SOILS OF JACKSON COUNTY, MICHIGAN

Thesis for the Degree of M. S.

Frank Willis Trull

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By Frank W. Trull

Description of the Area

Location - Jackson County is situated in the south central part of the Southern Peninsula of Michigan. It is in the second tier of counties north of the Ohio line and about 65 miles west of Detroit. The area includes 720 square miles, or 460,800 acres.

Topography - The topography of the area is diversified without having strong relief. The surface features are of glacial origin and comprise moraines, smooth till plains, outwash plains, and old Glacial drainage valleys. The south eastern part of the county is a dry sandy plain which is pitted and dotted with lakes and interspersed with swamps. This plain extends from the eastern line of the county to the city of Jackson and occupies about five townships. Thence here are valley-like arms extending westward and southward.

The greater part of the County is rolling or moderately hilly, although slopes are generally smooth and local differences in altitude are in most places not more than 100 or 150 feet. Prospect and Sackrider hills near the eastern edge of the County are in the most hilly areas. The rolling and hilly areas are also interspersed with lakes and swamps and dry sandy valleys.

The elevation ranges from about 800 feet to nearly 1200 feet above sea level and about 220 feet to 620 feet above the level of Lake Michigan.

Jackson County is, in general, well-drained although about 15 per cent of the area is comprised in swamps and lakes. Three large river systems of the State have their source within the area. The Grand River with its source just south of Grand Lake runs north and west through the area and drains better than half of the County. The Kalamazoo River rises south of Farewell Lake and drains the west tier of townships through what is called Rice Creek. These two rivers empty into Lake Michigan at Grand Haven and Saugatuck. The river Raisin has its source in Columbia and Grass Lake Townships and drains to the southeast, emptying into Lake Erie near Monroe.

Native Vegetation - This area was originally forested with the exception of a small amount of marsh which was covered with sedge and grass. All of the virgin timber has been cut and at present only woodlots of second growth timber are common. The trees were oaks, hickory, and some beech and sugar maple on the well-drained areas, while elm, black ash, soft maple, swamp white oak, willow, and basswood appeared on the wet mineral soils. Tamarack was the abundant species in the peaty swamps.

Water Supply - There is a generous supply of healthful water in Jackson County. Along Spring Brook are many springs of

clear cold water. Some of the farm homes have water piped from these springs. In several parts of the county there are artesian wells. Excellent water comes from wells of various depths, ranging from 30 feet to 150 feet. The most of the small streams are spring fed and carry cold clear water.

Population and Industries - The first white settlers came into Jackson County in 1829 and the present boundaries of the county were established shortly after. The census of 1880 shows 41,515 white and 518 colored people in the county. 16,105 lived in towns and 25,926 were rural population. In 1920 there were 48,347 urban and 24,374 rural population. Although there has been a large increase in total population, there has been a decrease of those living on the farms. The larger part of the population is native American although a number of foreign born are found in the city of Jackson.

Agriculture and manufacturing are the principal industries. The manufacturing is practically all in the city of Jackson and includes automobile wheels, cushion springs, radios, steel products, wire fence, candy, clothing, tools, etc. The Michigan Central Railroad shops are also located there. The value of agricultural products as given in the census of 1920 was $11,528,932. The farming communities are scattered well over the county.

Markets and Transportation - Jackson is the only city in the area and is the most important local market. Grass

Lake, Springport, Hanover, Rives Junction, Parma, and Brooklyn are small towns that serve as shipping points. Detroit and Chicago are the most important outside markets for farm produce.

Transportation facilities are exceptionally good. The main line of the Michigan Central R.R. goes through the center of the county from east to west, with branch lines running north and northwest. The Grand Trunk Railroad runs from Jackson through the northeast corner of the county. The southern half of the county is cut by the New York Central Lines and also by the Cincinnati and Northern Railroad. Paved trunk lines extend each way across the county and a net work of good gravel roads connect the farming communities with the main lines. Much of the produce is trucked to market.

Climate - Jackson county lies between 42 degrees and 42 degrees 30 minutes north latitude. It has a mean temperature of about 48 degrees, and an average precipitation, including snowfall, of about 32 inches. The temperature varies from -21 degrees to 104 degrees during the year. The average temperature for January is about 23 degrees and for July is 74 degrees.

About nineteen inches of rain falls during the growing season, and it is seldom that droughts of long duration occur. There are some short droughty periods when crops on the light porous soils suffer because of insufficient moisture. The snowfall averages about 35 inches and this

forms a cover for a part of the cold months, somewhat protecting fall planted grains.

The average date of killing frosts in the spring is May 4th and the average date of earliest frost in the fall is October 10th. This gives a growing season of about 160 days. There are about 134 days of sunshine during the year and about 85 of these occur during the growing season.

The general wind direction is west to northwest. High winds occur at intervals in connection with thunderstorms, but no appreciable damage usually results. Michigan is in the path of frequency of cyclones and tornadoes, but they seldom occur because of the cooling effect of the Great Lakes which checks the required convection.

Agriculture - Agriculture in Jackson County dates back to about 1829 when the first white settlers came into the county. Corn had been raised in a small way by the Indians prior to this time. The first soils to be planted were those most easily cleared, which in this area was on the Fox types because the tree growth was scattering. It was what the settlers called "oak openings".

In 1830 wheat, corn, marsh hay, and buckwheat were the principal crops. The first apple orchard was set the same year. The following table gives the principal crops and their acreage for 1880 and those for 1924 from the Agricultural census for 1925.

	1924	1880
Wheat	17,789	76,533
Hay	58,502	48,161
Corn	45,040	33,093
Oats	26,030	13,002
Potatoes	3,827	3,342
Rye	26,619	167
Barley	1,089	888
Buckwheat	2,068	1,111
Beans	8,734	0

The greatest change in crop acreage in the 44 years time is the dropping off in wheat and the increase in rye. The growing of beans has also become an important crop.

Other crops not grown on a large basis are popcorn, sweetcorn, cucumbers, and tomatoes for seed, melons, and special muck crops of celery, cabbage and onions. Alfalfa and sweet clover are increasing in importance each year on practically all types of soil.

The U.S. census for 1925 shows the livestock consisting of 10,059 horses, 242 mules, 27,122 cattle, 47,046 sheep, 148 goats and 26,019 swine. The value of dairy products for 1924 was $1,069,016. The value of wool was $141,713.

Fruits can be grown successfully and in some sections is quite an important branch of agriculture. Following are the number of fruit trees in the county as given in the U.S. census for 1925.

Variety	No. Trees
Apple	126,187
Peach	38,363
Pear	9,678
Plum	6,564
Cherry	9,323
Grape vines	38,444
Raspberry	117 acres
Strawberry	115 acres

Huckleberries are not cultivated, but many grow wild in the swamps.

Poultry and eggs are also important products. The value of eggs produced in the county in 1924 was $411,556 and the value of chickens raised was $254,036 (U.S. census 1925).

The greatest influence of soils and topography on the kinds of crops grown is shown on the muck soils. These soils are low and inclined to be somewhat frosty, therefore, special crops such as celery, cabbage, and onions are better suited then the general farm crops. Due to the nature of the muck soil, the special crops bring much greater returns than do the general crops.

General farming is practised on nearly all of the soil types with a great variation in the yields obtained. Rye takes the place of wheat and barley on many of the lighter types. Melons, cucumbers, tomatoes, and small fruits are found mostly on the lighter types where they are better

adapted than are the general farm crops. Alfalfa and sweet clover grow on nearly all of the types where drainage is sufficient and lime is present.

Crop rotation and the use of barnyard manure and some commercial fertilizer are the general methods practiced in keeping the soils in a state of productiveness. The use of lime is fast becoming an important factor in the improvement of the soil. A common rotation is corn, oats, wheat, and hay. The use of commercial fertilizers has been rather limited, but is now on the increase. In 1924 $32,287 was spent for lime and fertilizers, reported on 565 farms. (U.S. census 1925)

In general, the farm buildings in Jackson County are well kept and denote a measure of prosperity. Practically all of the farms are equipped with modern machinery.

Good draft horses are common, and the tendency in cattle is toward higher grades or pure bred herds.

Labor, at present is not very plentiful and a reliable experienced farm hand is hard to find. Many of the farmers are farming only what they can care for without hired help.

There are 3550 farms in the county. They are divided as follows, according to size:

398	less	than	20	acres	each	
474	between	20	and	50	acres	each
906	"	50	"	100	"	"
1130	"	100	"	175	"	"
439	"	175	"	260	"	"
190	"	260	"	500	"	"

There are 2810 farm owners, 20 managers, and 720 tenants. The number of tenants and managers has decreased during the last five years, while the number of farm owners has increased. (U.S. census 1925)

The several soils of the county may be divided into three classes based on the general agricultural value. In the first class are the following types which have the highest value: Miami loam, Brookston loam and clay loam, Hillsdale loam, Fox loam, and Conover loam. The second class includes Hillsdale sandy loam, Bellefontaine sandy loam, Fox sandy loam, Brody sandy loam, Berrien loamy sand, and Newton sandy loam. The Third class includes the soils of lowest agricultural value, namely: Plainfield loamy sand, Coloma loamy sand, Genesee sandy loam, and Griffin sandy loam and loam. The mucks may have a high value for truck crops when properly drained and intensively cultivated, but only a low value for general farming purpose. They rank as follows, beginning with the one of highest value: Carlisle, Rifle, Houghton, and Greenwood.

Recommendations for the better use and the improvement of soils would include the following: The lighter soils of the well-drained types are better adapted to the growing of fruit, melons, cucumbers, and tomatoes than to the growing of general farm crops. In general, the lighter soils of the area are deficient in organic matter and in lime. Practically all of the mineral soils are low in phosphorus and the mucks are low inpotash. The following points in improving

the soils are listed in the order of importance:

1. Drainage, if needed.
2. Lime, if needed.
3. Organic matter (Plowing down of green crops or use of plenty of barnyard manure).
4. The judicial use of the proper commercial fertilizers.

On the lighter soils, especially, cover crops should be used to retard or prevent erosion which is very damaging on the rolling and hilly types.

Soils - For the purpose of mapping and for correlation, soils are grouped into separate groups or what is called "series". This is based on differences in color, chemical nature, texture, thickness, consistency and structure. The separate layers of soil are called "horizons" and all of these together are called the soil profile. All of these separate layers are considered in determining the series to which a soil belongs. One important thing to consider in classifying the soil is whether it was developed under poor, or good drainage conditions. The other important thing is the arrangement and peculiar characteristics of the different layers. It is these peculiar characteristics by which we distinguish one series from another. The unit of mapping is what is called the "soil type". This is based on differences in texture of the surface layer. Thus there may be several types in one series, such as a loam, a sandy loam, a fine sandy loam, and a loamy sand. By texture is meant the relative

size of the particles composing the surface soils. The smallest size is called clay and in order toward the coarser particles are silt, very fine sand, fine sand, sand, medium sand, coarse sand, and gravel.

For the sake of convenience and easy reference each series is given a name. The names are usually local geographic names near where the series is first mapped. The different types of the series will also carry the series name, e.g. Plainfield sandy loam, the series name is Plainfield and the type is sandy loam.

It must be remembered that where two separate types or series join each other there is bound to be a grading together of the two. There are often small inclusions of other types in the area mapped as a certain type.

In Jackson County there are 14 series and 18 types of mineral soil mapped, also four separate kinds of organic soil. The distinguishing characteristic of each series follows: there are two main classes of soils in the county (1) Those developed under conditions of good drainage, and (2) those developed under conditions of poor drainage or excessive moisture.

In the first group are the Miami, Hillsdale, Fox, Bellefontaine, Plainfield, Coloma, and Parma series. In the poorly drained group are the Brookston, Berrien, Newton, Brady, and Conover series. The mucks were developed in lakes and permanently wet situations. The Genesee and Griffin series are recent alluvial soils subject to accre-

tion from stream overflow.

The Miami series is characterized by a brownish-gray surface, light gray upper subsoil, and then a few feet of yellowish-brown compact, but friable and granular clay. The lime content is high at a depth of 2 or 3 feet. Scattering boulders are found on the surface and in the substratum.

The Hillsdale types are characterized by a light brown surface followed by a pale yellow layer. Below this is a yellow sandy clay or clay loam which passes into pale yellow sand, gravel and clay mixture. The profile is acid throughout and fragments of sandstone are numerous on the surface and in the subsoil.

The Plainfield series is grayish-brown on the surface, followed by yellow sandy material becoming lighter colored with depth. Loose sand characterizes the whole profile. It is low in lime and acid in reaction and no rock fragments of stone or boulder size occur on surface or in subsoil.

The Fox series is sandy in the surface horizons, but is characterized by a compact sandy and gravelly reddish clay subsoil at a depth of 18 inches to 20 inches. Beneath this there is a layer of unconsolidated sand and gravelly material containing a high percentage of lime.

The Coloma series has a brownish-gray surface, a yellow subsoil, and a lighter yellow substratum. The soil is a loose sand to a depth of three or four feet or more, but thesubstratum may contain gravel, clay and bowlders. This type is low in lime and is typically acid to a depth of

three or four feet.

The Bellefontaine series has a brown surface, a yellowish sandy subsoil, followed by a layer of reddish-brown clayey material which is friable and moderately pervious. Underneath this layer is a gravelly calcareous drift in the form of a confused mass of bowlders, sand, gravel, and clay.

The Parma series is a new one found near Parma. It has a brown surface of fine nut-structured soil, followed by a stiff reddish-brown clay. Next is a layer of yellowish gritty calcareous sandy clay loam. This rests on limestone rock at a depth of 3 feet.

The Brookston types were developed under conditions of poor drainage and are characterized as follows: dark gray surface, light gray subsoil, and a substratum of gray or drab compact calcareous clay mottled with yellow and rusty brown.

The Berrien series is distinguished by a brown surface soil, a subsoil of compact sandy material mottled yellow or yellowish brown, and a substratum of yellow sandy material, saturated and stained with gray and rusty brown. Clay is found at a few feet depth.

The Newton series has a dark gray surface soil underlain by a dingy gray sandy material somewhat mottled with rusty spots in the heavier types. The substratum is sand or sandy clay of grayish color with brown and yellow mottlings. The substratum is generally saturated at a depth of 2 or 3 feet.

The Brady series has the following characteristics:

grayish-brown surface soils, a yellowish upper subsoil mottled gray and brown, and a mottled and more compact lower subsoil which is underlain by loose, gravelly, calcareous material.

The Griffin and Genesee series are made up of the recent alluvium of the stream bottoms. The surface soil is brown and the subsoil is brown mottled with gray and drab. Griffin is the wetter and the Genesee the better drained of the two.

The organic soils are differentiated into four types, Carlisle, Rifle, Houghton, and Greenwood.

Miami Loam

The Miami loam furnishes probably the best farm land in Jackson County. The profile of the virgin soil is as follows: A surface layer of about 2 or 3 inches of forest mold and loam. From 2 inches to 7 inches is a light brown silty loam. From 7 inches to 12 inches is a light gray silt. In cultivated areas the plow soil is a light brown or grayish brown color. From 12 inches to 36 inches is a yellowish brown clay of granular structure under normal moisture conditions, but plastic when wet. Below 36 inches is a drab, jointed, calcareous clay.

The upper layers of the profile are usually slightly to strongly acid, but the clay layers are alkaline. Due to the rather impervious nature of the subsoil, quite a high percent of the moisture is retained in the soil. There is not over ten square miles of Miami loam in the county. The largest area is in the northwest corner of the county. Two

or three small areas are found along the north boundary and one area along the south boundary where Jackson, Hillsdale, and Lenawee counties join each other.

The topography of this type is gently rolling to hilly and in practically all of it the natural drainage is sufficient. Very few of the slopes are so steep that the run-off of the rainfall causes rapid erosion.

The native vegetation consisted of oaks, hickory, beech, hard maple and elm. Practically none of the original forest is now standing, only a few woodlots of second growth timber of the same species.

General farming, including dairying and stock raising is practiced on most of the Miami loam. The most common crops are corn, beans, wheat, oats, barley, clover, and alfalfa. This type of soil is well adapted to power farming and tractors are found on several farms. This is a very durable soil when properly handled. There are no particular problems in the reclaiming of the virgin land, for the stumps quickly decay and the stones are not numerous. This type is very productive and high yields are obtained. Thirty bushels of wheat per acre is not uncommon and corn will yield as high as 100 to 125 bushels per acre. Beans range from 10 to 25 bushels per acre. This soil gives good response to fertilizers, especially phosphorus.

Hillsdale Loam.

The Hillsdale loam comprises an area of about 36 square miles. It is found mostly in Blackman, Spring Arbor, and Summit townships with several small areas along the north line of the county.

The following profile is typical: the upper three inches consists of a light brown humus loam which is mellow and friable. From 3 to 12 inches is a pale yellow loam. In the cultivated soil these two layers are mixed and the result is a lighter color of the surface soil. From 12 to 40 inches is a yellow, gritty, sticky clay loam underlain to a depth of 5 feet by a mixture of pale yellow sand, gravel, and clay.

This soil is rolling and the natural drainage is usually good. About 95% of this land is cleared and general farming or dairying is practiced. Corn, wheat, barley, oats and hay are the general crops and good yields are obtained. Fertilizers, aside from barnyard manure, have not been used to any great extent, but the usage is increasing. Quick response is shown to the use of superphosphate or complete fertilizers carrying small percentage of nitrogen and potash. Phosphorus is usually the most deficient of the three plant foods.

This type of soil is not hard to reclaim, the removal of stone causing the greatest labor. This type is adapted to power farming.

This type as mapped may include some small areas of

Hillsdale sandy loam that are too small to map out on the scale used.

Hillsdale Sandy Loam.

This is a very important type in Jackson county. Nearly 50% of the county is Hillsdale sandy loam. The profile of the virgin soil is as follows: the surface 2 inches consists of a brown sandy humus and mold. Below this is about 5 inches of light brownish sandy loam. From 7 inches to 24 inches is a pale yellow sandy loam. 24 inches to 36 inches is a yellow sand and clay a little lighter in texture than the preceeding layer.

This type is rolling to hilly and is well drained. It is used chiefly for general farming with corn, oats, wheat, beans, potatoes, and hay as the principal crops. Alfalfa is grown very successfully after an application of lime has been made. Liming is necessary for the profile is acid throughout. The natural fertility ranges from low to moderate, but where good farming practices are carried on, very good yields are obtained.

The use of commercial fertilizers, which has been very little, is increasing and excellent returns are received from the use of a complete fertilizer.

The native vegetation on the Hillsdale sandy loam was mostly oak and hickory and there are many woodlots of second growth oak and some hickory. This type of soil is fairly easily reclaimed. The removal of stones is the greatest problem as this soil is quite stony. Power farming is used on several of the farms. Only a small part of the area is too

hilly for power farming.

In the improvement of this soil, lime, organic matter, and fertilizers are the three important things to consider and are listed in the order of their importance.

Fox Loam

The Fox loam does not occupy more than about 10 square miles in Jackson county. It has the following profile: the first 7 inches is a brown coarse loam underlain to a depth of 12 inches by a yellow coarse loam or heavy sandy loam. From 12 inches to 40 inches is a reddish sticky clay full of grit and gravel. From 40 inches to 60 inches is an unconsolidated calcareous gravel and coarse sand. A samll percentage of limestone is found in the gravel.

About 95% of this type is under cultivation. The topography is level, the drainage good, and the general fertility medium to high. General farming is practiced with corn, oats, wheat, and hay the main crops. Alfalfa is commonly grown. Liming of the soil is generally advisable for this crop.

The native timber was oak and hickory and a few second growth woodlots of the same species are found.

This soil is easily reclaimed and is adapted to power farming. Very little commercial fertilizer is used although a complete fertilizer gives profitable returns. This type is found associated with the Fox sandy loam and may include small areas of that type.

Fox Stony Loam

This is one of the main types of soil in Jackson county.

It has the following profile: the upper three inches consists of a light brown friable sandy loam. From three to twenty inches is a pale yellow sandy loam. In cultivated fields these two horizons become mixed, giving the surface a lighter color. From twenty inches to thirty-six inches is a sand, gravel, and reddish sticky clay mixed together forming a compact layer. Beneath this layer to a depth of several feet is sand and gravel moderately calcareous.

The topography of the Fox sandy loam is generally level to undulating. The drainage is good and in a few instances is excessive.

The larger part of this area has been cleared and put under cultivation. General farming and some raising of small fruits is the usual type of farming. The yields are about medium, potatoes, corn, oats, wheat, alfalfa, popcorn, melons, cucumbers, and berries are the main crops. The fertility is low to medium and care is necessary to keep the soil in a productive state. Organic matter, lime, and fertilizers are necessary in improving the soil. The profile is usually acid to depths of 20 to 36 inches. A quick response is shown to the use of complete fertilizers. This type is adapted to power farming and several tractors are found throughout the area. The Fox sandy loam is easily tilled as there are no stones and the plow soil is friable and dries quickly.

This type as mapped may include small areas of Fox loam.

Bellefontaine Sandy Loam .

The Bellefontaine sandy loam occupies a total area of about 36 square miles distributed over the county in small bodies. The profile is as follows: the upper 6 inches of cultivated areas is a light brown stony sandy loam underlain to a depth of 18 inches by a yellowish sandy loam. From 18 inches to 40 inches is a reddish clay intermixed with gravel, cobble stones, and bowlders. Below 40 inches depth is sand, gravel and bowlders containing a small percent of limestone.

This type of soil is found in ridges and hilly areas. The larger part of it is used for pasture and woodlots. A small part is used for general farming with corn, oats, and hay as the chief crops. Alfalfa grows very nicely if there is enough lime present.

The drainage is good, but some slopes are so steep that the run-off of water causes the formation of gullies. The surface layers of this soil are usually acid, but some of the gravelly areas contain enough lime for the successful growing of alfalfa and sweet clover. The fertility is only fair and large yields are not common.

This type of soil, due to the topography, is not generally adapted to power farming. Very little fertilizer is used, altho the use of a complete fertilizer is practical. Green manure crops and cover crops are essential to increase the fertility and also to retard erosion.

Brookston Loam.

This is not an important type in Jackson county as there is not over six square miles of this soil. The largest area is just north of Puddleford. The profile is as follows: the first 5 inches is a dark gray mellow loam followed to a depth of 12 inches by a gray loam. In cultivated areas these two layers become mixed, giving the surface soil a lighter color. From 12 inches to 40 inches is a drab and rusty to pale lemon yellow, wet, gritty clay.

This soil has been formed under conditions of poor drainage. It occurs in small low areas. A small part of it is under cultivation. Corn, oats, wheat, barley and hay are the principal crops. Some is in pasture and some still timbered with elm, ash, soft maple, and some basswood and willow.

The fertility is high and excellent yields of grain and hay are obtained. The use of phosphate and potash fertilizers give good returns.

Drainage is the greatest problem in reclaiming this type of soil. The profile is alkaline and alfalfa grows well if drainage is sufficient. The moisture holding capacity is high. This soil is level and is adapted to power farming.

Brookston Clay Loam.

There is about one square mile of this soil in Jackson. county. It is along the Grand River about six miles north of Jackson. The profile is as follows: the first 7 inches is composed of a dark gray clay loam underlain to a depth of

12 inches by a drab to dark gray heavy plastic clay. Farmers often call this a buckshot soil when it breaks up and is dry. From 12 inches to 18 inches is a dark bluish-gray and yellowish-brown plastic clay followed by a light bluish gray and yellowish-brown heavy plastic clay.

This soil is level and because of the impervious nature of the soil artificial drainage is necessary. Some general farming is practiced on this soil, but the larger part of it is in pasture. Hay and small grains are the principal crops and high yields are common. The profile is alkaline throughout. Power farming is practical. The fertility is generally high but nevertheless response is shown to the use of phosphate and potash fertilizers.

Parma Loam.

This type occurs only in a small area near the village of Parma. It has the following profile: the upper four inches is a dark brown humus loam of fine nut structure, becoming a lighter brown when under cultivation. From four to eight inches is a light brown loam, followed to a depth of twenty-four inches by a stiff reddish brown, coarse crumb-structured clay. From twenty-four to thirty-six inches is a yellowish gritty, calcareous, sandy clay loam resting upon limestone rock.

This type is generally level except for two low limestone ridges and is used for general farm crops. It is quite fertile and good yields are obtained. This soil is well drained and

is alkaline. There is some second growth timber consisting chiefly of oak with a little hickory.

Conover Loam.

The Conover loam occupies an area of less than a square mile. It is located near the Grand River north of Jackson. It has the following profile: the upper 8 inches is a grayish-brown loam underlain by a yellowish-gray loam. At a depth ranging from 18 to 24 inches this changes into a mottled yellow, brown, and gray friable sandy clay loam. This type is situated on gentle slopes and is fairly well drained. A part of the area is used for general crops of hay, corn, wheat, barley, and oats, but the major portion is in pasture land. The lime content is fairly high. The fertility is moderately high. Response is shown to fertilizers, particularly phosphate.

Brady Loam and Sandy Loam.

This type of soil consists of the following profile: the upper six inches is a gray humus soil which is black when wet. From 6 inches to 20 inches is a gray bleached loam, followed by a gray and rusty yellow sandy clay to a depth of 40 inches. Form 40 inches to 60 inches is a saturated sand and gravel.

This type of soil is level and poorly drained. It occupies flat valley areas through which streams flow and is sometimes overflowed in the spring of the year. This type has a textural profile similar to the Fox type, but exists

under conditions of poor drainage.

The most of the area is not under cultivation, but is sparsely covered with a growth of elm, black ash, soft maple, and basswood, and is generally used for pasture land. General farming is practiced on parts of the area where corn, oats, and hay are the principal crops. The fertility is generally high and good yields are produced. The profile is usually alkaline throughout. Artificial drainage is necessary in reclaiming much of this soil and in some cases this would necessitate the lowering of the stream bed which would be too costly to warrant it.

Plainfield Loamy Sand.

This type of soil is small areal extent in Jackson county and occurs in small bodies widely separated. The largest area is northeast from Norvell. In the virgin state the following profile is typical: 2 inches to 3 inches of brown loamy sand and humus underlain by a half inch of gray loamy sand. From 4 inches to 6 inches is yellow-brown sand. In cultivated areas these layers are mixed, giving the surface soil a light brown color. From 6 inches to 15 inches is a dull yellow loamy sand. At about 15 inches this changes to pale yellow sand and continues to a depth of 40 inches where it changes to a yellow incoherent sand. One area near Portage Marsh is underlain by bed rock at a depth of about 40 inches.

Thenatural drainage of this soil is good to excessive. The larger part of the areas has been cleared and have been under cultivation. This soil is not particularly adapted

to general farming on account of the low moisture holding capacity. It is better adapted to fruit. Organic matter is needed in large amounts in this soil. The profile is acid to 3 to 4 feet and lime is needed to help build it up. Very little fertilizer is used, but a quick response is shown to the use of a complete fertilizer.

Coloma Loamy Sand

This type occurs only in small scattered areas in this county. The following profile is typical: the first three inches is a light brown loamy sand, followed to a depth of twenty inches by a dull yellow, loamy sand. From twenty to thirty-six inches is a pale yellow sand underlain to a depth of forty-eight inches by grayish loose sand, laminae and chunks of clay.

This type is hilly and has good natural drainage. Very little of it is farmed because of the low fertility unfavorable topography, and low water holding capacity. The profile is acid to depths of 3 or 4 feet. There is some second growth timber, chiefly oak on this type.

Berrien Loamy Sand

The Berrien loamy sand is a minor type in Jackson county. It occurs in small areas, the largest one being near the Grand River north of Jackson. The profile is characterized as follows: the first 8 inches on the surface is a brown loamy sand, a little darker than Plainfield or Fox types. From 8 inches to 20 inches (the depth varies) is a dull yellow sandy loam

slightly heavier in texture than the surface soil. This is underlain by gray, pale yellow, and rusty mottled sandy loam. Clay is sometimes found within the 40 inch depth. The water table is high, causing the mottled condition.

This soil is level to gently rolling and the drainage is poor due to the water table being so near the surface. It is moderately fertile and about 50% is cropped, the remainder being used for pasture. General farming is practiced with hay, oats, wheat, and corn as the principal crops. It is moderately acid to depths of 30 to 40 inches and is benefitted by liming. Complete fertilizers are also recommended on this soil.

Granby Sandy Loam.

The Granby sandy loam type of soil appears in small scattered areas throughout the county. It has the following profile: the first 8 inches is a dark gray mellow sandy loam, becoming black when wet. From 8 inches to 20 inches is a gray bleached sandy loam. Below 20 inches and continuing to a depth of 40 inches is a pale yellow sand or sandy loam containing mottlings of gray and rust color.

This profile is usually alkaline throughout. The topography is level and the natural drainage is usually poor. The fertility is moderate to high. The native timber consisted mainly of elm, black ash, and basswood. This type is mostly used for pasture. Where farmed, general crops such as corn, oats and hay are grown. This soil is easily reclaimed, but artificial drainage is necessary.

Griffin Loam and Sandy Loam.

These types are alluvial soils and occur on the flood plains of existing streams. The largest areas are found along the Grand River. Following is the profile; the surface 10 inches is a dark gray and rust colored mixture of sand and organic matter. From 10 inches to 40 inches is a gray wet sand mixed with mucky organic matter. This is not an important type in Jackson county. The water table is shallow, in places within 18 inches of the surface.

This soil is alkaline and a high percent of the moisture is retained due to the organic matter and small muck spots are included in the area. The fertility is relatively high. The topography is level. Very little of this type is under cultivation since it is frosty and is sometimes covered with overflow water from the streams. The larger part of the area is used for pasture. It is fairly well timbered with elm, soft maple, and willow.

Better drainage would be necessary to improve this type and in many cases that would require the lowering of the stream bed, which is too costly an operation. No lime is needed and probably the response to fertilizers would be small.

Genesee Sandy Loam and Loam.

These types represent the better drained alluvial soils. Practically none of it is under cultivation. The following profile is typical: the upper 10 inches is a brown, mellow, nut structure loam. From 10 inches to 40 inches is a yellow

sand and clay. This soil is found only along the bed of the Grand River for a few miles before it leaves Jackson county. It is alkaline throughout the profile. Not a large percent of the moisture is held in the surface, but the water table is usually within three or four feet of the surface. Small spots of muck may be included in parts of the area. The topography is level. The timber growth is elm, soft maple, willow, and butternut. No crops were found growing on this type in Jackson county. Part of the area is used for pasture. Crops are more susceptible to injury from frost than on the adjacent uplands.

Carlisle Muck.

The Carlisle muck is a black loamy muck to a depth of three to five inches. Below this to a depth of about twelve inches is a layer that is cheese-like when wet and hard and horny when dry. The thickness of the blackish decomposed material depends upon the age of the soil and the depth of the water table and generally extends to depths of 12 to 20 inches. Below this layer it grades into woody or fibrous more peatyless decomposed organic matter. This type of muck is very fertile. It needs drainage, but care must be taken not to lower the water table too much. The profile is usually alkaline or high in lime throughout. It contains very little inorganic matter.

The timber growth consists of elm, black ash, soft maple, and some basswood. The part of this area under cultivation is used mainly for special crops, mainly onions,

celery and cabbage: large yields are obtained. It is the best type of muck for farming purposes because it is further decomposed than the other types. Some areas are used for general farming but the frosty nature of the soil is against this practice. The larger part of the Kalamazoo type is not under cultivation, but is left idle or used for pasture. Potash is the fertilizer which gives the greatest benefit on this type of soil.

Rifle Peat

The Rifle peat is intermediate, in stage and depth of decomposition, between the Carlisle muck and Greenwood peat. At the surface there is generally 6 or 8 inches of dark brown to black finely fibrous or woody muck. Below this is a less decomposed fibrous and woody peaty matter. The water table is usually one to two feet below the surface.

The vegetation on this type is composed of sedge, blue-joint grass, winterberry, red osier dogwood, and tamarack trees. Some places a few soft maple, elm, and aspen trees are present, but are not common.

Some of this muck has been drained and is used in producing special crops such as onions, cabbage, and cauliflower; high yields are obtained. The surface is usually slightly to medium acid. Drainage is most important in reclaiming this land. It responds to fertilizers of high ptash content.

Houghton Muck

The profile of the Houghton muck is as follows: the upper twelve inches or surface layer is a dark brown to nearly black finely fibrous muck. From twleve to twenty-four inches is black very finely fibrous muck, below which is a wet mushy black muck. There is a very little mineral matter in the profile. The water table is high. The surface soil is sometimes slightly acid, but more often is alkaline throughout the profile. The vegetation is a coarse sedge grass. Very little of this type of muck is under cultivation in Jackson county but if used at all, it is for pasture. A small part of the area is drained and is now used for the production of special crops such as onions, cabbage, or cauliflower. Response is shown to the use of commercial fertilizer in the form of potash. The fertility is medium for this class of soil.

Greenwood Peat

The Greenwood peat consists of a brownish or yellowish coarse, fibrous peaty material. The water table is near or at the surface except during periods of drought. The peat is uncompacted, highly acid, and contains only a very small percentage of inorganic minerals. It is characterized by a growth of cassandra, moss, and huckleberries. None of this type is under cultivation. The deposits are scattered thruout the county. The depth of this material ranges from about 7 feet to more than 15 feet. This type of muck may possibly come into use for the production of huckleberries and cranberries.

Taxonomy and Origin of the Soils.

Jackson County lies within the glaciated area of Michigan. The last glacier to cover this area was the Late Wisconsin. The soils are gray-brown, formed under forest conditions and, although not true Podsols, belong to that group and are known as Podsolic soils. The genesis of the Podsol soils is believed to stand in intimate relation with the existence of forests, although Podsol development has been known to take place without the influence of forest vegetation. The name Podsol was given to the soils of this group by the Russian pedologists and means "ash soils". The surface horizon of the Podsols is "Rohhumus" or simply forest litter and mold, under which is a horizon of highly leached ashy gray soil; thence a brownish horizon of humic coloring and iron oxide concentration in the nature of a hardpan; this is followed by parent material only slightly altered.

The Jackson County soils are not, therefore, true Podsols. The surface horizon of the Jackson County soils consists of a thin layer of mold beneath which there is an appreciable light brown humus soil, thence instead of an ashy-gray horizon the soil is a yellowish color. The B horizon is a faintly reddish color and is a horizon of clay concentration. Here are found oxides, silicates, and carbonates that have leached from the upper horizons. The brown horizon characteristic of Podsols is absent, but weakly developed or exists merely as relicts of a past condition. However, leaching or eluviation is dominant in the soil forming processes and the soils are, therefore

Podsolic and belong to the gray-brown Family of forest soils of the central and central eastern United States.

The soils of the area may be divided into two general groups, namely (1) those developed under conditions of good drainage and moderate rainfall and (2) those developed under conditions of poor drainage and temporary excessive moisture.

Under the first group there are three distinct profiles which are as follows: (1) Horizon A is a light sandy material, horizon B is a heavy material, and horizon C is light material. The Fox series is an example of this profile. (2) In this profile the horizon A is a light sandy or loamy material, but horizons B and C are both heavy. The Miami types are typical of this profile. (3) Here we find horizons A, B and C all a light sandy material as typified by the Coloma types.

Under the group of soils developed under conditions, we have one profile with horizon A a light sandy or loamy material and horizons B and C both heavy as shown in the Brookston types. We also have one in which all three horizons are light sandy materials as in the Newton sandy loam. In the poorly drained soils, the Berrien type comes nearest to the formation of a hardpan in the B horizon. In this type we find little concretions of rusty-brown material.

The organic soils have been developed from heavy deposits of organic matter under conditions of poor drainage and excessive moisture. Some were forested while others were covered with sedge and grass. These types are classified according to age, stage of decomposition and the height of the

water table. In the Greenwood peat the water table is practically at the surface and practically no decomposition has taken place. In the Carlisle muck, the water table is a few feet below the surface and more decomposition has occurred. Under some of the mucks are found deposits of $CaCO_3$ which in many cases have been deposited by lime-loving plants, that took lime from the water of the lakes covering the area, and later settled to the bottom of the lake, there depositing the $CaCO_3$.

The Griffin and Genesee types of soil in Jackson County have been formed along the stream beds, carried there by the action of the water. These alluvial soils have no definite profile and are not finished in their formation as more material is being deposited there each year.

The soils of the area as affected by the parent material are very noticeable. In the southwestern part of the County the highest bed rock surface in the Southern Peninsula is found in an area of outcrop of the Marshall sandstone of early Carboniferous age.

In Parma and Sandstone townships are found many outcroppings of the Parma sandstone. Near Napoleon are outcroppings of the Napoleon sandstone. The presence of these sandstones appearing through the glacial drift has influenced the color of the soil formed, giving a more yellow color to the B horizon instead of the reddish color typical of Podsol soils. This is shown very well in the profile of the Fox series. In one area just north of Parma and in

a few small scattered spots north of Jackson outcroppings of Bayport limestone appear. The presence of limestone has caused a redder color in the B horizon probably caused by the precipitation and leaching, to that horizon, of iron oxides. The soil thus formed was mapped as Parma series.

A part of Jackson county is made up of moraines. A part of this morainic area has a distinct reddish color in the B horizon and has a moderate amount of limestone in the gravel present. This was mapped as Bellefontaine. The larger part of the morainic area has been influenced by the presence of sandstone giving it a more yellow color in the B horizon. This was put into the Hillsdale Series. In some parts of the area, thin veins of coal are found in the beds of shale which come near to the surface.

Summary

Jackson County is situated in the south central part of the Southern Peninsula of Michigan, about 65 miles west of Detroit.

The surface varies from level to hilly, being made up of outwash plains, till plains, and moraines.

The drainage is generally good. The area is drained by three river systems: The Grand, Kalamazoo, and Raisin rivers.

Jackson County lies at about 42 degrees north latitude. It has a mean temperature of 48 degrees, an average precipitation, including rainfall, of about 32 inches, 134 days of sunshine during the year, and a growing season of 160 days.

Jackson is the chief local market in the area, while Detroit and Chicago are the important outside markets. Transportation facilities are excellent. All parts of the area are easily accessible to railroads, while paved and gravelled highways run through all parts of the County.

There are three general classes of soils in the area: (1) The well-drained soils; (2) The poorly-drained soils; (3) The organic soils. The first class includes the Miami, Hillsdale, Fox, Bellefontaine, Parma, Plainfield, and Coloma series. The second class includes the Brookston, Berrien, Brady, Granby, Griffin, and Genesee series. The third class includes the Carlisle, Rifle, Houghton and Greenwood series.

The Carlisle muck has a special economic value as a soil for special crops of onions, cabbage, celery and mint.

The important agricultural crops are wheat, hay, corn, rye, barley, oats, potatoes, and beans. Special crops are popcorn, tomatoes, melons, cucumbers, onions and cabbage.