIVISIONS OF CRAWFORD COUNTY

To be of practical use, data must be classified. Essentially, classification refers to the grouping of entities that have similar characteristics; the more characteristics that are common to all the members in one group or division of a classification, the more serviceable the classification becomes.

When driving through Crawford County one becomes aware of the existence of different natural conditions. The flat, jack pine plains are easily separated from the low, rolling oak hills. The casual observer would probably base his divisions on a combination of cover type and topography.

The selection of criteria on which to base a classification is governed by the function which the classification is going to serve. A classification adaptable for a land use study should be broad. Soil types and topography, as mapped in the Soil Survey of Crawford County and by the Land Economic Survey of the Michigan State Department of Conservation, were selected as the criteria for dividing the county into natural land divisions. The following Natural Land Divisions were recognized:

	Area	% of County
1. Level loamy uplands	57.4 sq. miles	10.2
2. Low sand hills	178.0 " "	31.8
3. Flat sand plains	291.9 " "	52.0
4. Swampland	28.6 " "	5.1
5. Loamy plains	5.1 " "	.9

LEVEL LOAMY UPLAND

A. Soils

Types	Occurrence
Kalkaska loamy sand Coventry loam Kalkaska sandy loam	Dissected flat uplands
Hartwick sand	On steeper slopes between the flat uplands and valley floor
Rubicon sand	Bottoms of valleys

B. Topography

This division consists of flat topped moraines dissected by a dendritic valley system, the valley slopes of which vary from 3 - 15%. On the upland and in the valleys the slopes are not in excess of 3%.

C. Slope Classes	% of total area	Soil Types
0 - 3%	10	Kalkaska loamy sand Coventry loam Rubicon sand
3 - 7%	70	Kalkaska sandy loam Kalkaska loamy sand Coventry loam
7 - 15%	20	Hartwick sand

D. Cover

Soil type	Cover type
Kalkaska loamy sand	Second growth hardwood
Coventry loam	Mostly under cultivation; the remainder is covered by second growth hardwood and aspen
Kalkaska sandy loam	Second growth hardwood
Rubicon sand	Aspen
Hartwick sand	Aspen

E. Use

Soil type	Primary use	Secondary use
Kalkaska loamy sand	Forestry	Agriculture
Coventry loam	Agriculture	Forestry
Kalkaska sandy loam	Agriculture	Forestry
Rubicon sand	Forestry	—
Hartwick sand	Forestry	—

LOW SAND HILLS

A. Soils

Types	Occurrence
Roselawn sand	Low rounded morainic hills
Grayling sand	Small plainlike areas between sand hills
Grayling coarse sand	" " " " " "
Newton loamy sand	Poorly drained spots of plain and along edges of streams and swamps.
Ogemaw sandy loam	Pitted plainlike areas
Roselawn sandy loam	Small areas; gently undulating

B. Topography

This division is composed of low rolling hills or ridgelike series of hills with complementary basins and valleys, most of which are dry. The absence of permanent streams and swampland is a striking feature of this natural division.

Slope class	% of total area	Soil type
0 - 3%	20	Roselawn sand
		Grayling sand
		Roswlawn sandy loam
		Newton sandy loam
		Ogemaw sandy loam
3 - 7%	55	Roselawn sand
7 - 15%	25	Roselawn sand

C. Cover

Soil type	Cover type
Roselawn sand	Jack oak
Roselawn sandy loam	Jack oak
Grayling sand	Jack pine
Grayling coarse sand	Jack pine
Newton loamy sand	Alder and aspen
Ogemaw sandy loam	Aspen

D. Use

Soil type	Primary use	Secondary use
Roselawn sand	Forestry	—
Roselawn sandy loam	Agriculture	Forestry
Grayling sand	Forestry	—
Grayling coarse sand	Forestry	—
Newton loamy sand	Recreation	Forestry
Ogemaw sandy loam	Agriculture	Forestry

FLAT SAND PLAINS

A. Soils

Types	Occurrence
Grayling sand, Grayling coarse sand	Intermorainic valleys and extensive outwash plains
Rifle peat, Greenwood peat, Lupton muck, Kerston muck	Along stream bottoms and around lakes
Saugatuck sand, Newton loamy sand	First stream terrace and in shallow depressions

B. Topography

Extensive areas of gently sloping to level plain land with shallowly entrenched drainage ways.

Level sand plain land, winter aspect

Slope classes	% of total area	Soil types
0 - 3%	60	Grayling sand
		Grayling coarse sand
		Rifle peat
		Greenwood peat
		Lupton muck
		Kerston muck
		Saugatuck sand
		Newton loamy sand
3 - 7%	40	Grayling sand

C. Cover

Soil type	Cover type
Grayling sand	Jack pine
Grayling coarse sand	Jack pine
Rifle peat	White cedar and black spruce
Greenwood peat	Leatherleaf
Lupton muck	Swamp hardwood
Kerston muck	White cedar and black spruce
Saugatuck sand	Aspen
Newton loamy sand	Alder and aspen

D. Use

Soil type	Primary use	Secondary use
Grayling sand	Forestry	Agriculture
Grayling coarse sand	"	—
Rifle peat	Game refuge	Forestry
Greenwood peat	—	—
Lupton muck	Forestry	—
Kerston muck	Game refuge	Forestry
Saugatuck sand	Forestry	—
Newton sand	Recreation	Forestry

SWAMPLAND

A. Soils

Types	Occurrence
Rifle peat	Stream valleys and swamps
Saugatuck sand	Islands in swamps

B. Topography

Level

Swampy stream valley.

C. Cover

Soil type	Cover type
Rifle peat	White cedar and black spruce
Saugatuck sand	Aspen

D. Use

Soil type	Primary use	Secondary use
Rifle peat	Game refuge	Forestry
Saugatuck sand	Game refuge	Rorestry

LOAMY PLAIN

A. Soils

Types	Occurrence
Roselawn sandy loam Roselawn gravelly sandy loam Kalkaska loamy sand	Small plainlike areas confluent with the flat sand plains

B. Topography

Gently undulating, with very few steep slopes.

Slope classes	% of total	Soil types
0 - 3%	25	Kalkaska loam
3 - 7%	75	Roselawn sandy loam Roselawn gravelly sandy loam

C. Cover

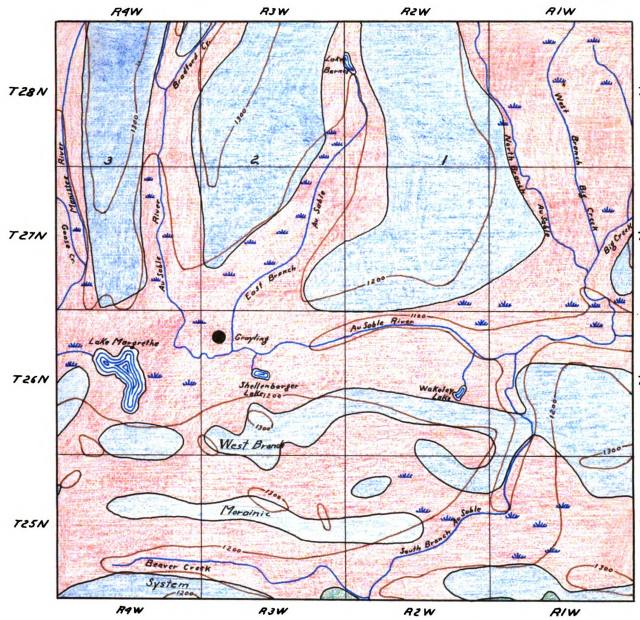
Soil type	Cover type
Roselawn sandy loam Roselawn gravelly sandy loam Kalkaska loamy sand	Mostly cleared for agriculture; remainder has second growth hardwood

D. Use

Soil type	Primary	Secondary
Roselawn sandy loam	Agriculture	Farm woodlot
Roselawn gravelly sandy loam	"	" "
Kalkaska loamy sand	"	" "

Surface Geology of Crawford County, Michigan.

from Leverett



Legend

Moraines — 1. Moraine passing thru Lovells
2. " " " Frederick
3. " " " Deward

Outwash Plains

Till Plains

Surface Geology of Crawford County

By comparing the map showing natural land divisions with a map of the surface geology of the county, it will be observed that the two maps have various features in common. The moraines of the geologic map correspond almost exactly with the level, loamy upland and low, sand hill natural divisions, while the outwash plains correspond with the flat sand plains. From this correlation, it would be presumed that glaciation played a significant role in the origin and development of the soils as well as in the topographic expression.

In the northern part of the county there are a series of north and south trending morainal ridges. Authorities on the glaciation of Michigan say that the ice movement in this region was complicated by several advances and retreats of two different ice lobes and the origin of these north and south trending moraines is the subject of much controversy.

These moraines occur in the interlobate area of the Michigan and Huron lobes. When the ice had retreated from the West Branch moraine to the position of the outer ridges of the Port Huron system just north of the Au Sable River, the Huron lobe began to split from the Michigan lobe. As the ice front melted back, the Michigan lobe retreated to the northwest and the Huron lobe retreated to the northeast. During the retreat the ice mass pivoted on the Port Huron moraine and the north and south trending ridges were deposited. As the interlobate angle became more acute and extended, the ice front changed from an east and west trend to a north and south trend. The newly developed ice front was approximately on a line between Grayling and Gaylord when the two lobes parted. While in this position, the Huron

lobe laid down the moraine passing through Lovells and then retreated to a position comparable to the Port Huron moraine. While the former moraine was being laid down, the Michigan lobe retreated westwardly and laid down successively the moraines passing through Frederick, Deward and Blue Lake.

The southern ends of these moraines extend to the Au Sable River, which was the border drainage way at that time. The bulk of the material that was washed down into its channel by the melting water activity was carried downstream and deposited in a valley train.

This interpretation of the formation of the north-south trending morainal ridges is useful in explaining the difference in soil texture found on the various morainal areas. The moraine passing through Lovells was laid down by the Huron lobe. This lobe was fed by ice from the Labrador center on the Laurentian Upland. In passing over the old Pre-Cambrian crystalline formations it picked up material that was of a coarse, sandy nature; consequently the moraine passing through Lovells is characterized by having deep, loose, sandy soils.

In contrast with the moraine passing through Lovells, those that pass through Frederick and Deward have surface soils that are of a loamy nature. The Michigan lobe, which laid down these moraines, had its origin in the Lake Superior basin and passed over belted outcrops of Lake Superior and St. Peters sandstone and Trenton, Lockport, Manistique, Engadine and Fiborn limestones and dolomites. Materials from all these formations were ground up in the glacial mill and became comingled in their journey southward. When finally deposited in the moraines passing through Frederick and Deward, loamy soils developed.

In the southern part of the county there is a series of east and west trending moraines that are part of the West Branch morainic system. These morainal ridges have comparatively little relief and gently rolling topography.

The two areas of loamy plains in the locality of Beaver Creek and Love School might be explained in several ways. In this particular region the glacial surface was complicated by several advances and retreats in the oscillating ice front. These loamy spots may represent the crests of old moraines of heavy till that later were almost completely blanketed by sandy till deposited during the readvancement of the ice sheet. Again, the islands of loamy till surrounded by sandy till may reflect the character of the rocks in the belted uplants of the northern peninsula from which the ice obtained a large part of its clay and silt.

Drill records are necessary before any really substantial explanation can be given for this interlobatearea.

Pit Lakes

There are several small pit lakes scattered along the main drainage ways of the county. These lakes were formed by blocks of ice that broke off from the main glacier and were dropped on the outwash plain as the ice front retreated. These blocks later melted and left pits which were filled by drainage water from the surrounding area. Lake Margrethe, with an area of almost 3 square miles, is the largest lake in the county and the best example of this type of feature.

Agricultural Classification Map

In a land use study it is necessary to know the amount and distribution of farm land and its productivity rating. The most efficient way of presenting data of this kind is to plot the areas of each grade of farm land on a base map of the county. This data can then be compared with similar base maps showing natural land divisions, cover type, tax delinquency and ownership. By these comparisons, correlations may be established leading to the development of criteria that may be used for future land use planning.

The soils were divided into four groups, based upon their productivity, and the data necessary for making the productivity rating was taken from the Soil Survey Report of the county.

Agricultural Classification of the Soils of Crawford County

First class - Nester loam

Second class - Coventry loam
Roselawn sandy loam
Roselawn gravelly sandy loam
Kalkaska sandy loam

Third class - Kalkaska loamy sand
Blue lake loamy sand
Bergland clay loam
Ogemaw sandy loam
Bergland loam

Fourth class: -

Well drained	Poorly drained
Roselawn sand	Rifle peat
Hartwick sand	Lupton muck
Grayling sand	Greenwood peat
Grayling coarse sand	Kerston muck
Rubicon sand	Houghton muck
Saugatuck sand	
Ottawa loamy sand	
Bridgman fine sand	
Newton loamy sand	
Griffin sandy loam	

The areas of each of these land classes were plotted on a base map and colored. Contrasting colors were used for each land class so that the amount and distribution of each class could be studied.

Cover Map

The cover of land is a primary factor in the development of many land use policies. In locating a deer yeard, it is necessary to include areas of cedar swamp to supply sufficient browse for winter feeding. A public camp ground should be well forested. Cabin sites occur on wooded stream banks rather than in treeless areas of grass or sweetfern.

Cover is usually considered in all forms of land utilization. Sometimes it may even be of a negative value, as in clearing land for

agricultural purposes. Some species sprout and continue to grow even though the area is clear-cut.

The cover map developed for this study is an interpretation of the Land Economic Survey cover map. The Land Economic Survey Cover map was considered too detailed to bring out the broad relationships existing between the natural features of the county.

In drawing up the cover map, seven divisions were recognized:

1. Jack pine
2. Aspen
3. Jack oak
4. Hardwood
5. Whitecedar and black soruce
6. Grass and sweet fern
7. Cleared land

In the process of plotting the extent of these various cover types, small acreages of grass, sweetfern and all the forest types were included within the boundaries of the dominant cover type. Within the area designated as jack pine there are small patches of aspen, jack oak, hardwood, cedar swamp and grassland, but considered as a whole, the area is predominantly forested by jack pine.

The map will be useful in making correlations between cover type, natural land divisions, and the intent of ownership map. It also shows the amount and distribution of cleared land.

Planimeter Study of Cover Map

Cover type	Area in Square miles	% of total
Jack pine	235.7	41.9
Hardwood	17.2	3.1
White cedar and black spruce	17.7	3.2
Aspen	64.0	11.4
Jack oak	140.2	25.1
Grass and sweet fern	72.0	12.8
Cleared land	10.1	1.8
Lakes	4.1	.7
	561.0	100 %

Intent of Ownership Map

In this county, as in many northern counties, public ownership has been increasing rapidly by the acquisition of land through tax delinquency. If a program of efficient land planning is considered, it will be necessary to know the amount and distribution of the various types of land ownership. Each type of intent of ownership has a different form of utilization, and the amount of land present in the county, qualified to serve these various forms of intent of ownership is undoubtedly limited by intrinsic characteristics of the land. If land was to be classified for just one form of utilization, the task would be relatively simple, but when there are several forms of utilization, and the complicating possibility of multiple use on the same area, by a number of non-conflicting agencies, is considered, the problem displays unusual complexity.

The data necessary for plotting the various types and intent

of ownership, were collected from several sources. Data was drawn from the files of the State Lands Division, National Forest Service, Michigan National Guard Headquarters, and from maps published by the Land Economic Survey. Observations on some of the other land uses were made in the field.

Quantitative Summary of the Intent of Ownership Map

Intent of Ownership	Acres	% of total area
Farmland	11,890	3.3
Industrial	360	.1
Hunting and Fishing Clubs	2,400	.7
Urban	600	.2
State	164,220	45.8
U. S. Government	55,690	15.5
Recreation	33,520	9.3
Speculation	90,320	25.1
	359,000	100%

RESULTS OBTAINED

Past Use:

Forestry

Formerly the whole county was covered by virgin forest, but through continuous cutting, this resource has been almost completely exhausted. Reproduction of economically important species has been hampered a great deal by cutting practices and by fire.

During the early stages of settlement, forestry was the dominating economic influence. All business within the county was either directly or indirectly dependent on the lumber industry. Actual logging and milling operations were the major sources of employment.

Railroads, agriculture, and retail sales of supplies and machinery were indirectly dependent upon the lumbering industry.

The cover conditions have changed greatly since the virgin stands were cut. When the soil map was made by the Land Economic Survey, the fieldmen made observations to determine the original cover of the various soil types. The original cover was determined by an examination and identification of the stumps that remained on the land. By summarizing this data the probable acreage of the original cover types was computed.

Cover Type Study

Original Cover

Cover type	Area in square miles	% of county
Jack and Red pine	195.1	34.9
Red pine	152.3	27.1
Hardwood	74.6	13.3
White and red pine	71.5	12.8
White cedar and black spruce	42.2	7.4
White pine	14.3	2.5
Leather leaf	4.4	.8
Swamp hardwood	3.9	.7
Sedge	2.7	.5
	561.0 sq. miles	100.0%

Present cover

Cover type	Area in square miles	% of county
Jack pine	239.8	42.6
Jack oak	140.2	25.1
Grass and sweetfern	72.0	12.8
Aspen	64.0	11.4
White cedar and black spruce	17.7	3.2
Hardwood	17.2	3.1
Cleared land	10.1	1.8
	561.0 sq. miles	100.0%

This data shows that the virgin forest was composed of stands of jack and red pine, red pine, hardwood, and white and red pine. The present cover types differ considerably from the original cover and the change is usually credited to fire, but there appears to be other trends of reasoning.

Ecological Aspects of the Development of the Present Cover Type

Factors affecting cover type

1. Fire
2. Lumbering
    a. Selective cutting
    b. Clear cutting

It has been customary to explain cover type changes by stating that fire most likely swept over an area, killing the original stock of trees and leaving the land open for the invasion of such fire species as jack pine, jack oak and aspen. Accurate records of fires have been kept

by the Conservation Department since 1927, but this data does not cover enough area within the county to justify the changes of cover type that have taken place. Where fire occurred it undoubtedly aided the spread of fire species, but it appears unlikely that the whole county would have been burned over. Other factors besides fire may have been effective agents in the changes.

While there may be some uncertainty about the acreage of Craw-County that has been burned over, there is little doubt existing as to whether the area has been logged. In 1927 there were only 2,095 acres of well stocked timber over 9 inches in diameter in the county. This figure included aspen and jack pine. It is doubtful if even this acreage of merchantable timber now exists.

It is thought that the kind and intensity of cutting that a stand of virgin timber is subjected to will determine its future development.

A virgin stand of red pine exists in association with northern white pine, jack pine, jack oak, white oak and paper birch. If cut selectively the more valuable species; red pine and white pine, will be removed, leaving a mixed stand in which jack pine will probably predominate. This change will most likely be complete, for red pine nearly always occurs as an even aged stand. Even if numerous red pine seed trees are left, the resulting stand would be dominated by jack pine because red pine is quite intolerant.

If the virgin stand of red pine was clear cut, the heavy cover of brush that usually follows this type of cutting would impede the growth of red pine reproduction. It is also quite possible that the cutting would not take place during a good red pine seed year, which normally occurs once every seven years. The presence of reproduction

of aggressive species, such as jack pine and aspen, combined with the intolerance of red pine and its peculiar seeding habits, might be considered a significant factor in the degeneration of virgin red pine stands.

This reasoning is easily applicable to other cover changes. By comparing the cover map(1) with the map of natural land divisions,(2) some very definite correlations can be observed. The jack pine cover type coincides almost perfectly with the flat sand plains; the jack oak cover type is found exclusively on the excessively drained low sandy hills; aspen and hardwood occur on the level loamy uplands. These correlations appear to show that the various cover types are closely related to definite edaphic conditions, and the data may be of use in planning for the future use of land for various kinds of forest utilization.

Present Forest Utilization

Sixty-two per cent of the total area of Crawford County is in public ownership. It is administered by the following agencies:

National Forest Service

National Park Service

State Division of Forestry

State Division of Parks

State Game Division

Michigan National Guard

Private Forestry

There has been considerable amounts of pulpwood cut in the past, but the present trend is to let the jack pine mature and then sell it to the cabin factory. White cedar is utilized down to a 3-inch diameter for rafters and other interior cabin construction.

(1) and (2) - located in pocket at end of thesis.

"Jack pine pulpwood"

"Stock pile" of Air Lock Cabin Company

The novelty factory uses jack pine and paper birch almost exclusively, but its annual consumption does not exceed 100 cords.

"Novelty Factory" at Frederick

Future of Forestry

So little of the forest land is in private ownership that future forest policies will be directed mainly by the State and Federal Forestry Departments. If pulp production ever developes to a point that it may become a feasible commercial enterprise, the public agencies may lease tracts of land for this purpose. Experiments are being conducted at present with a new hybrid poplar, and if the results are encouraging there are extensive areas in Crawford County that may be suitable for such a venture.

Agriculture

On a state-wide basis, Crawford County would not be considered a strong agricultural county. The 1940 census states that there are

101 farms which average 119 acres in size and that the total acreage of improved cropland is 2,882 acres.

Most farming is general and self-sufficing, producing hay, oats, corn and vegetables for home use. Dairy farming appears to be quite successful in those locations where a ready market for dairy products is available. It was noted in the field survey that those farms specializing in dairy or beef cattle were far superior to the average farm. In the future, the summer influx of tourists may make dairy farming practical even in those areas more remote from the local milk consuming centers or shipping centers.

The heavier soils produce fair yields of timothy and clover, but the light sand soils do not give practical yields unless treated with heavy applications of lime and stable manure.

Those factors that limit agriculture most in this county are the lack of fertile soil and the short growing period.

Distribution of Agricultural Land in Relation to Community and Public Conservation Unit Boundaries

Frederick Agricultural Area	No. of Sq. Miles	% of total area
First class land	0.00	0.0
Second class land	6.75	15.7
Third class land	9.82	22.7
Fourth class land	26.21	61.6
	42.78 sq. miles	100.0%

(43 sq. miles = 7.7% of whole county)

Au Sable State Forest	Area	% of total area
First class land	.01 sq. miles	.004
Second class land	5.18 " "	2.2
Third class land	5.89 " "	2.5
Fourth class land	223.59 " "	95.3
	234.67 sq. miles	100.0%

(234.67 sq. miles = 41.9% of whole county)

Huron National Forest	Area	% of total area
First class land	.10 sq. miles	.1
Second class land	9.87 " "	7.7
Third class land	.59 " "	.5
Fourth class land	118.52 " "	91.7
	129.08 sq. miles	100.0%

(129.08 sq. miles = 23.0% of whole county)

Hartwick Pines State Park	Area	% of total area
First class land	1.60 sq. miles	10.7
Second class land	1.01 " "	6.7
Third class land	1.19 " "	7.9
Fourth class land	11.20 " "	74.7
	15.00 sq. miles	100.0%

(15.00 sq. miles = 2.68% of whole county)

Higgins Lake State Forest	Area	% of total area
First class land	0.00 sq. miles	0.0
Second class land	4.46 " "	4.8
Third class land	.37 " "	.4
Fourth class land	88.03 " "	94.8
	92.86 sq. miles	100.0%

(92.86 sq. miles = 16.6% of whole county)

Beaver Creek Agricultural Area	Area	% of total area
First class land	0.00 sq. miles	0.0
Second class land	1.84 " "	22.2
Third class land	.56 " "	6.8
Fourth class land	5.87 " "	71.0
	8.27 sq. miles	100.0%

(8.27 sq. miles = 1.5% of whole county)

Hanson State Game Refuge	Area	% of total area
First class land	0.00 sq. miles	0.0
Second class land	0.00 " "	0.0
Third class land	0.00 " "	0.0
Fourth class land	36.64 " "	100.0
	36.64 sq. miles	100.0%

(36.64 sq. miles = 7.1% of whole county)

Summary of the Planimeter Study of the

Agricultural Classification Map

	Sq. miles	% of total area
First class land	.11	.2
Second class land	29.70	5.3
Third class land	18.24	3.5
Fourth class land	512.91	91.0
	560.96 sq. mi.	100.0%

In an effort to determine the "success factors" of farming, a number of correlation studies were made.

Correlation of Farmland and Abandoned Farmland

with the Natural Land Divisions

	Farm land (acres)	Abandoned farm land (acres)	Total cleared land (acres)	% of cleared land abandoned
Level loamy uplands	1332	2198	3530	62
Low sand hills	1357	2583	3940	66
Flat sand plains	1047	2801	3848	73
Loamy plains	960	565	1525	37
Total	4,696	8,147	12,845	

This study shows that abandonment has been comparatively high on all the land types except the Loamy Plains. The low rate of abandonment on this particular natural land division may be interpreted by analyzing its basic characteristics.

It may be observed on the Natural Land Division Map(1) that the loamy plains areas are compact undissected divisions. By referring to the Agricultural Classification Map it is seen that these areas are unbroken bodies of second class land.

Both communities are well serviced by good roads and they are conveniently located between Grayling and Roscommon.

Characteristics of Loamy Plains Agricultural Communities

1. Second class agricultural soil
2. Compactness of communities
   a. Well adapted for social relationships
   b. Easily serviced by (1) roads
      (2) schools
      (3) electricity
      (4) telephones
   c. Available market for farm products
   d. Easily accessible purchasing and recreational centers.

CORRELATION OF FARMLAND AND ABANDONED FARMLAND WITH THE AGRICULTURAL CLASSIFICATION OF THE SOILS

Item	Farm-land (acres)	% of total farm-land	Abandoned farm-land (acres)	Total area of cleared land (acres)	% of cleared land abandoned	Total acres of land clear	% of land class cleared
First class land	30	.6	0	30	0	70	43
Second class land	2,918	62.2	1,196	4,114	29	19,008	21.6
Third class land	354	7.5	1,001	1,355	74	11,674	11.6
Fourth class land	1,394	29.7	5,950	7,344	81	328,288	2.2
Total	4,695	100.0	8,147	12,843		359,040	

(1) Located in pocket at end of thesis

This study shows that abandonment is inversely proportional to the agricultural classification of the soil; abandonment increases as productivity decreases. At present sixty-three percent of all the farms in the county are located on first and second class land.

This study does not present all the facts related to abandonment for there are many old abandoned farms that have grown up to jack pine or jack oak and there are no records available by which they could be located.

This data indicates that farming is successful only on first or second class land or on those associations of several land classes in which the first and second class land predominates. Most of the third class land being farmed occurs in relationship with second class land.

CORRELATION OF FARM BUILDING CLASSIFICATION WITH AGRICULTURAL LAND CLASSIFICATION

Agricultural classification	Building Classification				Total number of farms on land class	% of total farms on land class
	Excellent (A)	Very good (B)	Average (C)	Poor (D)		
First class land	0	0	0	0	0	0
Second class land	1	12	26	9	48	73
Third class land	0	2	1	1	4	6
Fourth class land	1	0	4	9	14	21
Total	2	14	31	19	66	100%

During the field work in the county, 66 farms were visited and classified on a basis of the condition and quality of their farm buildings. In cases where there were more than one land class represented on a farm layout, the tabulation was credited to the dominant land class. Practically three-quarters of the farms were located on second class land.

Building Classification

Class "A" Buildings

Farm Layout of "South Branch Ranch"

Dairy Barn at "South Branch Ranch"

Class "B" Buildings

"Dairy Farm" in Beaver Creek Settlement

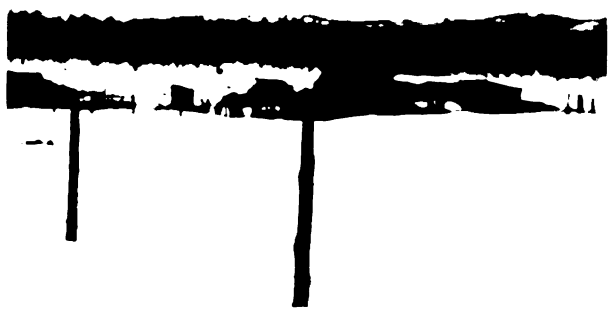
"Dairy Farm" near Love School

Class "C" Buildings

Farm located on south edge of Frederick Community

Farm located in north east part of Frederick Community

Class "D" Buildings



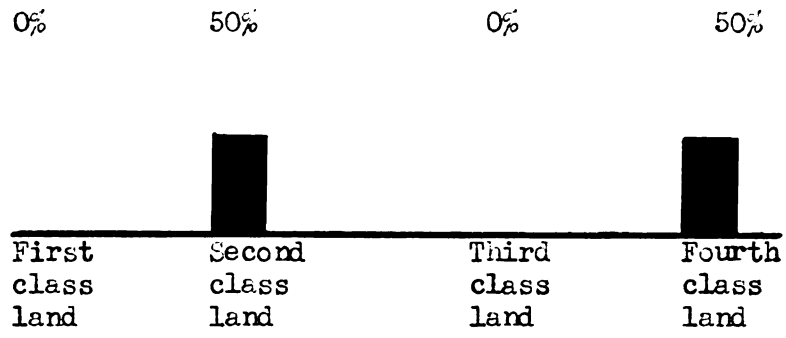
Farm located in northwest part of Beaver Creek Settlement

Farm located near Scott School in southeast part of county

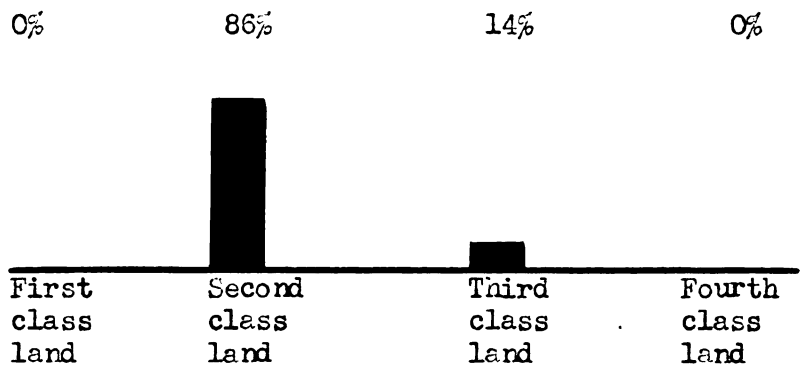
The distribution of farm buildings of a single class in relation to the agricultural land classification is best illustrated by means of a series of simple bar graphs.

Bar Graphs Showing the Distribution of Each Farm Building Class over the Various Land Classes

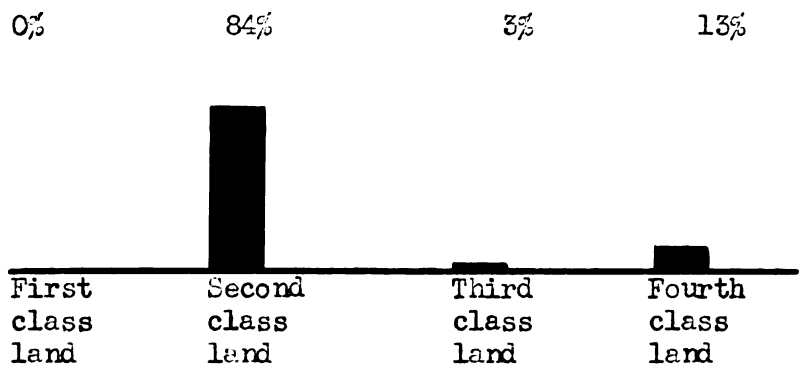
Class "A" Buildings



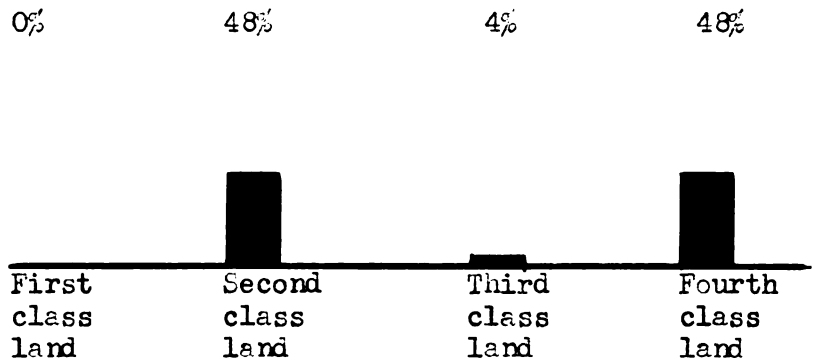
Class "B" Buildings



Class "C" Buildings

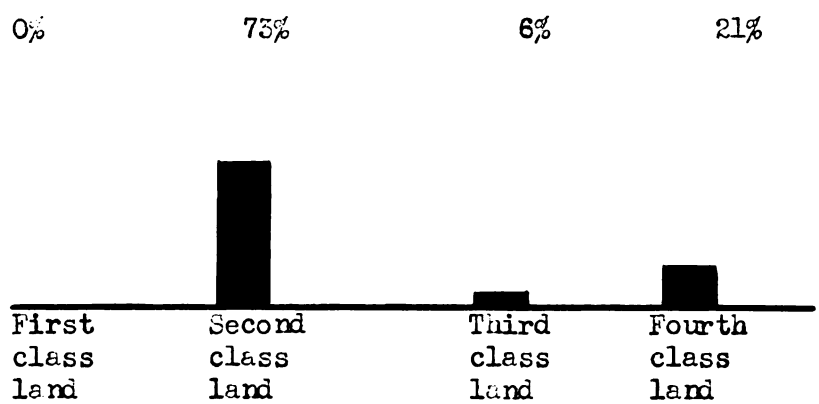


Class "D" Buildings



It is apparent that second class land ranks high in per cent of total buildings in each building class.

Summary of Total Number of Farms on each Land Class



The third class land appears to rank exceptionally low in the various classes of farm buildings and total number of buildings, but this is due to its relatively small acreage. The third class land usually occurs in close relationship with second class land, and whereas there were many farms on which the third class land was present, it was secondary in quantity to the second class land and the farm was tabulated on a second class land basis.

The bar graph on the class "A" building class is not normal. If more data were available, the graph would probably show that the better classes of land have better buildings. South Branch Ranch, the one Class "A" farm on fourth class land, is unusual in many ways. It might be referred to as a classic example of over-capitalization. The original plan of the owner was to establish a large dairy farm with equipment for handling 500 milk cows. The land could produce pasture of fair quality, but could not produce the enormous quantities of concentrates needed for a herd of 500 milk cows. The present owners of this ranch have been advertising the recreational possibilities of the area and are attempting to build up a tourist trade.

Headquarters of South Branch Ranch

Tourist Cottage at South Branch Ranch

AGRICULTURAL EXPANSION

Agriculture is so intricately related to the socio-economic status of people that it may appear futile to make any prediction as to its future, but progressive land planning must be flexible enough to withstand the inevitable mistakes that occur. An attempt should be made to estimate the extent of future agricultural expansion.

The tools or aids that are available for making such an estimate, consist of the results of quantitative and qualitative studies of the past use of the land. This is merely a projection of those facts arrived at by the trial and error process of private enterprise.

If a certain class of land has failed to support agricultural pursuits in the past, it seems logical that unless farming practices are revolutionized or economic conditions change, the land will continue to be submarginal for farming in the future. Predictions will be based on the present area of cleared land, present rate of abandonment and total area of each agricultural class of land.

The "success factor" used in the following calculations is that percentage of the land class that has stayed in farm use during previous agricultural use. If 100 acres of land, in a particular land class, were cleared and farmed over a period and 40 acres were later abandoned, the success factor of that land class would be 60 per cent.

Extent of Possible Agricultural Expansion

by Land Classes

Land class	Total Area of land class (acres)	Success factor (%)	Extent of total possible future utilization (acres)
First	70	100	70
Second	19,008	70	13,306
Third	11,674	25	2,919
Fourth	328,288	20	65,657
		Total	81,952 Acres

Over a period of 60 years, the average size of farms in Crawford County has been approximately 165 acres.(1) The maximum number of farms that the county could support would be about 495.

The chief source of possible error in this calculation would be the lack of accurate data on farmland abandonment, especially on the fourth class land.

(1) Census 1880-1940

Farm abandonment on fourth class land.

RECREATION

Skiing

"A new use for the sand slopes"

RECREATION

Recreation is no longer considered a luxury; it is truly a necessity in the modern mode of living. Although occurring in many varieties and intensities, recreation is always typified by some form of aesthetic satisfaction. Due to its intangible characteristics, recreational endeavors defy accurate classification and evaluation.

Recreational facilities in Crawford County

1. Cottage sites
2. Fishing - a. Lakes
   b. Streams
   c. Ice fishing
   d. Hatchery
3. Hunting - a. Deer
   b. Partridge
   c. Duck
   d. Rabbit
   e. Wildcat
4. Water sports -
   a. Swimming
   b. Canoeing
5. Winter sports -
   a. Tobogganning
   b. Skiing
   c. Snowshoeing
   d. Ice skating
6. Hartwick Pines State Park
7. Hanson Game Refuge and National Guard Reservation

Cottage Sites.

On the intent of ownership map[1] there are extensive areas

(1) Located in pocket at end of thesis.

designated as recreational land. It consists of relatively small plots of privately owned land being utilized for its recreational qualities or apparently held for future development. Most of the plots are from 40 - 80 acres, but there are a few holdings that contain as much as 640 acres. The large holdings are the summer estates of wealthy individuals and are quite elaborate in comparison to the usual modest cottage site of the average summer vacationist.

Several studies have been conducted to determine the characteristics of cottage sites. That land, designated on the intent of ownership map as recreational, is being utilized or held for cottage sites.

Correlation of Recreational Land with Lake and Stream Frontage
(Hunting and Fishing club property not included)

Item	Number	% of total
40's located within ½ mi. of lake frontage	109	13.6
40's " " 1 " " " "	25	3.1
40's " " ½ " " stream "	600	74.8
40's " " 1 " " " "	42	5.2
40's not located " 1 " " water "	27	3.3
Total	803	100.0%

Evidently water frontage was the greatest attraction to people seeking cottage sites. Only 3% of the land designated as recreational is not located within easy reach of water frontage and when examined more thoroughly, it was found that this 3% was situated near good roads leading to streams.

Typical Cottage Sites

Cottage on the North Branch of the Au Sable

The bluffs along the Au Sable are ideal for cottage sites, in that they are high, well drained, wooded and scenic.

Cottage on the South Branch of the Au Sable

Even the low sites are utilized - cottages near Wakely Bridge

Commercial cottage developments are also found located along the banks of the Au Sable River.

"Penrod's Cabins", Grayling, Michigan

Tourist cabins at McMaster's Bridge on South Branch of AuSable

Lake Margrethe

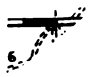
Lake Margrethe has developed to a point where lots are no longer available for cottage sites. The possibility of increased private ownership depends upon the future land policies of the Michigan National Guard. In the past, this agency has traded lake frontage for blocks of privately owned land centrally located in the reservation. In this way private ownership within the Military Reservation is being encouraged to concentrate around Lake Margrethe where it does not interfere with military training procedure.

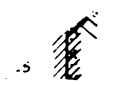
Lake Margrethe

Correlation of Recreational Land with Natural Land Divisions

Fully 90% of the land designated as recreational on the "intent of ownership" map (1) occurs on the flat sand plains. This is fourth class agricultural land. The remaining 10% of the recreational land occurs on the low sand hills. It is gratifying to note that land being used or

(1) Located in pocket at end of thesis





held for recreational use does not compete with farming for the ownership of first and second class agricultural land. Recreational endeavors do not normally utilize the fertility of the land and in a country endowed with so little good agricultural land, it would be poor land use to have the good land in the possession of owners who did not intend to utilize it to its fullest extent.

Fishing

The Au Sable River is a well known Michigan river and is as heavily fished as any other trout stream within the State. Its fishing qualities aids in explaining the close correlation of cottage sites and stream frontage.

"Aesthetic satisfaction"

The Au Sable, its tributaries and the head waters of the Manistee undoubtedly benefit from the experiments of the Hunt Creek Trout Experiment Station in Kalkaska County. The troup hatchery at Grayling supplies all the trout fry necessary for plantings. Numerous deflectors and improved spawning beds were noted on the streams during the field work.

There are 15 fishing clubs established along the banks of the Au Sable and its tributaries. This fact alone indicates that good fishing must be available.

Grayling Fish Hatchery

Lake Margrethe is the best known fishing lake in the county. Although primarily a bass lake, good pike fishing is enjoyed on this lake both in summer and winter. Recently plans have been completed for a dam to be built across its outlet. By flooding the swampland adjoining the outlet, it is hoped that the pike spawning grounds will be improved. This dam will also make it possible to regulate the water level, thereby stopping ice damage in the spring.

Hunting

The importance of deer hunting within the country is realized by noting that the Tenth Biennial Report of the Department of Conservation states that Crawford County had 13 to 15 hunters per square mile during the 1939 season. Only five other counties in the state had an equal or greater number of hunters per square mile. The popularity of the county, for deer hunting may be in part attributed to the fact that the Hanson Game Refuge aids in maintaining the deer population. The network of roads and trails that cover the county makes the hunting area accessible by car to those people who only have a few days or a week end to hunt. The vast acreage of State and Federal Forest land (62% of the whole county) which is open to public hunting, appeals to those hunters who dislike the inconveniences imposed by numerous posted areas that occur in other counties.

Investigation by the State Conservation Department indicates that the heaviest deer population in the lower peninsula is found on old pine plains with numerous swampy areas and a diversity of cover types. The optimum site for deer is cedar swamp dispersed throughout pine plains and jack oak hardwood hills. Deer seem to congregate along the edges of swampland and highland cover types. By observing the cover map of Crawford County, it may be seen that this ideal site condition is closely approximated throughout the whole county.

Deer are so numerous in the Hanson Game Refuge that the average winter-kill through starvation is estimated at 30 deer per square mile of the winter yarding area. Because of stipulations in the original deed to the state, this area is closed to all hunting and trapping.

Climatic conditions are such that the deer are seldom forced to yard up in the winter time and they browse over the sand hills and plains throughout the entire year.(1)

Deer hunting is king of its field, but the county also affords fair partridge, duck, and rabbit hunting. Wildcat hunting is being revived and attracts many hunters throughout those winter months when a good tracking snow is present.

Heavy stand of jack pine on Hanson Game Refuge

(1) Tenth Biennial Report - The Department of Conservation, State of Michigan

Fighting Deer Club - "Lodge" on north branch of the Au Sable

Water Sports

Swimming is of little importance except at Lake Margrethe, which is the principle place in the county that offers suitable facilities.

Canoeing is developing rapidly and promises to assume greater popularity in the future. The Au Sable River is well suited for canoe trips. It offers unexcelled scenic beauties, good fishing and convenient camping locations.

Resting place for canoeists. Table and dock in lower left corner are examples of canoe trail facilities.

The road system serving the main and tributary streams of the Au Sable is dispersed in a way that enables the canoeist to plan trips of varying lengths. All the bridges are well marked to aid the canoeist in locating himself and many of the bridges even have special docks and stream-side tables. The high bluffs offer ideal sites on which to camp over night.

If the facationist wishes, he can rent a canoe in Grayling at the local canoe livery and float down to Mio, 90 miles eastward, then by calling up the livery he can have his car brought to Mio for the return trip.

Canoe Livery at Grayling

Winter Sports

Entrance to Grayling Winter Sports Park

Grayling is a pioneer center of the winter sports activities in Michigan. The nucleus of the present sports park was subsidized and developed by local business men. Development was so rapid that private subsidies could not support necessary expansion, so the State and Federal Park authorities were invited to take charge of the area. Several years passed before the public park officials consented to accept the responsibility of this new park. All land and equipment was sold to the state for the sum of $1.00. At present the park is subsidized cooperatively by the State and Federal Park Divisions and is managed by the Grayling Winter Sports Inc., with the agreement that all profits are to be reinvested in the park.

Park Facilities

The winter sports park is located 4 miles southwest of Grayling, easily accessible from local train and bus depots. Roads are good and bus or taxi service is available. Ample parking space is provided at the park for the drive in attendance.

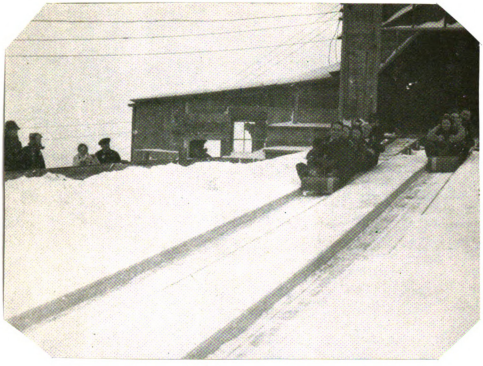
Equipment:

Tobogganing

70 x 80' log and stone toboggan house

6 steel toboggan troughs 1500' long, equipped with conveyor to return toboggans to top of hill.

94 steel-shod toboggans.



Toboggan house and slides[1]

Skiing:

2 ski jumps a. Amature jump 40' high

b. Professional Class A jump 95' high

40 miles of well-marked ski trail

Ice skating:

Warming shelters

2 ice rinks a. Standard racing rink, 200' x 412'

b. General rink 337 x 659'

Rinks are serviced by trucks with snow plows and brushes. A special ice planer is used to re-surface the rinks.

Flood lights and music

---

(1) Original photograph taken by Lou Kramer

View of general ice rink from Johnson Hill

Winter Sports Park

Ski jump and toboggan house on Johnson Hill

Ice throne at Grayling Winter Sports Park

What the Winter Sports Park Means to Grayling

During the winter of 1940 there were 19 snow trains routed to Grayling.

Attendance for 1940 season:

19 snow trains	9,463 passengers
Drive-in attendance	14,000 "
	23,463

Local business was stimulated by this influx of winter tourists. During January of 1939 and 1940 business was considered normal by local businessmen. In January of 1939 the weather was poor for winter sports and the attendance was low. In January of 1940, weather conditions were much better for winter sports and attendance was greater. Checks handled by the local bank during these two 1-month periods show a striking correlation with park attendance.

	Amount of checks handled
January 1939	$346,902.59
January 1940	425,054.63
Difference	$ 78,152.04

If the winter sports park attendance was the only variable that occurred in these two 1-month periods, then the $80,000 could be accounted for only by sales of goods and services to tourists.

Grayling is certainly well adapted to serve the vacationing public. In a survey of the town, the following tourist services were recorded:

2 hotels
8 restaurants
2 cocktail bars
1 night club
3 drug stores
5 grocery stores
1 hardware store

1 theatre
1 bowling alley
14 tourist homes
2 cabin rental establishments
17 gas stations
1 riding stable
1 golf course
1 canoe livery

Main street in Grayling

Riding stable - west of Grayling

Besides the income from the sales of goods and services to winter tourists, Grayling also benefits by the employment offered by the park. On a good Sunday, 45 men are needed to operate the park.

The financial report of the park shows a profit of $3,000 for the 1940 season.

Hartwick Pines State Park

Hartwick Pines

This park is a monument to the vast stands of white pine that once occupied the county. It is equipped to service both tent and trailer campers, and it has a good system of foot trails. The grove of virgin white pine attracted 75,000 visitors, sightseers and tourists last summer.

Community House - Hartwick Pines State Park
This building is available to organized groups of people for indoor activities.

Hanson Game Refuge and National Guard

Reservation

The heavy deer population of the Hanson Game Refuge annually draws crowds of tourists who wish to see deer in their wild state and few ever go away without having seen part of the herd. The area has four points of interest that attract visitors.

1. Lake Margrethe with its cottage and swimming facilities.
2. The National Guard layout on the south end of Lake Margrethe.
3. Wild life that flourishes under the protection offered by the Game Refuge
4. Winter Sports Park - with its numerous buildings and equipment.

Deer on Hanson Game Refuge

"Camp Grayling" - Michigan National Guard

Camp Grayling, situated on the south edge of Lake Margrethe, is the summer training grounds for the Michigan National Guard. It has improved camp grounds, a recreational hall, barracks, garages, stables and a rifle range. Being located just 6 miles from Grayling, this camp attracts many sightseers and tourists that travel north or south on trunk line U.S. 27.

Speculation

In a land use study, just the fact that land is being held for speculative purposes is not as important as its possible future utilization. Most of the land located along streamways will probably be purchased by people interested in cottage sites, but some of the land held by speculators will eventually find its way into public ownership through tax delinquency.

Gain may be realized from these speculative holdings by:

1. Sale of the land for cottage sites.
2. Development of water power or lease to power companies
3. Development of oil and gas wells or by leasing to oil companies
4. Harvesting of timber in future.

Correlation of Land Held for Speculation and Stream and Lake Frontage

Item	No. of 40's	% of total
40's located within 1 mile of stream or lake frontage	1,255	55.7
40's not " " " " " " " " "	1,003	44.3
Total	2,258	100.0%

From previous studies it is known that most land near streams or lakes is used for summer cottage, fishing or hunting cabin sites. Speculators have observed this and the above correlation demonstrates that over 50% of their holdings are well suited for recreational development.

Water Power

The National Resources Committee states that there are 13 potential hydro-electric power sites above Redheads, in the Au Sable drainage basin. It is possible that some of the land previously discussed as being held for recreational purposes by speculators will be used for hydro-electric power development. These potential water power possibilities will be developed only if the power companies can out-bid recreational interests for the use of the land.

Oil Interests

The petroleum industry has been gradually moving north from where the initial wells were located in the east and west central part of the state. In Crawford County, oil interest is most intense in the southeastern part. There is a considerable acreage of land in the southeast corner of the county held by speculators because of the possibility of oil development. Its location is not perceptively adaptable for recreation, forestry or agriculture.

Forestry

Except for farm woodlots, there is no appreciable amount of land, within the county, dedicated to private forestry. There are no commercial forest areas established under the Commercial Forest Reserve Act. Several applications have been made in the county, but they were all rejected upon examination.

CRITERIA FOR LAND USE IN CRAWFORD COUNTY

This study has led to the development of several axiomatic postulations.

1. A "blanket" set of criteria, applicable to all land uses cannot be drawn up. No one set of criteria will serve to separate the land of the county into the various specialized land use areas.

2. Some tracts of land are adaptable to more than one land use. The extensive public forest lands may be utilized for their recreational qualities without seriously conflicting with the forestry utilization possibilities.

3. All land, being used for any specialized use, has been found to possess common characteristics. The constancy of these dominant characteristics is likened to the average bell-shaped curve demonstrating the mode of mathematical data. The majority of the tracts of land in a certain land use will have common characteristics, but the remaining minority will have various diverse characteristics. This is exemplified by a study of the recreational land. It was found that 75% of the land occurred near lakes or had stream frontage, while the remaining 25% had various other characteristics.

Criteria for Agricultural Land

The limiting factors affecting agricultural development in Crawford County are low soil fertility, inadequate transportation facilities to local market, long distance to market or lack of a market.

Natural Land Divisions - Only land located on the Level Loamy Uplands and the Loamy Plains divisions has proven to be successful farming land. Successful farming communities must have good transportational connections with marketing outlets.

Cover Type - Successful farming communities coincide with hardwood cover types.

Agricultural Classification - Sixty-three percent of the total number of farms in the county are located on first and second class agricultural land and 70% of all the farms ever initiated on these classes of land have been maintained as farms.

Those conditions best suited for agricultural utilization are concentrated areas of fertile soil that are serviced by a good system of roads. All such areas are already being utilized to some extent at present. If future economic conditions permit, the farm capacity of the county could probably be increased five-fold on the basis of acreage of potential agricultural land.

Criteria for Forest Land

All land unsuited for any private enterprise has found its way into public ownership and is being used as State and Federal forest land.

Results of Correlative studies:

Natural Land Divisions - the cover type is easily correlated with the Natural Land divisions.

Level loamy uplands	- aspen and hardwood
Low sandy hills	- jack oak
Sand plains	- jack pine
Loamy plains	- hardwood
Swamps	- white cedar and black spruce

All the studies that were conducted in the preparation of this

report indicate that forestry is a subsequent land use. There are no selective factors governing the character of the land in forest utilization. The boundaries of the public forests are so extensive, that all land acquired by the state through tax delinquency, automatically becomes forest land.

Private forestry will not succeed in this county until new methods of utilization are developed or until the demand for forest products increases to that point where large investments of capital for forest management will be justified.

The present forest areas are more important from a recreational standpoint than for their yield of forest products. Multiple land use should be encouraged on the forest land for its practicability is generally accepted. It is a means of greatly increasing the yield of land and the efficiency of investments.

Criteria for Game Refuge

The pertinent factors governing the successfulness of a game refuge are the characteristics of the cover type and its size. A game refuge for deer must include uneven aged or young stands of cedar for winter browse and the area surrounding the swamp should consist of various upland cover types with frequent open grass and sweetfern meadows as coordinates of the general cover complex. This cover complex affords the maximum amount of "edge" which apparently constitutes the optimum site for deer.

The size of the refuge should not be established as an exact area, but should be so regulated as to best meet the current demands. In years of over-population, the size of the refuge could be reduced,

thereby giving deer hunters a better chance to increase the kill. If the breeding stock became limited, the size of the refuge could be increased, thereby affording added protection.

Criteria for Parks -

Parks utilize only those areas that have outstanding beauty or other points of recreational attraction. Hartwick Pines State Park is an example of the application of these criteria. The "Pines" are a scenic attraction and they are unusual in that they represent the last virgin area of white pine in the lower peninsula. Grayling Winter Sports Park has the rugged topography necessary for winter sports, combined with pleasing winter scenery and accessibility.

Potential park sties:

1. Au Sable River
   a. tourist camp sites
   b. Canoeist camp grounds
2. Lake Margrethe tourist park
3. Plains "nature study" camp grounds

Criteria for cottage sites -

Land suitable for cottage sites, must be located at least within one mile of stream or lake frontage and be accessible by car. Lake or stream frontage is a dominant character and transportational facilities are secondary. Development of cottage property often proceeds the establishment of an organized system of roads, maintained by the county or state.

Criteria for a public hunting ground:-

A public hunting ground should be extensive, unbroken by private tracts of land, accessible by car and controlled in accordance with an effective program of game management.

CONCLUSIONS

This study has not brought out any striking examples of present land misuse, but on the contrary, it indicates that natural trends have been developing a practical and efficient method of land use.

Agriculture

Maladjustment is evident on a few farms within the county. The first farmers coming into this area sought cheap, open land with no special reference to soil fertility or other crop requirements. A large part of these early farms were speedily eliminated by economic forces and edaphic and climatic deficiencies of the land for crop production.

Trial and error method of farm location is wasteful, both of capital and human resources. Attempts at farming submarginal land will undoubtedly continue until progressive legislation makes possible the establishment of zoning laws restricting the future use of the land. Education of those private individuals who control land sales in the county would aid in accomplishing this proper land use objective and could be promoted by cooperative research between local real estate men and public agencies of land control.

Many of the past mistakes of agricultural enterprise will not be repeated for the land is now "frozen" in public ownership as a part of either a State or Federal forest. Those people now farming in the

county, should not be pitied but should be admired for even subsisting. They would probably be much more successful if given an opportunity to farm on a better site. The farmers in this region are no worse off than farmers in other parts of the state.

Comparatively speaking, the loss or the depletion by misuse of all the farms in Crawford County would not be nearly so serious as misuse of first class agricultural land that is prevalent in the southern part of the state. Useless subdivisions around Detroit, for examole, are at present holding hundreds of acres of fertile land out of agricultural use.

In Crawford County present trends indicate that farming will probably decrease slightly in the future, to that point where only the better adapted farms will remain.

Game Management

Deer are probably the greatest single recreational asset that Crawford County possesses. In the fall thousands of hunters flock into the county for their annual deer hunt. Tourists and vacationists enjoy a year round season of camera hunting and sightseeing. Natural reproduction of deer has been so successful in the past that both hunter and tourist achieve their respective goals. Recently the question of deer over-population has been raised. Studies of winter starvation have been interpreted by some to mean that there are too many deer for the "carrying power" of the area. Others maintain that this winter kill is only normal and that sufficient food of various kinds is available. Even jack pine is frequently used as browse by deer in the late winter months.(1)

(1) Technical Notes No. 133, Feb. 1938 - Lake States Experiment Station, U. S. Forest Service.

and ducks are plentiful along the streamways and lakes. A cross section of the county from the standpoint of both flora and fauna can be observed during a canoe trip down the Au Sable River.

Judging from past records, future land use will probably continue to make the land more productive of wild life.

Recreation

In Crawford County, recreation may be said to be just in its infancy, in respect to the number of possibilities present. The county is ideally located in relation to the concentrated centers of population in the lower peninsula.

A possible demand may some day arise for greater public access to various parts of the Au Sable River. Now, practically all river frontage is privately owned and it is probable that when it is more completely developed, public access for fishing may be restricted.

A number of areas having river frontage, could be obtained by the state, by various methods and be held in reserve. These areas could be utilized for canoeist and fisherman camp grounds in the future.

Several small camp grounds, providing only water and sanitary conveniences, could be established throughout the county, even on the sand hills and plains to accommodate those groups, typified by Boy Scouts, which are merely seeking a change in environment or an opportunity to study nature.

Future recreational expansion appears inevitable, due to the growing demand of the public for cottage and camp sites, State and Federal parks and fishing and hunting grounds.

Forestry

Conditions are not very suitable for private forest management. On the type of cut over land, which is dominant in this county, forests should be managed extensively by public agencies in accordance with as many interests as possible. Saw log production may be quite unimportant in relation to the recreational value of the land. Present day foresters maintain that it is necessary to publically own only 40 - 50% of a forest area, to be able to efficiently and economically manage the whole tract. More stress is continually being placed upon coordinated management of property owned by several interests to achieve greater benefits for all.

Jack pine pulp production may become increasingly important in the future, due to the economic forces of the present war. Eighty-five percent of the poor sandy soils in the county will produce fair yields of jack pine. Private land holders should be encouraged and aided in pulp production.

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